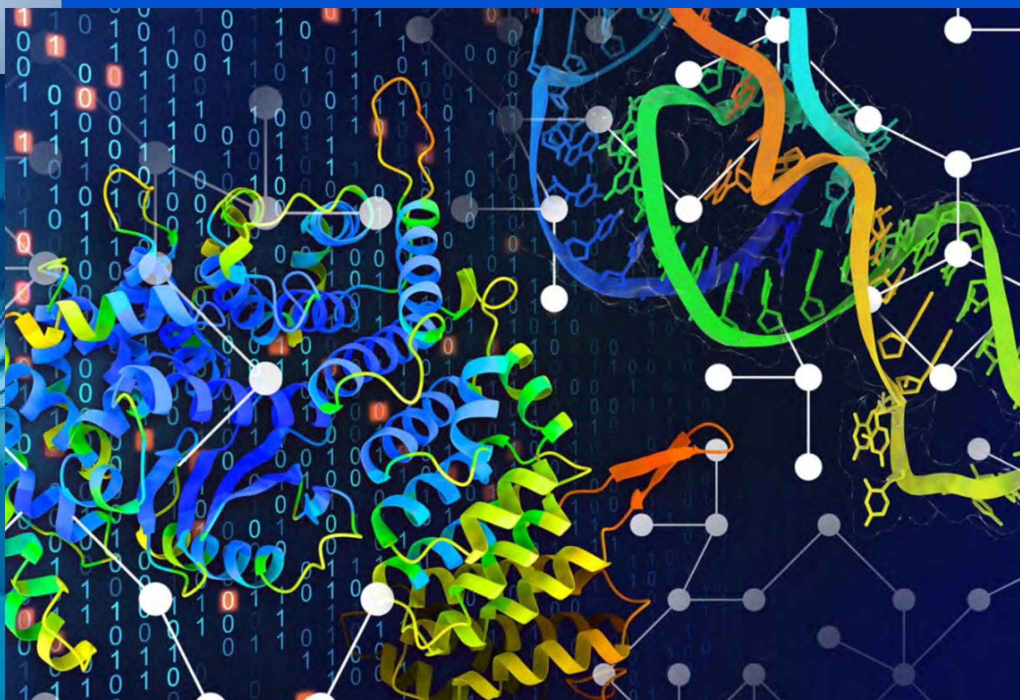
Karnataka Science and Technology Academy (KSTA)

&

Karnataka Science and Technology Promotion Society (KSTePS)

PCMB

Science Talent Search Programme



Physics
Chemistry
Mathematics
Biology

Question Bank
with
SAMPLE
QUESTION
PAPERS

Published by : Karnataka Science and Technology Academy (KSTA)

SCIENCE TALENT SEARCH PROGRAM [STSP] FOR PRE-UNIVERSITY STUDENTS

FY: 2023-2024

Karnataka Science and Technology Academy
(KSTA)
&
Karnataka Science and Technology Promotion Society
(KSTePS)

KSTA:

Dr A M Ramesh
Dr Anand R
Shri V K Srinivasu
Shri V G Umesh
Shri Siddegowda S N

KSTePS :

Shri Pawan Kumar Malapati, IAS
Mrs. H K Umarani

Citation: Question Bank in PCMB, Science Talent Search Program [STSP] for Pre-University Students, 2023-2024, Karnataka Science and Technology Academy (KSTA), Bengaluru

Published by

Karnataka Science and Technology Academy (KSTA)

College of Horticulture Entrance, GKVK Campus
Major Sandeep Unnikrishnan Road, Vidyaranyapura Post, Bengaluru 560097 Tel: 080- 29721 1550; Email: ksta.gok@gmail.com: Website: www.kstacademy.in

and

Karnataka Science and Technology Promotion Society (KSTePS)

Jointly Organised Talks Under

Science Talent Search Program

KARNATAKA SCIENCE AND TECHNOLOGY ACADEMY (KSTA)

Karnataka Science and Technology Academy is an organisation under Department of Science and Technology, Govt. of Karnataka which was established under the Chairmanship of distinguished space scientist Padma Vibhushan Late Prof. U R Rao, Former Chairman, ISRO / Secretary, DOS, Govt. of India. Presently, Prof. S Ayyappan, Former DG, ICAR/ Secretary, DARE, Govt. of India is the Chairman of KSTA. KSTA has 15 members (including special invitees) comprising eminent scientists, well known educationists and senior administrators.

KSTA is carrying out several dovetailed programs across the State and it has been playing a pivotal role in providing impetus for basic science education and popularization of science among different cross sections of society, more particularly among rural students.

Vision: "To nurture and enable knowledge, Science & Technology for All"

Mission: "To play a pivotal role in Science promotion, Technology dissemination and fostering Innovation for Societal Welfare"

PROGRAMMES :

- KSTA Annual Conferences
- S&T Lifetime Achievement Awards
- Science Communication Lifetime Achievement Awards
- Science Talent Awards for Young Scientists
- Awards for Best Books in Science, Technology, Agriculture and Medicine
- *Vijnana Loka,* Kannada bimonthly; E-Newsletters; S&T Policy / Strategy / Approach / Status papers
- S&T Conference in Kannada
- Science Communication Workshops; Interfacing
- Science writers and Publishers; Media Communication; Science Popularisation in Kannada
- Special Lecture Series for Postgraduate Students
- Celebration of important S&T-related National & International Days
- Certificate Courses (Engineering & Science)
- Science Quiz and Exhibition competitions for Specially abled Students
- Science Models Exhibition for High School Students
- State and Divisional competitions in Essay, Drama, Quiz & Modeling; Arts & Painting for Students
- Small grants for Science Programmes
- Digital Content Generation; Production of Science
- Capsules, Short Film Features/Clippings; ICT applications
- Innovation Platform and Promotion of indigenous talents in frontline S&T areas, with a focus Entrepreneurship development; Awards and Grants
- PME & Impact Assessment Studies
- Programme of Fellowships, Memberships & Emeritus Positions
- Collaborative R&D with Corporate Institutions
- Post Covid-19 Restoration related Workshops and Publications

KARNATAKA SCIENCE AND TECHNOLOGY PROMOTION SCOEITY (KSTePS)

Karnataka Science and Technology Promotion Society (KSTePS) is an autonomous organization of Department of Science and Technology (DST), Govt. of Karnataka established under the Societies Registration Act 1960 in 2013. KSTePS aims at serving as a mechanism for supporting the preparation and implementation of policy initiatives of Department of Science and Technology and act as a nodal agency in channelizing the funding and coordinating the programmes of the Department across the State. It has also been entrusted to identify priority areas of science and technology, which are useful for long term development of the State towards developing core competency in such advanced areas.

Presently, KSTePS is chaired by the Additional Chief Secretary to Govt., Department of Electronics, Information Technology, Biotechnology and Science & Technology with members drawn from various line Departments. Director (Technical), Electronics, Information Technology, Biotechnology and Science & Technology is the Member Secretary and Managing Director of KSTePS.

KSTePS is implementing Science Talent Search Program in association with Karnataka Science and Technology Academy [KSTA] to encourage talented students studying in Pre-University Colleges to pursue higher education in the field of STEAM [Science, Technology, Engineering, Agriculture & Mathematics].

Vision:

Encourage innovation and promotion of S & T to foster a knowledge driven society

PHYSICS

Brief Profile of the Author:

Shri Rohith V is currently serving as the Principal at Hongirana Independent PU College located in Sagar, within the Shimoga District. His professional journey spans an impressive 13 years, during which he has dedicated himself to teaching PUC Physics. Widely recognized as an expert in CET NEET, Rohith has played a pivotal role in guiding numerous students to success, establishing himself as a prominent personality in the field.

Beyond his teaching prowess, Rohith has delved into the realm of Robotics, garnering national-level recognition from NITI AAYOG, Government of India. His multifaceted expertise extends to various dimensions of education. He possesses commendable knowledge in Physics and has taken the initiative to conduct state-level teacher training programs. These programs focus on crucial aspects such as conceptual teaching in physics and optimizing laboratory resources for effective learning experiences.

In addition to his role at Hongirana Independent PU College, Rohith is actively engaged as a subject expert at the prestigious Samvit Research Foundation in Bangalore. Furthermore, he contributes significantly to the field of science as a member of the editorial boards for science magazines Savijnana and Sutra. His proficiency in Kannada is evident in his role as a skilled writer, where he imparts knowledge on diverse science topics in the Kannada language. Overall, Rohith V stands out as an influential personality, contributing significantly to both education and the dissemination of scientific knowledge.

Shri. Rohith V
Principal, Hongirana Indp. PU College
Amatekoppa, Sagar, Shimoga Dt.
Mobile / WhatsApp : +91 9481503603

Physics Syllabus Competitive Exams Topics of 1st and 2nd PUC

SECTION A : 1ST PUC SYLLABUS

Chapter 1 : Physical World

1. Natural sciences does not include

   (a) Physics (b) Chemistry (c) Biology (d) Social Science

2. Principal thrusts in Physics are

   (a) Unification (b) Reduction (c) Both (a)and (b) (d) None of the above

3. Attempt to explain diverse physical phenomenon in terms of a few concepts and laws is called

   (a) Unification (b) Reduction (c) Fusion (d) All of the above

4. Classical Physics mainly deals with

   (a) Microscopic phenomenon (b) Macroscopic phenomenon

   (c) Atomic phenomenon (d) Heisenberg's uncertainty principle

5. Among the following, choose the incorrect statement

   (a) The microscopic domain of physics deals with the constitution and structure of matter at the minute scales of atoms and nuclei

   (b) Classical Physics deals mainly with macroscopic phenomena and includes subjects like Mechanics, Electrodynamics, Optics and Thermodynamics

   (c) Both of the above (d) None of the above

6. Phenomenon of neutron induced fission of uranium, which serves as a basis of nuclear power reactors and nuclear weapons, was discovered by

   (a) Hahn and Meitner (b) Einstein

   (c) Neils Bohr (d) Nicholas Tesla

7. Among the following, the scientists are matched with their major contribution or discovery. Which among the following is incorrectly matched?

   A) Archimedes — Principle of Buoyancy

   B) Christiaan Huygens — Wave Theory of Light

   C) JCBose — X-rays

D) Albert Einstein	Theory of Relativity

(a) A (b)B (c)C (d)D

8. Among the following scientists, the one who is credited for the contribution to theory of condensed matter is

(a) Ernest Orlando Lawrence (b) C-V. Raman

(c) Ernest Rutherford (d) Lev Davidovich Landau

9. Full form of LASER is

(a) Light amplification by shorted extraction of rays

(b) Light amplification by stimulated emission of radiation

(c) Long absorption of silent extraction of radiation

(d) None of the above

10. Choose the incorrect statement among the following in relation to the electromagnetic waves.

(a) Electromagnetic force do not require intervening medium

(b) They act over large distances

(c) Electromagnetic force is weaker than the gravitational forces

(d) Electromagnetic forces may be attractive or repulsive

- Answer Keys -

1) d 2) c 3) a 4) 2 5) d 6) a 7) c 8) d 9) b 10) c

Chapter 2 : Units And Measurements

1. Choose the correct option.

(a)A most precise measurement may be most accurate

(b) A most precise measurement will necessarily be most accurate

(c) A most precise measurement will be less accurate

(d) A most accurate measurement will necessarily be most precise

2. 1 metre is the length of path travelled by light in vacuum during a time interval of of a second of a second of a second of a second

(a) $\frac{1}{299,972,458}$ of a second (b) $\frac{1}{299,792,548}$ of a second

(c) $\frac{1}{299,792,458}$ of a second (d) $\frac{1}{299,792,854}$ of a second

3. The kelvin is the fraction

(a) $\frac{1}{273}$ of the thermodynamic temperature of triple point of water

(b) $\frac{1}{312}$ of the thermodynamic temperature of triple point of water

(c) $\frac{1}{273.16}$ of the thermodynamic temperature of triple point of water **i**

(d) $\frac{1}{273}$ of the thermodynamic temperature of triple point of mercury

4. 1" (second of arc) in radian is (approximately)

(a) 5.85×10^{-6} rad (b) 8.55×10^{-6} rad

(c) 5.85×10^{-5} rad (d) 4.85×10^{-6} rad

5. The diameter of sun is 1.39×10^{9} m. The distance of sun from earth is 1.496×10^{11} m. The angular diameter of sun is

(a) 1290" (b) 9210"

(c) 2190' (d) 1920"

6. The measured length of two rods are $\mathbf{l_1}$ = 30 cm ± 0-5 cm and $\mathbf{l_2}$= 20 cm + 0.1 cm. The percentage error in difference of length of rods is

(a) 6% (b) 4% (c) 5% (d) 3%

7. Two resistors of resistances R_1 = 300 ± 3 ohm and R_2 = 200 ± 2 ohm are connected in parallel. The equivalent resistance of parallel combination with error is

(a) [120 ± 1.8] ohm (b) (120 ± 1]ohm

(c) [120 ±1.6] ohm (d) [120 ±2.0] ohm

8. If percentage error in measurement of quantities A, B. C and D are 1 %, 2%. 3% and 4% respectively, then percentage error in measurement of $z = \frac{A^2 B^{1/2}}{C^{1/3} D^{1/4}}$ is

(a) 5% (b) 4% (c) 6% (d) 8%

9. The number of insignificant zeros in 0.0048050

(a) 1 (b)2 (c)3 (d)4

10. The value of $(3.8\times10^3 + 3.5\times10^2)$ with regards to significant figure

(a) 7.3×10^5 (b) 4.2×10^3 (c) 4.15×10^3 (d) 7.3×10^3

11. The value of gravitational constant is $G = 6.67\times10^{-11}\frac{N\times m^2}{kg^2}$ Suppose we employ a new system of units in which unit of mass is **u** kg, the unit of length β m and the unit of time is γ s. The value of gravitational constant in terms of new units is

(a) $6.67\times10^{-11}\alpha\beta^{-3}\gamma^2$ (b) $6.67\times10^{-11}\alpha^{-1}\beta^3\gamma^{-2}$

(c) $6.67\times10^{-11}\alpha\beta^3\gamma^2$ (d) $6.67\times10^{-11}\alpha^{-1}\beta^{-3}\gamma^2$

12. In Cesium clock 1 second is the time in which cesium - 133 atom, vibrate between two hyperfine levels

(a) 9,292, 631, 770 times (b) 9, 192, 361, 770 times

(c) 9, 192, 136, 770 times (d) 9,192, 631,770 times

13. Least count error belongs to the category of

(a) Random error only (b) Systematic error only

(c) Neither systematic error nor-random error

(d) Systematic and random error both

14. A student measures the period of oscillation of a simple pendulum in successive measurements, the reading turn out to be 1.93 s, 1.99 s, 2.06 s, 2.08 s and 1.95 s. A more accurate way to write the measurement with error is

(a) (2.00 ± 0.05) s (b) (2.03 + 0.06) s (c) (2.0 ± 0.06) s (d) (2.03 ± 0.1) s

15. Each side of a cube is measured to be 6.372 m. The total surface area of cube with appropriate significant figures is

(a) $2.5\times10^2 m^2$ (b) $2\times10^2 m^2$ (c) 243.6 m^2 (d) 251.3207 m^2

16. Choose the correct statement

(a) A dimensionally correct equation need not be an actually correct equation

(b) A dimensionally correct equation may be an actually correct equation

(c) A dimensionally incorrect equation may be correct

(d) Both (a)and (b)

17. A famous relation in physics with many printing errors, relates the moving mass *'m'* with rest mass for a moving object with speed ***v*** is printed as $m = \frac{n_0^2}{\sqrt{1 - \frac{b}{c^2}}}$. The dimensional formula of n_0 and b are respectively (c is speed of light)

(a) $[M],[LT^{-1}]$ (b) $[M],[L^{-2}T^{-2}]$ (c) $[M^{½}],[L^2T^2]$ (d) $[M^{½}],[LT^{-1}]$

18. Parsec is a unit of

(a) Distance (b) Velocity (c) Time (d) Angle

19. If the size of atom is in the range of 10^{-10} m to 10^{-9} m is scaled up to the tip of sharp pin (assume tip of pin to be in the range of $l0^{-6}$ to 10^{-5}m), Roughly, size of nucleus is

(a) 0.1 A (b) 0.01 A (c) 0.001 A (d) 10 A

20. In a screw gauge, each main scale division is 1 mm and there are 200 divisions on the circular scale. The least count of screw gauge is

(a) 0.05 mm (b) 0.005 mm (c) 0.05 cm (d) 0.005 cm

- Answer Keys -

1) a 2) c 3) c 4) d 5) d 6) a 7) b 8) a 9) c 10) b
11) a 12) d 13) d 14) 1 15) c 16) d 17) c 18) a 19) a 20) b

Chapter 3 : Motion In A Straight Line

1. Choose the correct statement

(a) Area under velocity-time graph gives the distance travelled

(b) Area under velocity-time graph gives the change in position

(c) Area under velocity-time graph gives average acceleration

(d) Area under velocity time graph gives change in acceleration

2. Choose the correct statement for one dimensional motion

(a) A constant speed in an interval must have non-zero acceleration in that interval

(b) With negative value of acceleration speed must decrease

(c) With negative value of acceleration speed may increase

(d) With positive value of acceleration speed must increase

3. A drunkard walking in a narrow lane takes 5 steps forward, 3 steps backward and then stay for 1 s and repeat the same process again and again. Each step is 1 m long and takes 1 s. The time taken by drunkard to fall in a pit 10 m away from start is

(a) 45 s (b) 27 s (c) 30 s (d) 31 S

4. The reaction time is the time interval in which a person

(a) Observe the things

(b) Think about the observations

(c) Observe the things and act

(d) Observe the things, think and act

5. A person driving a car with a speed of 72 km/h observes a boy crossing the road at a distance of 100 m from the car. Driver applies the brakes and retards the car with a retardation of 5 m/s^2 and is just able to avoid this accident. The reaction time of driver is

(a) 2.0 s (b) 2.4 s (c) 3.0 s (d) 2. 8 s

6. In any realistic condition (v-t) and (a - t) graph cannot have sharp kinks at some points. This implies that

(a) Both velocity and acceleration can change abruptly at an instant

(b) Both velocity and acceleration cannot change abruptly at an instant

(c) Only velocity cannot change abruptly at an instant but acceleration can change

(d) Only acceleration cannot change abruptly at an instant but velocity can change

7. A ball is thrown vertically upward with a velocity of 20 m/s from the top of 160 m high building. The time taken by ball to hit the ground is

(a) 8S (b) 10S (c) 4 s (d) 6 s

8. In which of the following cases an object can be considered as point object?

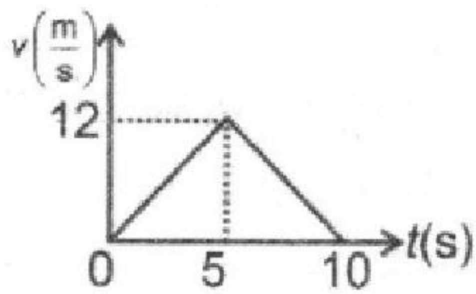
(a) Length of train in comparison to platform

(b) Length of engine in comparison to length of a small bridge

(c) A spinning cricket ball that turns sharply on hitting the pitch

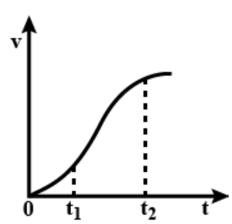
(d) A -ailway carriage moving without jerks between two stations

9. The velocity time graph of a particle moving along a fixed direction is as shown in figure. The average velocity of particle between 5 s to 10 s is



(a) 15.6m/s (b) 6.0 m/s (c) 8.9 m/s (d) 15.0 m/s

10. The velocity-time graph of a particle in one dimensional motion is as shown in figure. Which of the following relation is correct for describing the motion of particle over time interval t_1 to t_2?



1) $v_{t_2}^2 = v_{t_1}^2 + 2a_{average}(t_2 - t_1)$ 2)

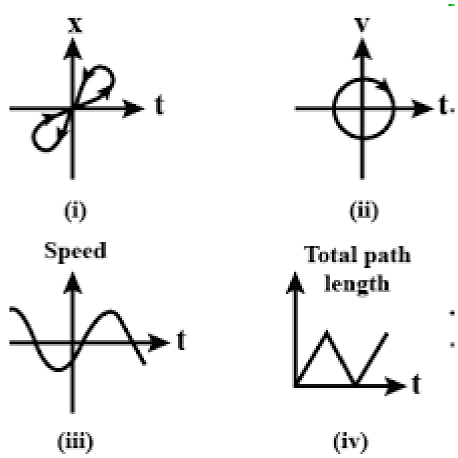
$v_{t_2} = v_{t_1} + a_{average}(t_1 - t_2) + \frac{1}{2}a_{average}(t_2 - t_1)$

3) $v_{t_2} = v_{t_1} + a(t_1 - t_2)$ 4) $a_{average} = \dfrac{v_{t_2} - v_{t_1}}{t_2 - t_1}$

11. A boy is standing on an open lift moving upwards with speed 10 m/s. The boy throws the ball with speed w.r.t. lift is 24.5 m/s. In how much time the ball returns to the hand of boy? (g= 10 m/s^2)

(a) 10s (b) 4.9 s (c) 7.5 s (d) 6 s

12. Which of the following graphs can't represent one dimensional motion of a particle?



(a) i (b) ii (c) all the four (d) iv

13. A man walks on a straight road from his home to market 2.0 km away with a speed of 4.0 km/h. The stays in the market for 30 minute for purchasing and returns to home with a speed of 6 km/h. The magnitude of average speed of whole journey is

(a) 4.0 km/h (b) 3.0 km/h (c) 4.5 km/h (d) 3.5 km/h

14. Two trains P and O of length 300 m and 500 m are moving on two parallel tracks each with a uniform speed of 72 km/h in the same direction, with Q ahead of P. The driver of train ***P*** decide to overtake train Q and accelerates by 2.0 m/s^2, if after 40 s the guard of P just brushes past the driver of Q, then the original distance between the trains is

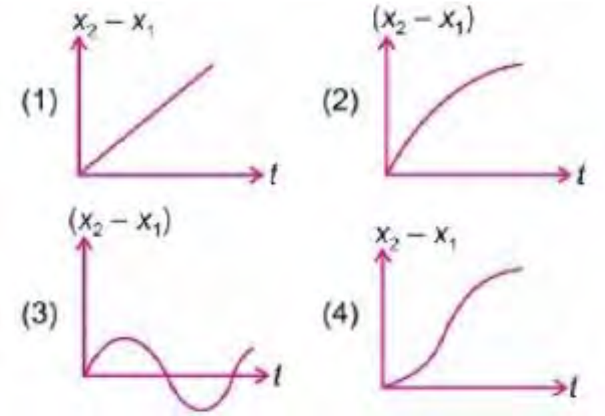
(a) 450 m (b) 650 m (c) 800 m (d) 1300 m

15. Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T minutes. A man cycling with a speed of 20 km/h in the direction from A to B notices that a bus goes past him every 18 min in the direction of his motion and

every 6 min in the opposite direction. The speed with which (assumed constant) buses ply on road is

(a) 40 km/h (b) 60 km/h (c) 75 km/h (d) 80 km/h

16. Two stones are thrown up from the edge of a cliff 300 m high with initial speed of 10 m/s and 20 ***m/s.*** Which of the following graph best represents the variation of relative position of second stone with respect to first stone till both the stones are in air? (neglect air resistance) g = 10 m/s^2



17. Graphically derivative coefficient means or differential

(a) Angle made by the line joining two points on the curve with x-axis

(b) Slope of the tangent line at any point on the curve

(c) Area enclosed under the curve

(d) Both (a) and (c)

18. A police van moving on a highway with a speed of 30 km/h and a thiefs car speeding away in same direction with speed is 192 km/h. Thief in the car fires bullet on police van. If muzzle speed of bullet is 150 m/s, then the speed with which bullet hits the w.r.t. police van is

(a) 145 m/s (b) 130 m/s (c) 115 m/s (d) 105 m/s

19. The acceleration of a body starting from rest vanes with time as a = 2f + 3, where **t** is in second. The speed of body at **t = 2** s, is

(a) 10 m/s (b) 12 m/s (c) 15 m/s (c) 18 m/s

20. The position of an object moving along x- axis is given by, x = 10 + 15t + 5t^2, where x is in meter and t is in second. The velocity of body at t = 3 s is

(a) 15 m/s (b) 30 m/s (c) 40 m/s (d) 45 m/s

- Answer Keys -

1) b	2) c	3) d	4) d	5) c	6) b	7) a	8) d	9) b	10) d
11) b	12) c	13) b	14) c	15) a	16) a	17) b	18) d	19) a	20) d

Chapter 4 : Motion In A Plane

1. Two vectors are said to be equal, if

(a) They have equal magnitude only

(b) Same direction only

(c) They have equal magnitude and same direction

(d) They have unequal magnitude and same direction

2. A null vector has

(a) Zero magnitude, specified direction

(b) Zero magnitude, arbitrary direction

(c) Non-zero magnitude, no direction

(d) Non-zero magnitude, arbitrary direction

3. To a person moving with a speed of 5 m/s towards east, rain appears to be falling vertically downward with speed $5\sqrt{3}$m/s. The actual velocity of rain is

(a)10 m/s at 30° with vertical (b) 20 m/s at 30° with vertical

(c) 10 m/s at 60° with vertical (d) 20 m/s at 60° with vertical

4. A vector can be resolved

(a) Only in two components (b) Only in three components

(c) In any number of components (d) Either two or three components

5. The magnitude of component of a vector

(a) Is always less than magnitude of vector

(b) Is always equal to magnitude of vector

(c) May be greater than magnitude of vector

(d) Is always greater than magnitude of vector

6 A motor boat is racing towards north at 25 km/h and the water current in that region is 10 km/h in the direction of 60° east of south. The resultant velocity of the boat is nearly

(a) 22 km/h (b) 12 km/h (c) 35 km/h (d) 26 km/h

7 In uniform circular motion, the centripetal acceleration is

(a) Due to change in magnitude of velocity only

(b) Due to change in direction of velocity only

(c) Due to change in both magnitude and direction of velocity

(d) Neither due to change in magnitude of velocity nor due to change in direction

8. In circular motion, the direction of angular velocity is

(a) In the plane of circle (b) Perpendicular to plane of circle

(c) In the direction of velocity (d) In the direction of acceleration

9. The shape of the trajectory of an object is determined by

(a) Acceleration only (b) Velocity of projection only

(c) Initial position and initial velocity only

(d) Initial position, initial velocity and acceleration

10. Which of the following vector operation is meaningful?

(a) Multiplication of any two vectors (b) Adding any two vectors

(c) Adding a component of vector to the same vector

(d) Both (b) and (c)

11. Which of the following quantities is/are vector?

(a) Angular frequency (b) Angular velocity

(c) Number of moles (d) Both (a) and (b)

12. Which of the following option is correct?

(a) Each component of a vector is always scalar

(b) Three vectors not lying in a plane can never add up to give null vector

(c) Two vectors of different magnitude can be add up to give null vector

(d) Minimum number of vectors to give null vector is five

13. A particle A is moving with velocity $(3\hat{i}+4\hat{j})$ m/s and particle 6 is moving with velocity $(-3\hat{i}-4\hat{j})$ m/s. The magnitude of velocity of B w.r.t A is

(a) 6 m/s (b) 8 m/s (c) 10 m/s (d) 5 m/s

14. If two vectors $\vec{A}=a\hat{i}+6\hat{j}$ $\vec{B}=b\hat{i}+c\hat{j}$ and are equal then correct options for value of a, 6 and c is

(a) a = 4 (b) a = c (c) c = 6 (d) Both (a) and (c)

15. Equation of trajectory of projectile is $y = \sqrt{3}x - 5x^2$, Then angle of projection with vertical is (Assume x-axis as horizontal and y-axis as vertical)

(a) 45° (b) 30° (c) 60° (d) 53°

16. A projectile is projected with initial velocity $(10\hat{i} + 20\hat{j})$ m/s from the ground. The velocity of the body just before hitting the ground is

(a) $10\hat{i} + 20\hat{j}$ (b) $-10\hat{i} + 20\hat{j}$ (c) $10\hat{i} - 20\hat{j}$ (d) $-10\hat{i} - 20\hat{j}$

17. The component of $(3\hat{i} + 4\hat{j})$ in the direction of $(\hat{i} - \hat{j})$ is

(a) $\frac{\hat{j} - \hat{i}}{2}$ (b) $\frac{\hat{i} - \hat{j}}{2}$ (c) $\frac{1}{\sqrt{2}}(\hat{i} - \hat{j})$ (d) $\frac{1}{\sqrt{2}}(\hat{j} - \hat{i})$

18. The correct statement for a scalar quantity is

(a) It is conserved in a process

(b) It can never take negative values

(c) It does not vary from one point to another in space

(d) It has the same value for the observers with different orientations of axis

19. A man can swim with a speed of 5 km/h in still water. How long does he take to cross a river 1.0 km wide, if the river is flowing steadily at 3 km/h and he makes his strokes normal to the river current?

(a) 20 min (b) 30 min (c) 12 min (d) 15 min

20. A particle starts from origin at t=0 s with a velocity 4.0 $\hat{j}$ m/s and moves in *x-y* plane with a constant acceleration of $(6\hat{i} + 4\hat{j})$ m/s^2 - The time after which y-coordinate of particle will be 48 m, will be

(a) 6s (b) 4s (c) 8s (d) 5s

- Answer Keys –

1) c 2) b 3) a 4) c 5) c 6) a 7) b 8) b 9) d 10) a

11) b 12) b 13) c 14) d 15) b 16) c 17) a 18) d 19) c 20) b

Chapter 5 : Laws of Motion

1. A constant retarding force 100 N is applied to a body of mass 20 kg, moving initially with speed 20 m/s. How long does the body take to stop?

   (a)2s (b) 3 s (c) 1s (d) 4s

2. A man of mass 60 kg stands on a weighing scale in a lift which is moving upward with a uniform speed of 10 m/s. The reading on the scale is.

   (a) Zero (b) 120kgwt (c) 60kgwt (d) 90kgwt

3. A rocket with a lift-off mass 10000 kg is blasted upwards with an initial acceleration of 2 m/s^2. The initial thrust of the blast is

   (a) 120 kN (b) 80 kN (c) 100 kN (d) 140 kN

4. Consider the following statements

   (a) Frictional force between block and contact surface depends on area of contact

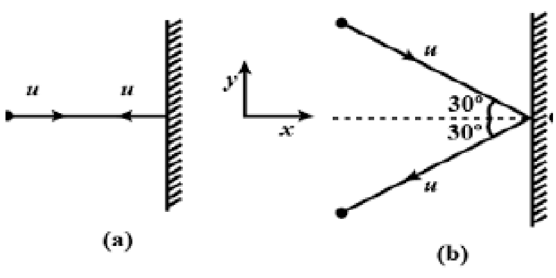
   (b) Frictional force may also act when there is no relative motion between the contact surfaces.

   The correct statement is

   (a) (a)only (b) (b)only

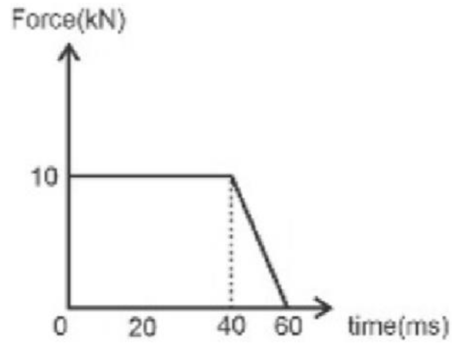
   (c) (a) and (b) both (d) Neither (a) nor (b)

5. Two identical billiard balls strike a rigid wall with same speed as shown in the figure. The ratio of magnitude of impulse imparted to the balls by the wall



   1) $\frac{2}{\sqrt{3}}$ 2) $\frac{1}{\sqrt{3}}$ 3) $\frac{1}{2}$ 4) $\frac{1}{3}$

6. A force-time plot for a body is shown in the figure. The total change in momentum of the body is



(a) 400 Ns (b) 300 Ns (c) 500 N s (d) 200 N s

7. For a given surface, the normal reaction and frictional force are inclined at

(a) 0°to each other (b) 90° to each other

(c) 45° to each other (d) $\tan^{-1}(\mu)$ to each other

8. A machine gun fires 10 bullets per second each with speed 200 m/s. If the mass of each bullet is 20 g, then the force required to keep the gun stationary is

(a) 40N (b) 04 N (c) 4N (d) 8N

9. A mass of 2 kg rests on a horizontal plane. The plane is gradually inclined until at an angle $\theta = 30°$ with the horizontal, the mass just begins to slide. The coefficient of static friction between the block and the surface is

1) $\sqrt{3}$ 2) $\frac{1}{\sqrt{3}}$ 3) $\sqrt{2}$ 4) $\frac{1}{\sqrt{2}}$

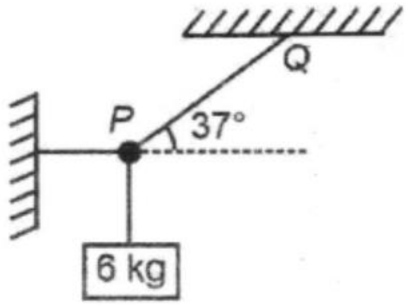
10. A cyclist speeding at 5 m/s on a level road takes a sharp circular turn of radius 2.5 m without reducing the speed. The minimum value of coefficient of static friction between tyre and road such that cyclist does not slip is

(a) 0.5 (b) 1.5 (c) 1.0 (d) 0.8

11. A truck starts from rest and accelerates uniformly with 5 m/s^2. The minimum value of coefficient of static friction between surface of truck and a box placed on it such that box does not slip back, will be

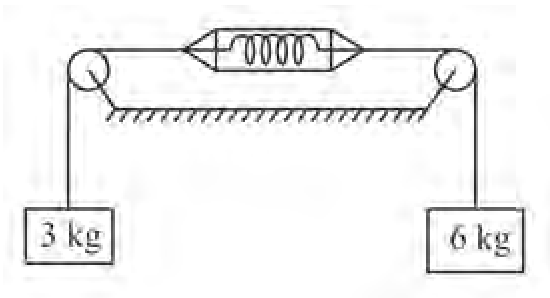
(a) 0.4 (b) 0.6 (c) 0.5 (d) 0.2

12. The tension in string PQ as shown in the figure is ($g = 10\ m/s^2$)



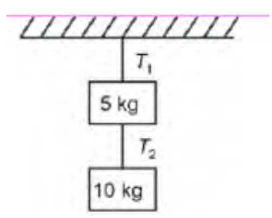
(a) 100 N (b) 150N (c) 130 N (d) 50 N

13. In the given figure, the reading of spring balance is ($g = 10\ m/s^2$)



(a) 10N (b) 20 N (c) 80 N (d) 40 N

14. The ratio of tension T_1 and T_2 as shown in the figure is



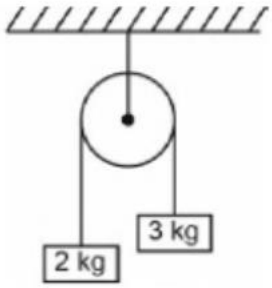
1) $\frac{3}{2}$ 2) $\frac{1}{2}$ 3) $\frac{1}{3}$ 4) $\frac{4}{3}$

15. A car is moving on a curved road of radius *R*. The road is banked at an angle θ. The coefficient of friction between tyres of the car and road is μ. The minimum safe velocity on this road is

(a) $\sqrt{\dfrac{gR(\mu+\tan\theta)}{(1-\mu\tan\theta)}}$ (b) $\sqrt{\dfrac{gR(\tan\theta-\mu)}{(1+\mu\tan\theta)}}$

(c) $\sqrt{\dfrac{gR^2(\tan\theta-\mu)}{(1+\mu\tan\theta)}}$ (d) $\sqrt{\dfrac{gR(\tan\theta-\mu)}{(1-\mu\tan\theta)}}$

16. Two masses as shown in the figure are suspended from a smooth massless pulley. The acceleration of 3 kg mass, when system is released, will be



(a) 2.5 m/s^2 (b) 2.0 m/s^2 (c) 4.0 m/s^2 (d) 5.0 m/s^2

17. A body is acted upon by unbalanced forces, then body

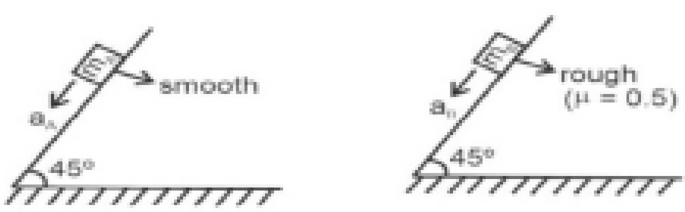
(a) Will be at rest

(b) Will keep moving with uniform speed

(c) Will accelerate

(d) Will be at rest if even number of forces will act

18. Two blocks *A* and B are released from rest on two inclined plane as shown in the figure.



The ratio of the accelerations (a_A / a_8) is

(a) 1 (b) 2 (c) 1.5 (d) 0.8

19. A 60 kg monkey, climbs on a rope which can withstand a maximum tension of 900 N.

The case in which the rope will break if the monkey

(a) Climbs up with acceleration of 6 m/s^2

(b) Climbs down with acceleration of 4 m/s^2

(c) Climbs up with uniform speed of 5 m/s

(d) Falls down the rope nearly freely under gravity

20. Which of the following is self adjusting force?

(a) Static friction (b) Limiting friction (c) Kinetic friction (d) All of these.

- Answer Keys -

1) d	2) c	3) a	4) b	5) a	6) c	7) b	8) a	9) b	10) c
11) c	12) a	13) d	14) a	15) b	16) b	17) c	18) b	19) a	20) a

Chapter 6 : Work, Power, Energy

1. What is the angle between force $\vec{F} = 3\hat{i} + 4\hat{j} - 5k$ unit and displacement $\vec{S} = 4\hat{j} + 3k$ unit?

(a) $\cos^{-1}\left(\frac{1}{5\sqrt{2}}\right)$ (b) $\cos^{-1}\left(\frac{1}{25\sqrt{2}}\right)$ (c) $\cos^{-1}\left(\frac{1}{5}\right)$ (d) $\cos^{-1}\left(\frac{1}{25}\right)$

2. A force F = 20 N acts on a object and displaces it from rest to speed of 10 m/s in its direction. What is displacement, if mass of object is 2 kg?

(a) 6m (b) 5 m (c) 12 m (d) 10 m

3. Raindrop is falling downwards under influence of gravity and opposing resistive force. Consider a drop of mass 5.00 g falling from height of 500 m and hits ground with speed of 70 m s_{-}^{1}. What is work done by resistive force?

(a) -7.85 J (b) -9.50 J (c) -12.75 J (d) -13.50 J

4. A cyclist comes to skidding stop in 6 m. During this process the force on cycle due to road is 120 N and is opposing the motion. How much work does road do on cycle?

(a) -720 J (b) -420 J (c) 20 J (d) Zero

5. A shooter fires a bullet of mass 50 g with speed of 200 m s_{-}^{1} on softwood of thickness 2 cm. If bullet looses 80% of its kinetic energy and emerges out. What is emergent bullet speed?

(a) 89.4 ms^{-1} (b) 69.5 ms^{-1} (c) 100 ms^{-1} (d) 20.0 ms^{-1}

6. A woman pushes a box on railway platform which has rough surface. She applies a force of 20 N over a distance of 5 m thereafter gets tired and applied force which reduces linearly to 10 N with distance. The total distance which box has been moved is 10 m. Work done during second displacement is

(a) 175 J (b) 19.5 J (c) 75J (d) 14.65 J

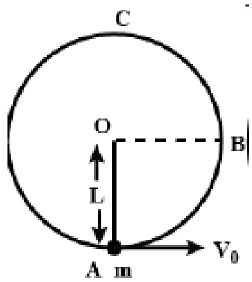
7. A block of mass m = 1 kg is moving on horizontal surface with speed of 4 m s_{-}^{1} enters a rough patch ranging from x = 0.1 m tox = 1.6 m. The retarding force in this range is inversely proportional to x

$$F = -\frac{1}{x} \quad (0.1 < x < 1.6 \text{ m})$$

What is final kinetic energy of the body?

(a) 9.2J (b)7.3J (c) 6.84 J (d) 5.23 J

8. A bob of mass ***m*** is suspended by light string of length *l*. At lowest position it is imparted a horizontal velocity $\sqrt{5gl}$ such that it just completes circular trajectory in vertical circle. What is ratio of its KE at *B* and C?



(a) 2:1 (b) 3:1 (c) 5:3 (d) 3:2

9. The potential energy of a body as a function of distance is given as ***U(x)*** = $(-6x^2 + 2x)$ J

The conservative force acting on body at x = 1 m will be

(a) 6N (b) 8N (c) 10 N (d) 12 N

10. Consider the following statements.

A; Spring force is deformation dependent.

B: Work done by Spring force depends on initial and final deformation.

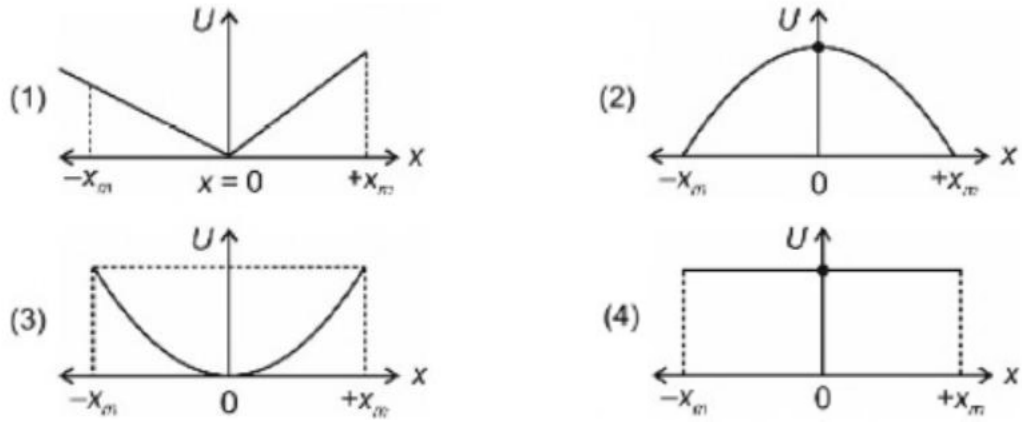
(a) Both statements are true (b) Both statements are false

(c) Only first statement is true (d) Only second statement is true

11. A spring is executing motion about equilibrium position $x = 0$ where we take potential energy of spring to be zero. The spring is oscillating between $-x_m$ and $+x_m$ position with a mass ***m*** attached. During motion, maximum speed of spring will be

1) $2\sqrt{\frac{k}{m}}x_m$ 2) $\sqrt{\frac{k}{m}}x_m$ 3) $\sqrt{\frac{k}{2m}}x_m$ 4) $\sqrt{\frac{k}{m}}\left(\frac{x_m}{2}\right)$

12. The graph between potential energy ***(U)*** of a spring versus its position (x) is best shown by graph (equilibrium $x = 0$)



13. Consider a situation in which a car of mass 2000 kg moving with speed of 54 km/h on a smooth road and colliding with a horizontal mounted spring of spring constant 12.5 10^3 Nm^{-1}. What is maximum compression of spring?

    (a) 4m (b) 6 m (c) 8 m (d) 1 m

14. An elevator can carry a maximum load of 900 kg (elevator + passengers) is moving up with constant speed of 2 m s^{-1}. A constant frictional force of 5000 N opposes the motion. What minimum power is delivered by motor (in HP)?

    (a) 37.5 HP (b) 32.5 HP (c) 42.5 HP (d) 50.2 HP

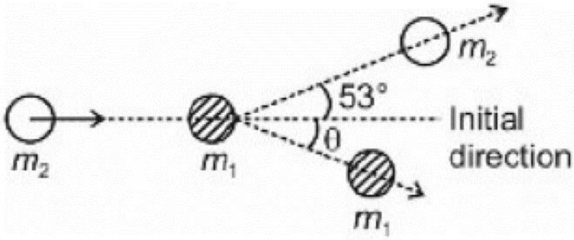
15. Two objects with mass mi = 2 kg and ***rm*** **=** 3 kg collides perfect inelastically. The particles were moving with speed of 10 m s^{-1} and zero respectively before collision. The loss of KE

    on collision is

    (a) 60 J (b) 40 J (c) 100 J (d) 90 J

16. Consider a collision between two identical billiard balls with equal masses $m_1 = m_2 = m$.

    First ball was at rest and second hits it on edge. Second ball after hitting moves through an angle of 53° to initial direction. Assuming elastic collision, the angle through which first ball moves with initial line after collision is



(a) 53° (b) 47° (c) 37° (d) 90°

17. In a nuclear reactor, a neutron of high speed 10^4 m s_{-}^{1} collides elastically with a light nuclei of deuterium (at rest). The collision results in loss of KE of neutron. What fraction of KE is lost by neutron?

(a) $\frac{1}{4}$ (b) $\frac{2}{5}$ (c) $\frac{1}{9}$ (d) $\frac{2}{9}$

18. A bullet of mass 12 g and moving with horizontal speed of 100 m s_{-}^{1} strikes a block of wood of mass 348 g and instantly comes to rest with respect to block. The block is suspended from ceiling by means of a thin wire. The height through which block rises is

(a) 0.55 m (b) 0.88 m (c) 0.77 m (d) 1.22 m

19. The blades of wind mill sweep out a circle of area $\boldsymbol{A} = \boldsymbol{2}$ m^2. The wind is flowing at velocity $\boldsymbol{v} = 6$ m s ^{1} perpendicular to circle, the density of air is 1.2 kg nr^3. What is power generated?

(a) 160.8 W (b) 259.2 W (c) 302.5 W (d) 239.2 W

20. An electron and a proton are detected in cosmic ray experiment. The electron has kinetic energy of 20 keV and proton has 50 keV. The ratio of speed of electron to proton is(m_e=9 10^{-31} kg, $\boldsymbol{m_p}$= 1.610^{-27} kg)

(a) 157 (b) 17,5 (c) 26.6 (d) 4.9

- Answer Keys -

1) b 2) b 3) c 4) a 5) a 6) c 7) d 8) b 9) c 10) a

11) b 12) c 13) b 14) a 15)a 16) c 17) c 18)a 19) b 20) c

Chapter 7 : System of Particles And Rotational Motion

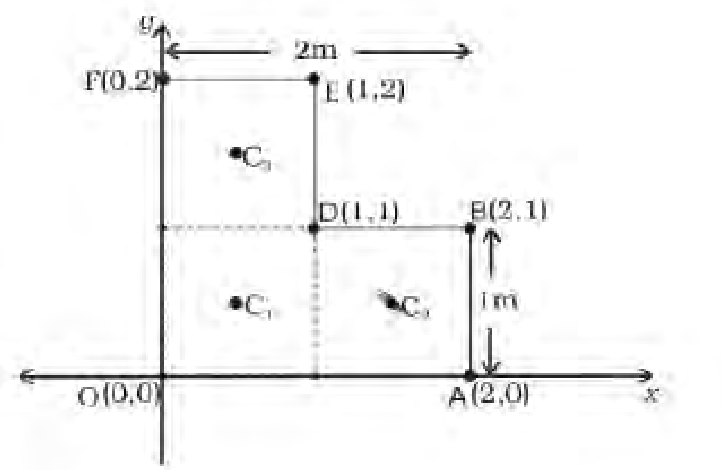
1. Three particles of equal masses are placed at co-ordinates (1, 1), (2, 2) and (4, 4) respectively. The position co-ordinate of COM of system of three particles is

(a) (0, 0) (b) $\left(\frac{2}{7},\frac{7}{2}\right)$ (c) $\left(\frac{7}{3},\frac{7}{3}\right)$ (d) (2, 2)

2. Consider a system of two identical particles. One of the particles is at rest and the other has an acceleration a. The centre of mass has an acceleration

(a) Zero (b) $\frac{1}{2}a$ (c) a (d) 2 a

3. A thin uniform flat plate is in shape of ***L*** as shown. The mass of lamina is 6 kg. The position of centre of mass from point O



(a) $\left(\frac{5}{3}m,\frac{5}{3}m\right)$ (b) $\left(\frac{2}{3}m,\frac{5}{3}m\right)$ (c) $\left(\frac{1}{6}m,\frac{2}{6}m\right)$ (d) $\left(\frac{5}{6}m,\frac{5}{6}m\right)$

4. Which relation regarding product of two vectors is incorrect ?

(a) $\vec{a}\times\vec{a}=0$ (b) $a.(\vec{b}+\vec{c})=(\vec{a}.\vec{b})+(\vec{a}.\vec{c})$

(c) $\vec{a}\times\vec{b}=-(-\vec{a})\times(-\vec{b})$ (d) $\vec{a}\times\vec{b}=\vec{b}\times\vec{a}$

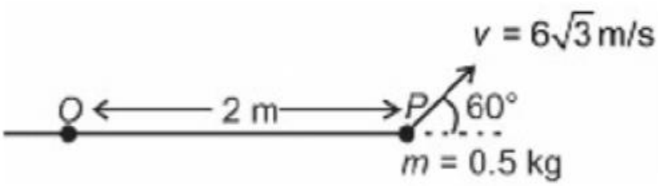
5. The vector product of given two vectors $\vec{A}=3\hat{i}-4\hat{j}+5k$ and $\vec{B}=2\hat{i}+\hat{j}+k$ is

(a) $-9\hat{i}+13\hat{j}+11k$ (b) $-9\hat{i}-13\hat{j}+11k$ (c) $-9\hat{i}+7\hat{j}+11k$ (d) $-9\hat{i}+7\hat{j}-11k$

6. The force acting on a particle is $(\hat{i}+2\hat{j}+3k)$. Find the torque of this force about origin if position vector of force is $(7\hat{i}+3\hat{j}+5k)$ m.

(a) $\hat{i}+16\hat{j}-11k$ (b) $-\hat{i}-16\hat{j}+11k$ (c) $\hat{i}+16\hat{j}+11k$ (d) $-\hat{i}+9\hat{j}+11k$

7. The angular momentum of a particle of mass 0.5 kg about point O at the instant as shown in the figure, is



(a) $6 kgm^2s^{-1}$ (b) $9\ kgm^2s^{-1}$ (c) $18 kgm^2s^{-1}$ (d) $9\sqrt{3}\ kgm^2s^{-1}$

8. Which of the following statement is incorrect?

(a) Moment of couple is independent of point about which moment is taken.

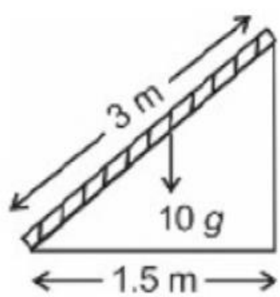
(b) For translational equilibrium of a body vector sum of all the forces on it must be zero

(c) A body may be in translational equilibrium but may not be in rotational equilibrium simultaneously

(d) Rotational equilibrium depends on location of origin about which torques are taken

9. A 3 m long ladder weighing 10 kg leans on a frictionless wall. Its feet rest on floor 1.5 m

from wall as shown. What is reaction force of the wall?



(A) $\frac{50}{\sqrt{3}}$ N (B) $50\sqrt{3}$N (C) $100\sqrt{3}$N (D) 120 N

10. Which of the following statement is incorrect?

(a) Moment of inertia depends on distribution of mass about rotational axis

(b) Moment of inertia depends on orientation and position of axis of rotation

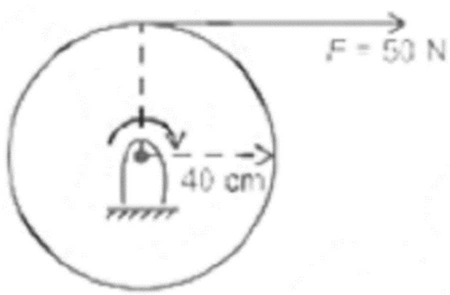
(c) Moment of inertia changes when angular velocity of body changes

(d) Flywheel resists sudden increase or decrease of speed of vehicle

11. A ring has mass of 6 kg and radius of 2 m. What is moment of inertia of this ring about a tangent to the Circle of ring in its plane?

(a) 24 kg m^2 (b) 12kgm^2 (c) 30 kg m^2 (d) 36 kg m^2

12. A cord of negligible mass is wound round the rim of flywheel disc with mass of 15 kg and radius of 40 cm. A steady pull of 50 N is applied to cord as shown. The wheel is mounted on horizontal axis. What is angular acceleration of wheel?



(a) 10.33 rad s^{-2} (b) 16.66 rad s^{-2} (c) 20.66 rad s^{-2} (d) 4.99 rad s^{-2}

13. A cord of negligible mass is wrapped around a solid cylinder of a mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on cord tangentially. The cylinder is mounted on

horizontal axis with frictionless bearings. What is kinetic energy of wheel when 2 m cord is unwound?

(a) 50 J (b) 100J (c) 150J (d) 90 J

14. Four bodies; a ring, a solid cylinder, a hollow sphere and a solid sphere of same mass are

allowed to roll down a rough inclined plane without slipping from same level- The body with greatest rotational kinetic energy at bottom is

(a) Ring (b) Solid cylinder (c) Hollow sphere (d) Solid sphere

15. A car weighs 1800 kg. The distance between its front axle and back axle is 1.8 m. Its centre of gravity is 1.05 m behind front axle. The force exerted by level ground on front wheels is (g = 10 ms^{-2})

(a) 7500 N (b) 6500 N (c) 9500 N (d) 1800 N

16. A ring (circular) of radius 2 m has mass of 100 kg. It rolls purely along horizontal floor so that its COM has speed 20 cm s^{-1}. The work required to stop it is

(a) 2J (b) 3 J (c) 4J (d) 8J

17. To maintain a rotor at a uniform angular speed of 200 rad sH an engine needs to transmit a torque of 125 Nm. What is power required by the engine?

(a) 15 kW (b) 20 kW (c) 25 kW (d) 50 kW

18. A bullet of mass 10 gram is fixed with speed of 500 m s^{-1} into a door and gets embedded exactly at centre of door. The door is 1 m wide and weighs 12 kg. Door is hinged along one side and rotates about vertical axis without friction. The angular speed of door just after bullet embeds into it is

(a) 0.35 rad s^{-1} (b) 0.625 rad s^{-1}

(c) 0.255 rad s^{-1} (d) 0.935 rad s^{-1}

19. A solid disc of radius 10 cm are placed on a horizontal table (rough) with initial angular speed equal to 10 % rad s^{-1}. if coefficient of kinetic friction between disc and table is 0.2 then time taken by the disc to start pure rolling will be

(a) $\frac{\pi}{2}$s (b) $\frac{\pi}{3}$s (c) $\frac{\pi}{6}$s (d) $\frac{\pi}{4}$s

20. A child stands at centre of turntable with his two arms outstretched- The turntable is set rotating with angular speed of 40 rad s^{-1}. What will be angular speed of child if he folds his hands back reducing moment of inertia to $\frac{2}{5}$ times the initial value (ignore friction?)

(a) 50 rad s^{-1} (b) 75 rad s^{-1} (c) 100 rad s^{-1} (d) 150 rad s^{-1}

- Answer Keys -

1. (c) 2. (b) 3. (d) 4. (d) 5. (c) 6. (b) 7. (b) 8. (d) 9. (a)
10. (c) 11. (d) 12. (b) 13. (a) 14. (a) 15. (a) 16. (c) 17. (c)
18. (b) 19. (c) 20. (c)

Chapter 8 : Gravitation

1. The escape speed of a body from the earth depends on

(a) Mass of the body

(b) The direction of projection

(c) The height of location from where the body is launched

(d) All of these

2. A planet of mass *m* revolved around the sun of mass Min an elliptical orbit. The maximum

and minimum distance of the planet form the Sun are *r* and 3r respectively. The time period of the planet is proportional to

(a) r^3 (b) $(2r)^{\frac{3}{2}}$ (c) 4r (d) $(4r)^{\frac{2}{3}}$

3. Two point masses *m* and 9m are separated by a distance don a line. A third point mass of **1** kg is to be placed at a point on the line such that the net gravitational force on it is zero.

The distance of 1 kg mass from mass *m* is

1) $\frac{d}{4}$ 2) $\frac{d}{2}$ 3) $\frac{d}{3}$ 4) $\frac{d}{6}$

4. The force of gravitation between two masses is 10 mN in vacuum. If both the masses are placed in a liquid at the same distance, then new force of gravitation will be

(a) 10mN (b) $\frac{40}{3}mN$ (c) $\frac{30}{4}mN$ (d) Can't say

5. Three equal masses of 3 **kg** each are fixed at the vertices of an equilateral triangle ***ABC.*** The gravitational force acting on mass 2 kg placed at the centroid of triangle is

(a) Zero (B) $6.67 \times 10^{-3}N$ (c) $9 \times 10^{-9}N$ (d) Data is insufficient

6. An object is projected from earth's surface, with speed half of the escape speed of earth, then maximum height attained by it is

1) $\frac{R_E}{2}$ 2) $\frac{R_E}{3}$ 3) R_E 4) $2R_E$

7. The change in gravitational potential energy when a body of mass m is raised to height $4R_E$ from the earth surface is $4R_E$ is radius of earth)

(a) $\frac{4}{3}mgR_E$ (b) mgR_E (c) $\frac{mgR_E}{5}$ (d) $\frac{4}{5}mgR_E$

8. The potential energy of a system of four particles each of mass *m,* placed at vertices of a square of side a is

(a) $-(4+\sqrt{2})\frac{Gm^2}{a}$ (b) $-4\frac{Gm^2}{a}$ (c) $-4\sqrt{2}\frac{Gm^2}{a}$ (d) $-\frac{4Gm}{a}$

9. A satellite of mass *m* is in a circular orbit of radius $2R_E$ around the earth. The energy required to transfer it to a circular orbit of radius $4R_E$ is

(a) $\frac{mgR_E}{2}$ (b) $\frac{7}{8}mgR_E$ (c) $\frac{mgR_E}{8}$ (d) $\frac{mgR_E}{4}$

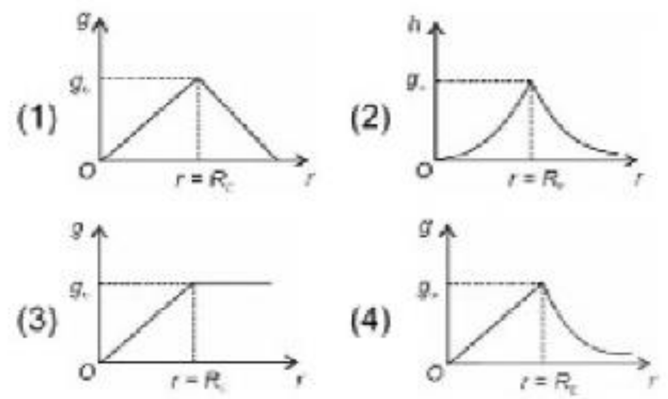
10. If the gravitational potential at the surface of earth is V_0, then potential at a point at height equal to radius of earth is

(a) V_0 (b) $\frac{V_0}{2}$ (c) $\frac{V_0}{3}$ (d) $\frac{V_0}{4}$

11. A satellite revolving around earth has potential energy - 2 MJ, then the binding energy of the satellite is

(a) 1 MJ (b) 2MJ (c) – 1 MJ (d) 8 MJ

12. Starting from the centre of earth having radius R_E , the variation is acceleration due to gravity is best represented by the curve



13. A body weighs 90 N on the surface of earth. The gravitational force on it due to earth at a

height equal to half the radius of earth is

(a) 81 N **(b)** 40 N (c) 45 N (d) 30 N

14. The escape speed of a projectile on the earth surface is 11.2 km/s. A body is projected out with three times of escape speed. The speed of body far away from the earth is (Ignore the presence of sun and other planets)

(a) 31.7 km/s (b) 24 km/s (c) 22.4 km/s (d) Zero

15. The density of a newly invented planet is twice that of earth. The acceleration due to gravity at the surface of the planet is double that at the surface of earth, If radius of earth is R_E then the radius of the planet would be

1) R_E 2) $\frac{R_E}{2}$ 3) $2R_E$ 4) $4R_E$

16. For a satellite moving in a circular orbit around the earth, the ratio of kinetic energy to the magnitude of potential energy is

(a) 1 (b) $\frac{1}{2}$ (c) 2 (d) $\frac{1}{4}$

17. A point mass m is placed inside a spherical shell of mass M and radius R. The gravitational force experienced by the point

(a) $\frac{GMm}{R^2}$ (b) $\frac{GMm}{2R^2}$ (c) $\frac{2GMm}{R^2}$ (d) Zero

18. A Geostationary satellite is orbiting at a height of $6R_E$ above the surface of earth. The time period of another satellite at a height $2.5R_E$ above the surface of earth is (R_E is radius of earth)

(a) 6 hours (b) $6\sqrt{2}$ hours (c) $\frac{6}{\sqrt{2}}$ hours (d) 12 hours

19. A particle is projected vertically up with velocity $v = \sqrt{\frac{5}{4} g R_E}$ from earth surface. The velocity of particle at height equal to the maximum height reached by it is

(a) $\sqrt{\frac{gR_E}{4}}$ (b) $\sqrt{\frac{gR_E}{3}}$ (c) $\sqrt{\frac{gR_E}{5}}$ (d) Zero

20. When energy of a satellite-Earth system is non-zero positive, then satellite will

(a) Move around the earth in circular orbit

(b) Just escape out

(c) Move around the earth in elliptical orbit

(d) Escape out with speed some interstellar speed

- Answer Keys -

1. (c) 2. (b) 3. (a) 4. (a) 5. (a) 6. (b) 7. (d) 8. (a) 9. (c) 10. (b)

11. (a) 12. (d) 13. (b) 14. (a) 15. (a) 16. (b) 17. (d) 18. (b) 19. (d) 20. (d)

Chapter 9 : Mechanical Properties of Solids

1. Which of the following materials is/are close to ideal plastics

   (a) Putty (b) Mud (c) Steel (d) Both(a)&(b)

2. The restoring mechanism in solids can be visualized by taking a model of

   (a) Spring-ball system (b) Atwood machine

   (c) Plum - Pudding (d) Liquid - Drop

3. Bulk modulus is relevant for

   (a) Solids only (b) Solid (c) Fluids (d) Both (b) & (c)

4. The strain produced by a hydraulic pressure is called

   (a) Longitudinal strain (b) Shearing strain

   (c) Volume strain (d) Both(a)&(b)

5. The ratio of stress and strain, within proportional limit is called

   (a) Modulus of elasticity (b) Compressibility

   (c) Poisson's ratio (d) Both (b) & (c)

6. For most materials

   (a) $G \approx \frac{Y}{3}$ (b) $G \approx \frac{Y}{2}$ (c) $G \approx 3Y$ (d) $G \approx 2Y$

7. The strain perpendicular to the applied force is called

   (a) Longitudinal strain (b) Volume strain

   (c) Lateral strain (d) Shear strain

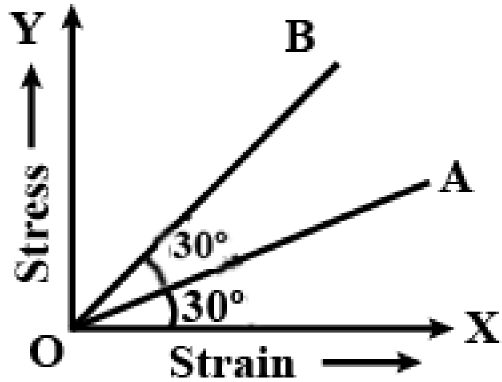
8. For aluminium alloys Poisson's ratio is about

   (a) 0.20 (b) 0.16 (c) 0.33 (d) 0.40

9. The average depth of Indian ocean is about 3000 m. The fractional compression, $\frac{\Delta V}{V}$ of water at the bottom of the ocean is $(B = 2\times10^{9}\,Nm^{-2}, g = 10\,ms^{-2})$

   (a) 1.5% (b) 2.5% (c) 4% (d) 3%

10. In the graph shown, if the Young's Modulus of material ***A*** is V, then the Young's Modulus for material B is

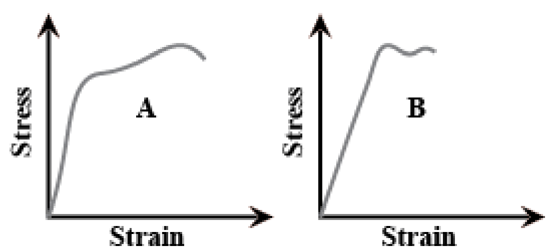


(a) $\sqrt{3}$Y (b) V/3 (c) 3Y (d) 2Y

11. The volume contraction of a solid copper cube. 10 cm on an edge, when subjected to a hydraulic pressure of 10^7 Pa is (B» 14010^9 N m^{-2})

(a) 0.07 cm^3 (b) 0.03 cm^3 (c) 0.02 cm^3 (d) 0.01 cm^3

12. The stress-strain graphs for materials A and B are as shown in figure



The correct Statement is

(a) A is having greater Young's modulus ard B is stronger

(b) B is having greater Young's modulus ard A is stronger

(c) B is having greater Young's modulus ard it is stronger as well

(d) A is having greater Young's modulus ard it is stronger as well

13. The edge of an aluminum cube is 10 cm. One face of the cube is firmly fixed to a vertical wall. A mass of 100 kg is attached to the opposite face of the cube. The vertical deflection of this face is ($G = 25 \times 10^9$ Pa)

(a) 4×10^{-7}m (b) 3×10^{-6} m (c) 2×10^{-6} m (d) 1×10^{-6}m

14. A rigid bar of mass 15 kg is supported symmetrically by three wires each 2.0 m long. Those at each end are of Copper and the middle one is of iron. If tension in each rod is same, the ratio of diameters is nearly

(a) 6 (b) 0.8 (c) 4.2 (d) 2.0

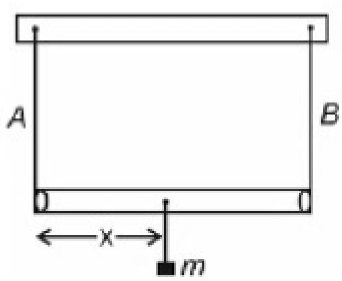
15. The density of water at a depth where pressure is 80.0 atm (Given density at the surface is 1.03 x 10^3 kg m^{-3}, $B = 2.2\times10^9$ N nr^2)

(a) $1.034\times$ 10kg m^{-3} (b) 1.34×10^3 kg m^{-3}

(c) 1.64×10^3kg m^{-3} (d) 2.084×10^3kg m^{-3}

16. A rod of length 1.05 m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminum (wire B) of equal lengths as shown in figure. The cross-sectional areas of wire ***A*** and ***B*** are 2.0 mm^2 and 4.0 mm^2, respectively. The distance x from left end, where a mass m is suspended in order to produce equal stresses, is

$(Y_{steel} = 2\times10^{11}\,Nm^{-2}, Y_{Al} = 7\times10^{10}\,Nm^{-2})$



(a) 70 cm (B) 35 cm (b) 43.2 cm (d) 40 cm

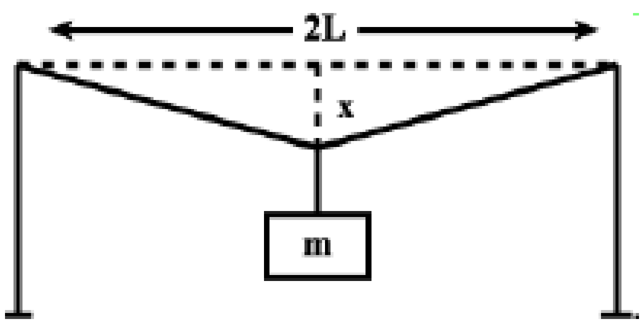
17. In Q16, the distance x from left end to produce equal strains is

(a) 70 cm (b) 43.2 cm (c) 65 cm (d) 35 cm

18. A 15 kg mass, fastened to the end of a steel wire of unstretched length 1.0 m, is whirled in a vertical circle with an angular velocity of 4TT radian's at the bottom of the circle. The cross-sectional area of the wire is 0.065 cm^2. The elongation of the wire when the mass is at the lowest point is (g = 10 m/s^2)

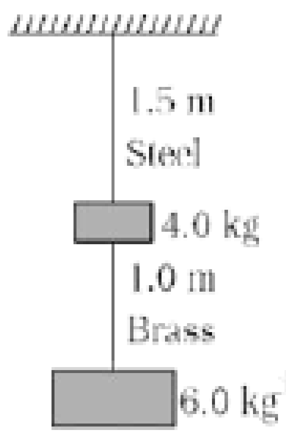
(a) 1.93 mm (b) 2.05 mm (c) 1.65 mm (d) 3.05 mm

19. A mild steel wire of length 2L and cross-sectional area ***A*** is stretched, within elastic limit, horizontally between two pillars as shown in the figure. A mass m is suspended from the mid-point of the wire. Strain in the wire is



1) $\frac{x^2}{L^2}$ 2) $\frac{x^2}{2L^2}$ 3) $\frac{x}{L}$ 4) $\frac{2x^2}{L^2}$

20. Two wires of diameter 0.25 cm, one made of steel and the other made of brass are loaded as shown in the figure. The unloaded length of steel wire is 1.5 m and that of brass wire is 1.0 m. The ratio of tensile stress in steel to brass wire is ($g = 10\ m/s^2$)



1) $\frac{5}{9}$ 2) $\frac{5}{2}$ 3) $\frac{3}{2}$ 4) $\frac{4}{3}$

- Answer Keys -

1. (d)	2. (a)	3. (d)	4. (c)	5. (a)	6. (a)	7. (c)	8. (c)	9. (a)
10. (c)	11. (a)	12. (c)	13. (a)	14. (b)	15. (a)	16. (a)	17. (b)	18. (a)
19. (b)	20. (b)							

Chapter 10 : Mechanical Properties of Fluids

1. The energy required for having a molecule at the surface of liquid is

(a) Heat of evaporation

(b) Roughly half the heat of evaporation

(c) Heat capacity

(d) Roughly half of heat capacity of liquid

2. Which of the following conversion is correct?

(a) 1 atm = 1.0110^4 Pa(b) 1 mm of Hg= 133 Pa

(c) 1 bar= 10^7 Pa (d) 1 torr= $10^?$ Pa

3. Pressure is equal to

(a) It is product of force and area and both force and area are vectors

(b) It is the ratio of force which is a vector and parallel to area

(c) It is ratio of the component of force normal to area

(d) It depends on size of area chosen

4. Along a streamline in flow

(a) The velocity of a fluid particle remains constant

(b) The velocity of all fluid particles crossing a given position is constant

(c) The velocity of all fluid particles at a given instant is constant

(d) The speed of all fluid particle at any instant must be constant

5. Which of the following statements is incorrect?

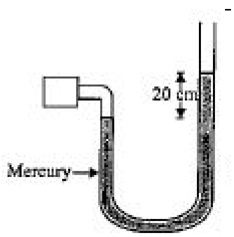
(a) Blood is more viscous than water

(b) The blood pressure in humans is greater at the feet than at the brain

(c) The angle of contact of mercury with glass is obtuse while that of water with glass is acute

(d) A spinning cricket ball in air follows a parabolic trajectory

6. A manometer reads the pressure of a gas in an enclosure as shown in figure. The absolute and gauge pressure of the gas (in cm of mercury) in the enclosure is



(Take atmospheric pressure = 76 cm of Hg)

(a) 76, 20 (b) 20, 76 (c) 96, 20 (d) 20, 96

7. Streamline flow is more likely for liquids with

(a) High density and high viscosity (b) Low density and low viscosity

(c) High density and low viscosity

(d) Low density and high viscosity

8. The ratio of inertial force to the viscous force represents

(a) Magnus effect (b) Reynold's number

(c) Relative density (d) Torricelli's law

9. The Onset Of turbulence in a liquid is determined by

(a) Pascal's law (b) Avogadro number

(c) Stoke's law (d) Reynold's number

10. A plane is in level flight and each of its wings has an area 20 m^2. If the speed of air on upper and lower surfaces are 80 m/s and 70 m/s respectively, then the mass of plane is (density of air = 1 kg/m^3)

(a) 1500 kg (b) 1700 kg (c) 1650 kg (d) 1750 kg

11. Which of the following instrument is used to measure blood pressure in humans?

(a) Sphygmomanometer

(b) Cardioverter defibrillator

(c) Barometer

(d) Syphnometer

12. When temperature increases, the viscosity of

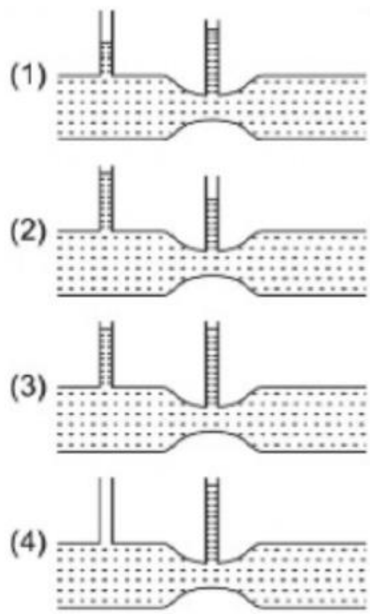
(a) Gases decreases and liquids increases

(b) Gases increases and liquid decreases

(c) Both gases and liquids increases

(d) Both gases and liquids decreases

13. Which of the following figure shown below is correct regarding the steady flow of an ideal liquid?



14. When a drop of water splits up into number of droplets

(a) Surface area will increase (b) Volume decreases

(c) Energy is absorbed (d) Both (a) and (c)

15. Which of the following statement is not true about angle of contact?

(a) The angle of ccntact for pure water and glass is nearly zero

(b) Angle of contact may increase with increase in temperature

(c) if the angle of contact of a liquid and a solid surface is less than 90% then liquid spread on surface of solid

(d) Angle of contact depends upon the inclination of the solid surface to the liquid surface

16. A soap bubble is having internal and external radii as *R* and *2R* respectively. If surface tension of soap solution is *T,* then excess pressure inside bubble will be

1) $\frac{4T}{R}$ 2) $\frac{3T}{R}$ 3) $\frac{2T}{R}$ 4) $\frac{4T}{3R}$

17. When a capillary tube is dipped in a liquid, the liquid rises to a height h in the tube. The free liquid surface in the tube is hemispherical in shape. The tube is now pushed down so the height of the tube outside the liquid is less than h. Then the

(a) Liquid will come out of the tube in the form of small fountain

(b) Liquid will ooze out of the tube slowly

(c) Free liquid surface inside the tube remain hemispherical

(d) Liquid will rise to the top of capillary tube increase the radius of curved surface and stay there

18 Dynamic lift due to spinning of a ball is

(a) Magnus effect (b) Doppler's effect

(c) Pascal effect (d) Torricelli effect

19. A solid sphere falls with a terminal velocity $\boldsymbol{v}$ in air. If it is allowed to fall in vacuum, then

(a) Terminal velocity of sphere is equal to $\boldsymbol{v}$

(b) Terminal velocity of sphere is greater than $\boldsymbol{v}$

(c) Terminal velocity of sphere is less than $\boldsymbol{v}$

(d) Sphere will never attain terminal velocity

20. The sap in tree rises in a system of capillaries of radius 2.5×10^{-5} m. The surface tension of sap is 7.28×10^{2} N/m and the angle of contact is 0°. The maximum heightto which sap can rise in a tree through capillary action is (density of sap is = 1×10^3 kg/m^3)

(a) 0.21 m (b) 0.59 m (c) 0.87 m (d) 0.91 m

- Answer Keys -

1.(b) 2. (b) 3. (c) 4. (b) 5. (d) 6. (c) 7. (d) 8. (b) 9. (d)
10. (a) 11. (a) 12.(b) 13. (b) 14. (d) 15. (d) 16. (b) 17. (d) 18. (a)
19. (d) 20. (b)

Chapter 11 : Thermal Properties of Matter

1. A rod of length 5 m is prevented from thermal expansion by fixing its ends rigidly.

   Its cross-sectional area is 40 cm^2. Calculate thermal stress developed on a temperature rise of 20°C, if $Y = 2\times10^{11}$ ***Nm–2*** and $\alpha = 1.2\times10^{-5}K^{-1}$

   (a) 2.410^3 N m^{-2} (b) 2.410^7 N m^{-2}

   (c) 4.810^7 N m^{-2} (d) 5.610^7 N m^{-2}

2. A blacksmith fixes iron ring on rim of woods wheel of a cart. The diameter of rim and iron

   ring are 3.243 m and 3.231 m respectively at 27°C. To what temperature should ring be

   heated to fit on rim? ($\alpha = 1.2\times10^{-5}K^{-1}$)

   (a) 309.5°C (b) 336.5°C

   (c) 412°C (d) 232.6°C

3. A temperature of 60°C in Fahrenheit scale is equal to

   (a) 104°T (b) 140°T (c) 119°F (d) 100°F

4. The property of water that has important environmental effect on marine life is

   (a) Low viscosity (b) Low thermal conductivity

   (c) High heat capacity (d) Maximum density at 4°C

5. Coefficient of volume expansion of ideal gases at constant pressure and at temperature T K is equal to

   1) $\frac{1}{T}$ 2) T 3) $\frac{1}{T^2}$ 4) $\sqrt{T}$

6. Assertion: When hot water is poured in a beaker of thick glass, the beaker cracks.

   Reason: The beaker experiences unequal expansion.

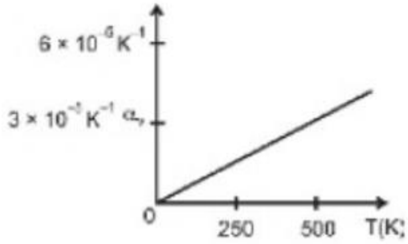
   (a) If both assertion and reason are true and reason is true explanation of assertion

   (b) If both assertion and reason are true but reason is not correct explanation of assertion

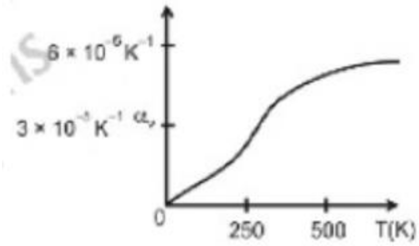
   (c) Assertion is true but reason is false

   (d) Both assertion and reason are false

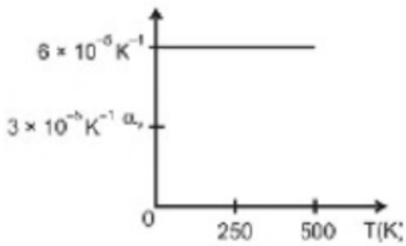
7. Which of the following graph gives the correct dependency of coefficient of volume expansion of copper with temperature?



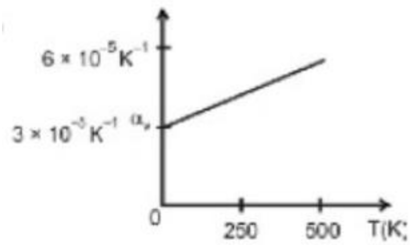
1)



2)



3)



4)

8. The specific heat of a substance depends on

(a) Nature of substance

(b) Temperature of the substance

(c) Mass of the substance

(d) Both (a)and (b)

9. An aluminium sphere of mass 47 gm is at 100°C. It is then transferred to 140 gm copper calorimeter containing 250 gm of water at 20°C. In steady state the temperature of water rises by 3^{D}C. What is specific heat of aluminium if that of copper is 386 J kg^{-1} K^{-1}?

(a) 911 J kg^{-1} K^{-1}

(b) 516 J kg^{-1} K^{-1}

(c) 312 J kg^{-1} K^{-1}

(d) 612 J kg^{-1} K^{-1}

10. Two ideal gas thermometers A and B use oxygen and hydrogen gas respectively. Following observation were made

Temperature	Pressure thermometer *A*	Pressure thermometer *B*
Triple point of water	1.25×10^5 Pa	2×10^4 Pa
Normal melting point of sulphur	1.797×10^5 Pa	2.87×10^4 Pa

What is absolute temperature of normal melting point of sulphur as read by thermometer ***A*** and ***B*** respectively?

(a) 39269 K, 391.98 K (b) 362.3 K, 378.6 K

(c) 378.4 K, 375.4 K (d) 3875 K, 386.3 K

11. Boiling water is converting into steam at atmospheric pressure. The heat supplied is now being utilised to change water from liquid state to vapour state. Under this condition, specific heat of water is

(a) Less than zero (b) Zero

(c) Slightly greater than zero (d) Infinite

12. Certain amount of heat is given to 200 gm of copper to increase its temperature by 20°G. If same amount of heat is given to 60 gm of water, then rise in its temperature is

(Specific heat of copper = 385 J kg^{-1} K^{-1} and water = 4200 J kg^{-1} K^{-1})

(a) 4°C (b) 5°C (c) 6°C (d) 9°C

13. When 150 gm of ice at 0°C is mixed with 300 gm of water at 50^{B}C in a container, the resulting temperature is (L_f= 3 34 x 10^5 J kg^{-1}. S_w = 4186 J kg^{-1} K^{-1})

(a) 2.7°C (b) 3.7°C (c) 5.7°C (d) 6.7^{n}C

14. Steam at 100°C causes more burns than boiling water at 100°C because

(a) Low specific heat of steam

(b) Steam is in gaseous phase

(c) Steam at 100°C carries more heat than water at 100°C

(d) Steam has low viscosity

15. The incorrect statement among the following is

(a) Cooking pots have copper coating on bottom to promote distribution of heat quickly

(b) Plastic foams are insulators because they contain pockets of air

(c) Convection can be forced or natural but is possible only in fluids

(d) Trade winds is an example of forced convection

16. An iron bar of conductivity $\mathbf{K_1}$ = 79 W m^{-1} K^{-1} and an identical brass bar of conductivity K_2 = 109 W m^{-1} K^{-1} are soldered end to end. The free end of iron and

brass bars are maintained at 400 K and 300 K respectively. What **is** temperature of junction of two bars?

(a) 350 K (b) 342 K (c) 333 K (d) 305 K

17. When a piece of iron is heated in a hot flame, it first becomes dull red, then reddish yellow and finally white hot. This phenomenon can be explained by

(a) Stefan- Boltzmann's law (b) Greenhouse effect

(c) Wien's displacement law (d) Newton's law of cooling

18. A tungsten lamp at a temperature of 3000 K has surface area of 0.3 cm^2. If the lamp has emissivity of 0.4, the rate of heat radiated is

(a)40W (b) 50 W (c) 90 W (d) 55 W

19. The amount of radiations emitted by a perfectly black body is proportional to

(a) Temperature on ideal gas scale

(b) Fourth power of temperature on ideal gas scale

(c) Square of area of the black body

(d) Square of temperature on Celsius scale.

20. A box filled with hot tea cools from 94°C to 86°C in 4 minute, when room temperature is 40QC. How long will it take to cool from 71°C to 69°C?

(a) 10 minute (b) 3 minute

(c) 100 second (d) 50 second

- Answer Keys -

1. (c)	2. (b)	3. (b)	4. (d)	5. (a)	6. (a)	7.(b)	8.(d)
9. (a)	10. (a)	11. (d)	12. (c)	13. (d)	14. (c)	15. (d)	
16.(b)	17.(c)	18. (d)	19. (b)	20. (c)			

Chapter 12 : Thermodynamics

1. 1 gm of water is changed from its liquid to vapour phase. The measured latent heat of water is 2256 J/g. What is the amount of change in internal energy?

   (a) 169.2 J (b) 3068.2 J (c) 2086.8 J (d) 2548.3 J

2. A monoatomic ideal gas undergoes an adiabatic process from temperature 300 K to 600 K. The gas has 2 moles, calculate work done by this ideal gas

   (a) 600 R(J) (b) -200 R(J) (c)-450R(J) (d) -900 R (J)

3. A reversible cyclic heat engine absorbs 900 joule of heat from source. If 400 J of heat is released to the sink, what is the efficiency of the engine?

   (a) $\frac{2}{9}$ (b) $\frac{3}{7}$ (c) $\frac{5}{9}$ (d) $\frac{4}{9}$

4. In an isothermal process, two moles of an ideal gas expands from volume 2 m^3 to 8 m^3 at temperature of 227°C. Heat absorbed by the gas during process is nearly

   (a) 2752 cal (b) 3250 caL (c) 1945 cal (d) 1875 cal

5. In a refrigerator, the system extracts heat of 600 J from a cold reservoir and released 900 J of heat to hot reservoir. The coefficient of performance of a refrigerator is given by

   (a)2 (b)3 (c) 6 (d) 9

6. What amount of heat must be supplied to 210^{-2} kg of nitrogen at room temperature to raise its temperature, by 25°C at constant pressure? (Molecular wt. of $\mathbf{N_2}$ = 28)

   (a) 270.5 J (b) 519.6 J (c) 370.4 J (d) 148.3 J

7. In changing the state of a gas adiabatically from an equilibrium state *A* to another equilibrium state S, an amount of work equal to 104.6 J is done on the system. If this gas is taken from state *A* to *B* via a process in which the net heat absorbed by the system is 35 cal, how much is net work done by the system in later case? (1 cal = 4.19 J)

   (a) 192.7 J (b) 89.6 J (c) 42.05 J (d) 142.5 J

8. A cylinder with movable piston contains 2 moles of hydrogen at standard temperature and pressure. The cylinder walls of the cylinder are made of heat insulator. By what factor does the pressure of a gas increase when gas is suddenly compressed to half of its Original volume?

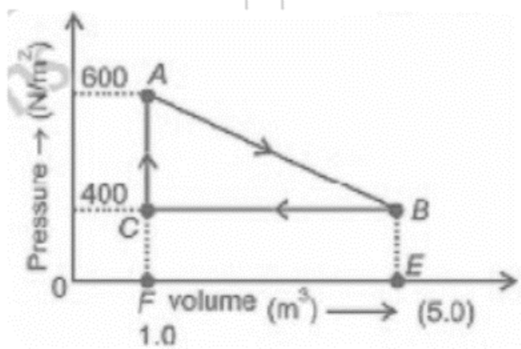
   (l) 1.5 (b) 3.82 (c) 2.64 (d) 6.23

9. Two cylinders *A* and *B* of equal capacity are connected to each other via a stopcock. *A* contains a gas at standard temperature and pressure. *B* is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. What is effect on internal energy of gas?

(a) Increases (b) Decreases

(c) No change (d) May decrease or no change

10. A thermodynamic system is taken from original state to another intermediate state by linear process shown in diagram. Its volume is then reduced to original volume from *B* to C by an isobaric process. What is total work done by gas from *A* to 6 to C?



(a) 500 J (b) 400 J (c) 1200 J (d) 2000 J

11. A steam engine working like an ideal heat engine delivered 5.410^{8} J of work per minute and takes 3.610^{9} J of heat per minute from its boiler at 127°C. What is sink temperature?

(a) 37°C (b) 47°C (c) 57°C (d) 67°C

12. A diatomic gas with three moles are in a container at 400 K. Under isobaric process, its temperature is changed to 900 K. How much heat is absorbed by the gas during this process?

(a) 6.4 kcal (b) 9.4 kcal (c) 10.4 kcal (d) 12.4 kcal

13 Which of the following is incorrect statement?

(a) Free expansion of a gas is irreversible process

(b) A thermodynamic process is reversible if process can be turned back **SO** that both system and surrounding return to their original states

(c) No process is possible whose sole result is transfer of heat from a colder object to hotter object

(d) The efficiency of an ideal heat engine is unity.

14. In thermodynamic processes, correct match of column-I with column-II is

Column-l	Column-ll
Type of process	Feature
a. Isothermal	(i) Volume constant
b. Isobaric	(ii) Pressure constant
c. Isochoric	(iii) No heat flow between system and surroundings
d. Adiabatic	(iv) Temperature constant

(a) a(i), b(ii), c(iii). d(iv) (b) a(iv), b(l). c(iii). d(ll)

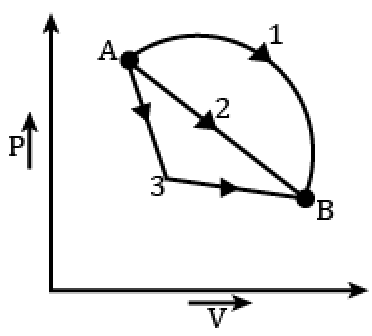
(c) a(iv), b(ii), c(iii),d(i) (d) a(iv), b(ii), c(i), d(iii)

15. Molar specific heat of an ideal gas at constant volume is 21 joule/mol K and molar specific heat at constant pressure is about 35 joule/mol K. The ideal gas is

(a) Monoatomic (b) Diatomic

(c) Triatomic (d) Polyatomic

16. An ideal gas goes from state *A* to state *B* via three different processes as indicated in *P* - *V* diagram. If Q_1, Q_2 and Q_3 indicate the heat absorbed by gas along the three processes $\Delta U_1, \Delta U_2$ and ΔU_3 and indicate the change in internal energy along three processes, then



(a) $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(b) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(C) $Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

(D) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

17. If Q, E and W denote respectively the heat added, change in internal energy and work done in a closed cyclic process, then

(a) Q = 0 (b) *Q= W=0* (c) *W= 0* (d) E = 0

18. Thermodynamic state variables may be

(a) Extensive only (b) Intensive only

(c) Both (a)and (b) (d) Neither (a) nor (b)

19. An ideal gas is compressed to half of its initial volume by means of different thermodynamic processes. Which of the process result in the maximum work done on the gas?

(a) Isothermal (b) Adiabatic

(c) Isobaric (d) Isochoric

20. Refrigerator is to maintain eatables kept inside at 7°C. If the room temperature is 43°C, coefficient of performance of refrigerator must be

(a) 7.78 (b) 13.7 (c) 9.72 (d) 0.75

- Answer Keys -

1. (c) 2. (d) 3. (c) 4. (a) 5. (a) 6. (b) 7. (c) 8. (c) 9. (c) 10. (b)

11. (d) 12. (c) 13. (d) 14. (d) 15. (a) 16. (a) 17. (d) 18. (c) 19. (b) 20. (a)

Chapter 13 : Kinetic Theory

1. A vessel contains two non-reactive gases; monoatomic neon and diatomic oxygen. The ratio of their partial pressure is 5 : 3. Estimate the ratio of number of moles of neon and oxygen in a vessel. (Molar mass oxygen O_2 = 32.0 u and atomic mass of neon = 20.2 u)

   (a) 5:3 (b) 3 : 5 (C) 4 : 3 (D) 2 : 5

2. In case of two ideal gases under ideal conditions of same temperature, pressure and volume, the ratio of mean free paths of molecules having molecular diameter 1A and 2A is

   (A) 2 : 1 (b) 4 : 1 (C) 1 : 4 (D) 8 : 1

3. An inflated rubber balloon contains one mole of an ideal gas has a pressure P, volume V

   and temperature ***T.*** If temperature rises to 1.1 T and volume increases to 1.05 V, final

   pressure will be

   (a) 1.1 P (b) P

   (c) Less than P (d) Between P and 1.1 P

4. Which of the following statement is incorrect?

   (a) In case of collision of gas molecules in a given amount of gas in container, total kinetic energy is conserved

   (b) All collisions of gas molecules is elastic in nature

   (c) Average kinetic energy per degree of freedom depends on temperature only and is indepencent of nature of gas

   (d) By law of equipartiiion of energy, the energy for each degree of freedom in thermal equilibriim is K_BT

5. Which of the following is not an assumption of kinetic theory of gases?

   (a) The volume occupied by molecule of gas is negligible

   (b) The force of attraction between molecules is negligible

   (c) All molecules have same speed at a temperature

   (d) The collisions of molecules among themselves are elastic

6. The temperature of the gas is increased from 120 K to 480 K. If at 120 K, the rms speed of gas molecules is V_{RMS} then at 480 K, it becomes

(a) 4 Vrms (B) 2 VRMS (C) V_{RMS} (d) $\frac{V_{RMS}}{2}$

7. Three moles of oxygen are mixed with two moles of helium, what will be approx. ratio of specific heat at constant pressure and constant volume for the mixture?

   (a) 1.2 (b) 1.4 (c) 1-5 (d) 1.67

8. The kinetic theory of gases gives the formula $P = \frac{1}{3}\frac{Nm}{V}(v^{-2})$ for the pressure P exerted by a gas enclosed in a vessel of volume *V,* the term *Nm* represents

   (a) Mass of one mole of the gas

   (b) Mass of gas present in volume *V*

   (c) Total number of molecules present in volume *V*

   (d) Average mass of one molecule of the gas

9. A balloon contains 1500 m^3 of helium at 300 K and 4 atmospheric pressure. The volume of helium at 270 K and 2 atmospheric pressure will be [Assuming no leakage of gas]

   (a) 1500 m^3 (b) 1900 m^3 (c) 1700 m^3 (D) 2700 m^3

10. A vessel contains 6 g of oxygen at pressure *P* and temperature 400 K. A small hole is made in it so that oxygen leaks out. How much oxygen leaks out if final pressure is $\frac{P}{2}$ and temperature is 300 K?

    (a) 5g *(b)3g* *(c)2g* *(d)4g*

11. If the pressure and volume of a certain quantity of an ideal gas is halved, then its temperature becomes

    (a) Doubled (b) One fourth (c) Four times

    (d) Remains same

12. Pressure of a gas at constant volume is proportional to

    (a) Total internal energy of gas

    (b) Square of average kinetic energy of gas molecule

    (c) Average potential energy of molecules

    (d) Speed of the gas molecule

13. *If three molecules have speeds of 2000 ms^{-1}, 1000 ms^{-1} and 500 ms^{-1}, the ratio of rms speed to average speed is*

(a) 1.14 (b) 0.92 (c) 1.78 (d) 1.71

14. A real gas behaves like an ideal gas if its

(a) Both pressure and temperature are high

(b) Both pressure and temperature are low

(c) Pressure is high and temperature is low

(d) Pressure is low and temperature is high

15. What will be mean free path of a nitrogen molecule in a container at 2 atmospheric pressure and at 17°C, radius of nitrogen molecule is about 1A?

(Molar mass of nitrogen = 28.0 u)

(a) $1.11\times10^{-7}\,\text{m}$ (b) $2.3\times10^{-6}\,\text{m}$ (c) $2.4\times10^{-7}\,\text{m}$ (d) $1.8\times10^{-9}\,\text{m}$

16. Air has density of 1.3 kg nr^3 and temperature of air is 37°C. If molar mass of air is 28.8, what will be air pressure?

(a) $1.16\times10^{5}\,\text{N}\,\text{m}^{-2}$ (b) $2.1\times10^{4}\,\text{N}\,\text{m}^{-2}$ (c) $1.92\times10^{5}\,\text{N}\,\text{m}^{-2}$ (d) $0.92\times10^{5}\,\text{N}\,\text{m}^{-2}$

17. The ratio of degrees of freedom of a monoatomic gas to diatomic gas is

(a) 3:5 (b) 3:1 (c) 4:5 (d) 1:1

18 A flask contains argon and chlorine in the ratio of 2 : 1 by mass. The mixture temperature is 300 K. What is ratio of root mean square speed of molecules of two gases?

[Atomic mass of argon = 39.9 u and molecular mass of chlorine = 70.9 u]

(a) 1.33 (b) 1.55 (c) 1.77 (d) 1.66

19 A polyatomic gas has 3 translational. 3 rotational degrees of freedom and 2 vibrational modes. What is molar specific heat ratio for the gas?

(a) 1.50 (b) 1.30 (c) 1.40 (d) 1.20

20. A cylinder of capacity 44.8 litres contains helium gas at standard temperature and pressure. What amount of heat is needed to raise the temperature of gas in cylinder by 10°C?

(a) 173.5 J (b) 249.3 J (c) 205.2 J (d) 374.2 J

- Answer Keys -

1. (a)	2. (b)	3. (d)	4. (d)	5. (c)	6. (b)	7. (c)	8. (b)
9. (d)	10. (c)	11. (b)	12. (a)	13. (a)	14. (d)	15. (a)	16. (a)
17. (a)	18. (a)	19. (d)	20. (d)				

Chapter 14 : Oscillations

1. The equation of motion is represented by $y = \sin\omega t + \cos\omega t$. The time period of periodic motion is

(a) $\frac{\pi}{\omega}$ (b) $\frac{2\pi}{\omega}$ (c) $\frac{2\pi}{\omega}$ (d) $\frac{4\pi}{\omega}$

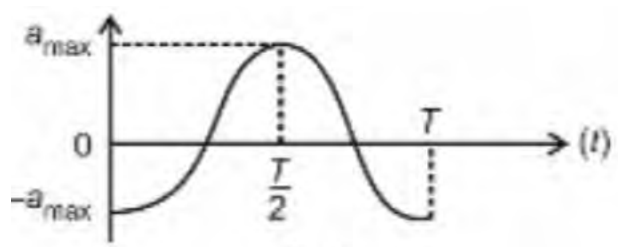
2. The equation of motion of particle executing SHM is given as $y = \sin^2 \omega t$. The position of equilibrium is

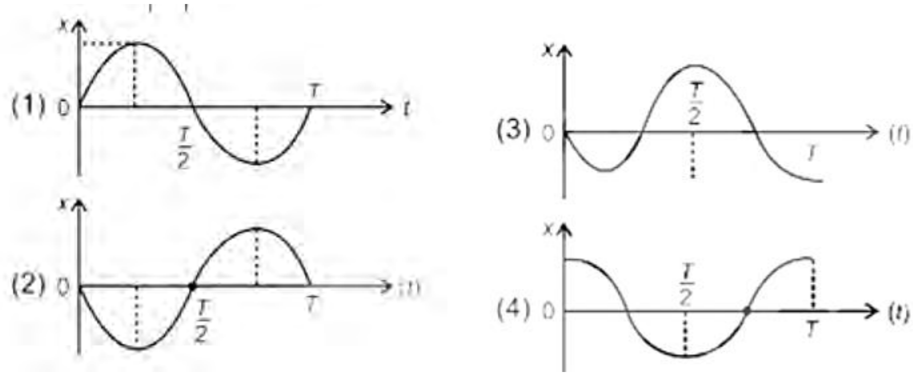
(a) $y = 0$ (b) $y=1$ *(c)* $y = \frac{1}{2}$ *(d)* $y = -1$

3. A body execute SHM according to equation . At t= 3/2s. what is speed of the particle?

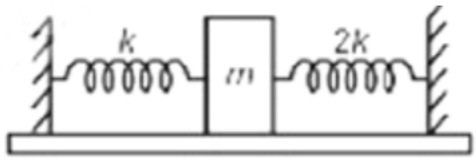
(a) 10 ms^{-1} (b) 20 ms^{-1} (c) 22 ms^{-1} (d) 44 ms^{-1}

4. Acceleration versus time graph for a particle executing SHM is shown in figure below. Corresponding position time graph will be





5. Two springs with spring constants K and 2K are attached to a block of mass *m* and with fixed supports as shown. When mass is displaced from equilibrium position on either side, it executes SHM. The frequency of oscillation is



1) $\frac{1}{2\pi}\sqrt{\frac{3m}{K}}$ 2) $\frac{1}{2\pi}\sqrt{\frac{m}{2K}}$ 3) $\frac{1}{2\pi}\sqrt{\frac{3m}{2K}}$ 4) $\frac{1}{2\pi}\sqrt{\frac{3K}{m}}$

6. A particle executes SHM. Its time period is *T.* The kinetic energy of the particle is also periodic with time period of

(a) T *(b) 2T* *(c)* $\frac{T}{2}$ *(d) Infinity*

7. A block whose mass is 500 g is fastened to a spring. The spring has spring constant of 100 N/m. The block is pulled to a distance of $x = 10$ cm from its equilibrium position state of $x = 0$ from rest at $t = 0$. What is kinetic energy of block at $x = 5$ cm?

(a) 0.375 J (b) 0.19 J (c) 0.56 J (d) 0.76 J

8. A block of mass 2 kg is attached to a spring of spring constant 200 Nm^{-1} oscillates without friction over a smooth horizontal surface. The block is displaced by 10 cm from equilibrium position and released. What is maximum acceleration of block?

(a) 1 ms^{-2} (b) 2 ms^{-2} (c) 0.5 ms^{-2} (d) 1.5 $^{-2}$

9. Length of a simple pendulum whose time period is 2 second on earth surface will be nearly

(a) 0.5 m (b) 1m (c) 1.5 m (d) 2 m

10. A block of mass 500 g and attached to one end of a spring of spring constant K = 450 Nm^{-1}. The friction is also present which dissipate energy and damping constant of system is 25 g/s. What is time taken for its amplitude of oscillation to drop to half of its initial value.

(a) 18.73 s (b) 27.72 s (c) 32.2 s (d) 6.52 s

11. Which of the following example does not represents SHM?

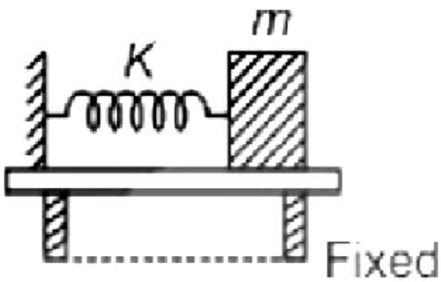
(a) Oscillations of a spring block system

(b) Motion of ball bearing inside smooth curved bowl, when released slightly away from equilibrium

(c) Motion of oscillating mercury column in vertical U-tube

(d) Rotation of earth about its axis

12. A spring having spring constant of 800 Nm^{-1} is mounted on a horizontal table as shown. A mass of 2 kg is attached to free end of the spring. The mass is pulled sideways to distance of 2.5 cm and released. How much time the mass takes from one extreme to other



(a) 0.157s (b) 0.2s (c) 0.314 s (d) 0.782 s

13. The acceleration due to gravity on the surface of moon is 1.7 ms^{-2}. What will be period of oscillation of a simple pendulum on the surface of moon if its time period on the surface of earth is 2s ?

(a) 4.8s (b) 2.8 s (c) 1.8s (d) 3.5 s

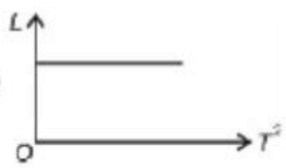
14. A particle executes SHM has maximum speed of 20 cm s^{-1} and maximum acceleration of 40 cm s^{-2}. The period of oscillation is

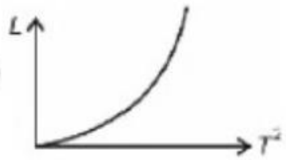
(a) πs (b) $\frac{\pi}{2}s$ (c) $\frac{\pi}{3}s$ (d) $2\pi s$

15. A spring balance has a scale that reads from 0 to 100 kg. The length of scale is 25 cm. A block suspended from this balance when displaced and released oscillates with time period of 0.2 s. What is mass of block approximately?

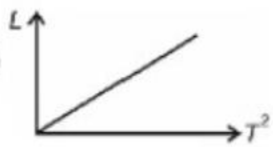
(a) 2 kg (b) 4 kg (c) 5 kg (d) 6 kg

16. The graph between length of pendulum and square of its time period is shown below. The best graph is

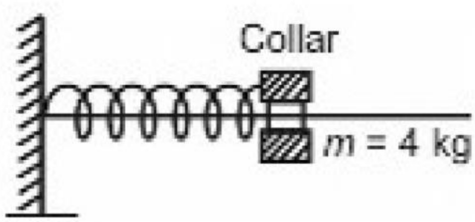
(1)


(2)


(3)


(4)


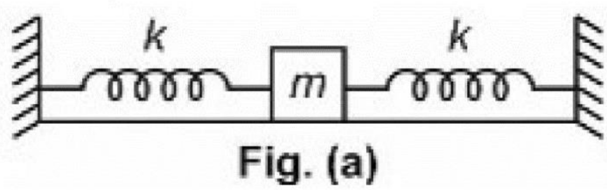
17. A collar of mass 4 kg is attached to a spring of spring constant 500 Nnr^{1}. If collar is displaced from equilibrium position by a distance of 2 cm and released, what is

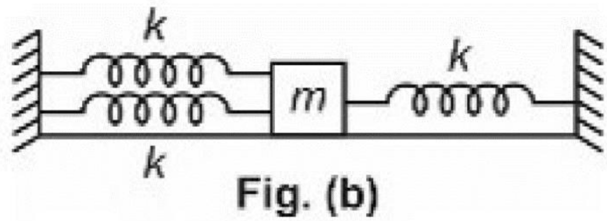


frequency of oscillation?

(a) 5.4 Hz (b) 1.78 Hz (c) 9.36 Hz (d) 3.26 Hz

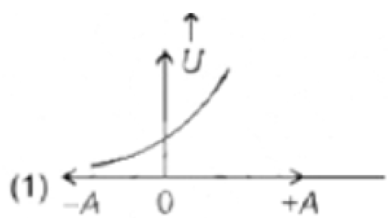
18. Two identical springs of spring constant ***K*** each are attached to block of mass ***m*** and fixed supports as shown in figure (a). The period of oscillation was observed to be 7. If one more identical spring is attached as shown in figure (b) then new period will be

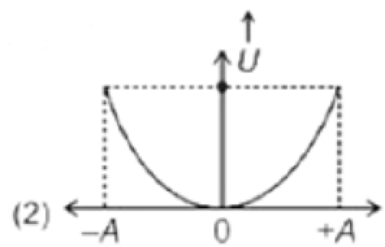


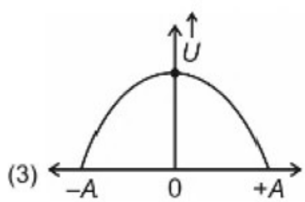


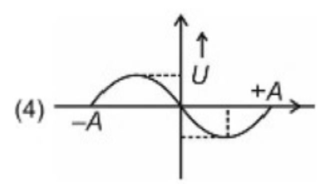
1) $\sqrt{\frac{2}{3}}T$ 2) $\sqrt{\frac{3}{2}}T$ 3) 2T 4) $\sqrt{\frac{1}{3}} \times T$

19. A particle executes SHM, has potential energy which changes with position. If potential energy at equilibrium position is assumed to be Zero. then potential energy versus position graph is best represented by

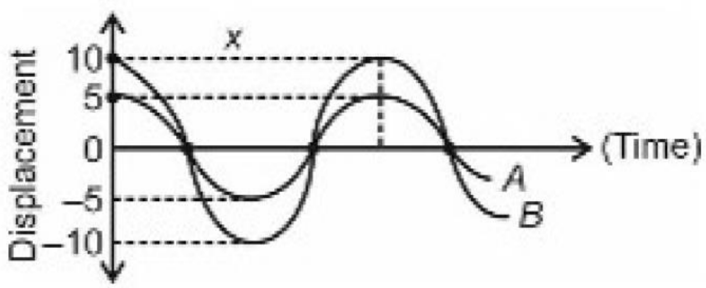








20. The graph of a particle executing SHM is shown for two particles *A* and B. The ratio of maximum accelerations of A to B is



1) 1: 1 2) 1:2 3) 2:1 4) 1:4

- Answer Keys -

1. (b) 2. (c) 3. (d) 4. (d) 5. (d) 6. (c) 7. (a) 8. (a) 9. (b) 10. (b)
11. (d) 12. (a) 13. (a) 14. (a) 15. (b) 16. (d) 17. (b) 18. (a) 19. (b) 20. (b)

Chapter 15 : Waves

1. Some examples of wave motion are given in the following options. In which case wave motion is a combination of both transverse and longitudinal waves?

(a) Motion of a kink in a longitudinal spring produced by displacing one end of the spring side ways

(b) Waves produced in a cylinder containing a liquid by moving its piston back and forth

(c) Waves produced by a motorboat sailing in water

(d) Both (a) and (c)

2. Longitudinal waves in a medium propagate due to

(a) Shear modulus (b) Bulk modulus

(c) Both Shear and Bulk modulus (d) Young's modulus

3. Modification in Newton's formula for speed of sound in air was made by

(a) Stefan (b) Boltzman (c) Laplace (d) Edison

4 . At what temperature will the speed of sound in air becomes 3 times of its value at 0°C?
(a) 1184°C (b) 1148*C (c) 2184°C (d) 2148°C

5. A bat emits ultrasonic sound of frequency 1000 kHz in air. If the sound meets a water surface, the wavelength of the reflected and transmitted sound are (speed of sound in air = 340 m/s and in water 1500 m/s)

(a) 3.4 mm, 30 mm (b) 6.8 mm. 15 mm

(c) 0.34 mm, 1.5 mm (d) 6.8 mm. 30 mm

6. A pipe 30 cm long, is open at both the ends. Which harmonic mode of the pipe resonates with 1.1 kHz source? (v = 330 ms^{1})

(a) First (b) Second

(c) Third (d) Forth

7. A progressive wave is represented by y = 2 $\sin(100\pi t - 2\pi x)$, where x and y are in cm and ***t*** is in second. The maximum particle velocity and wave velocity respectively are

(a) 628 cm/s, 628 cm/s (b) 50 cm/s. 50 cm/s

(c) 628 cm/s , 50 cm/s (d) 50 cm/s, 628 cm/s

8. Equation of a plane progressive wave is given by $y = 0.6\sin 2\pi\left(t - \frac{x}{2}\right)$. On reflection from a denser medium its amplitude becomes $\left(\frac{2}{3}\right)^{rd}$ of the amplitude of incident wave. The equation of reflected wave is

(a) $y = 0.6\sin 2\pi\left(t + \frac{x}{2}\right)$ (b) $y = 0.4\sin 2\pi\left(t + \frac{x}{2}\right)$

(c) $y = -0.4\sin 2\pi\left(t - \frac{x}{2}\right)$ (d) $y = -0.4\sin 2\pi\left(t + \frac{x}{2}\right)$

9. A sound is produced by plucking a string in a musical instrument, then

(a) The velocity of wave in string is equal to the sound velocity in string

(b) The frequency of wave in string is equal to the frequency of sound produced

(c) The wave in string is progressive

(d) The frequency of the wave in string is dcuble the frequency of sound

10. A glass tube of 100 cm length is filled with water. The water can be drained out slowly at the bottom of the tube. If a vibrating tuning fork of frequency 500 Hz is brought at the upper end of the tube and the velocity of sound in air is 330 m/s, then the total number of resonances obtained will be

(a)4 (b)3 (c)2 (d) 1

11 . A tuning fork *A* of frequency 512 Hz produces 5 beats per second when sounded with another tuning fork *B* of unknown frequency. If 0 is loaded with wax the number of beats is again 5 per second. The frequency of fork S before it was loaded is

(a) 507 Hz (b) 502 Hz (c) 517 Hz (d) 522 Hz

12. The equation of a stationary wave along a stretched string is given by $y = 5\sin\frac{2\pi x}{3}\cos 40\pi t$ in, where x and y are cm and *t* is in second. The separation between two adjacent nodes is

(a) 1.5 cm (b) 3 cm (c) 6 cm (d) 4 cm

13. A second harmonic has to be generated in a string of length $\boldsymbol{L}$ stretched between two rigid support. The point where the string has to be plucked and touched are

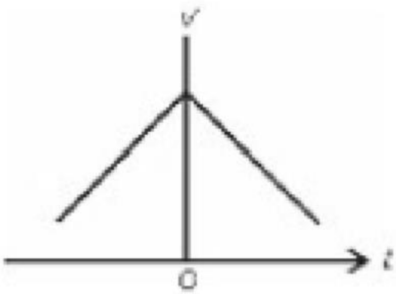
(a) Plucked at $\frac{L}{4}$ and touch at $\frac{L}{2}$ (b) Plucked at $\frac{L}{4}$ and touch at $\frac{L}{2}$

(c) Plucked at $\frac{L}{2}$ and touch at $\frac{L}{4}$ (d) Plucked at $\frac{L}{2}$ and touch at $\frac{3L}{4}$

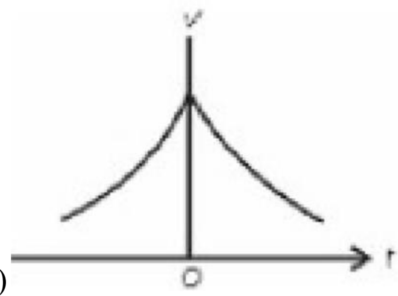
14. An observer moves towards a stationary source of sound with a velocity one fifth of the velocity of sound. The percentage change in apparent frequency is

(a) 0% (b) 5% (c) 10% (d) 20%

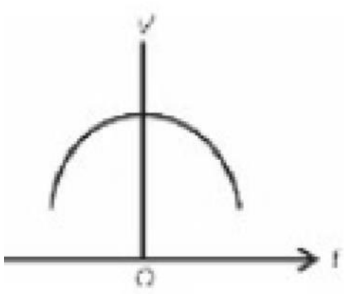
15. A railway engine whistling at a constant frequency moves with a constant speed.lt goes past a stationary observer standing beside the railway track. The frequency (v') of the sound heard by observer is plotted against time *(t)*. Which of the following graph best represent the variation in apparent frequency with time?



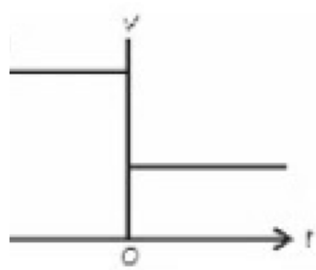
1)



2)



3)



4)

16. If a wave is incident on a surface and a part of the incident wave is reflected back and a part is transmitted into the second medium, then

(a) Incident and refracted waves obey Snail's law of refraction

(b) Incident and refracted waves doesn't obey laws of refraction

(c) Incident and reflected waves obey the usual laws of reflection

(d) Both (a)and (c)

17. Two sitar strings A and B playing a note are slightly out of tune and produce beats of frequency 5 Hz. When the tension in the String B is slightly increased, the beat frequency is found to reduce to 3 Hz. If the frequency of String A is 427 Hz. The Original frequency of string B is

(a) 422 Hz (b) 424 Hz (c) 430 Hz (d) 432 Hz

18. The transverse displacement of a string clamped at its both ends is given by $y = 0.06 \sin\left(\frac{2\pi x}{3}\right)\cos(120\pi t)$, where x and y are in metre and *t* is in second. The length of the string is 1.5 m and its mass is 3×10^{-2} kg. The tension in string is

(a) 324 N (b) 648 N (c) 832 N (d) 972 N

19. In longitudinal stationary waves, displacement nodes are the points where there is

(a) Maximum displacement and maximum pressure

(b) Minimum displacement and minimum pressure change

(c) Minimum displacement and maximum pressure change

(d) Maximum displacement and maximum pressure change

20. Newton assumed that sound propagation in a gas takes under

(a) Isothermal condition (b) Adiabatic condition

(c) Isotropic condition (d) Isochoric condition

- Answer Keys -

1)	d	2)	b	3)	c	4)	c	5)	c
6)	b	7)	c	8)	d	9)	b	10)	b
11)	c	12)	a	13)	a	14)	d	15)	d
16)	d	17)	a	18)	b	19)	c	20)	a

SECTION B : 2ND PUC SYLLABUS

Chapter 1 : Electric Charges and Fields

1. The electrostatic force between two small charged spheres having charges of 2 x 10^{-6} C and 3 x 10^{-6} C placed 30 cm apart in air is

(a) 0,9 N (b) 0.6 N (c) 1.2 N (d) 1.8 N

2. Four point charges $q_A = -2\mu C, q_B = -5\mu C, q_c = -2\mu C$ and $q_D = -5\mu C$ are located at the corners of a square of side 20 cm (In cyclic order). What is electric force on a charge of $1\mu C$ placed at the centre of square?

(a)0.9N (b) Zero (c) 0.6 N (d) 2.4 N

3. A system of two charges $q_A = 2.5 \times 10^{-7} C$ and $q_B = -2.5 \times 10^{-7} C$ are located at points

A: (0. 0,-15 cm) and B: (0. 0, 15 cm) respectively. The electric dipole moment of system is

(a) $2.5 \times 10^{-7} Cm$ (b) $5 \times 10^{-7} Cm$

(c) $7.5 \times 10^{-8} Cm$ (d) Zero

4. A polythene piece rubbed with wool is found to have negative charge of $3.2 \times 10^{-6} C$. The number of excess electrons on polythene is

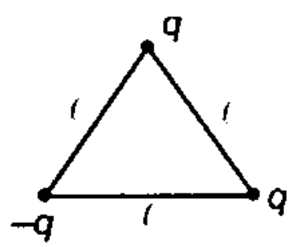
(a) 2×10^{13} (b) 4×10^{12} (c) 5.5×10^{9} (d) 6×10^{20}

5. An electron falls through distance of m in uniform electric field from state of rest. The time of fall if $E = 6 \times 10^{4} NC^{-1}$ is

(a) $1.5 \times 10^{-6} s$ (b) $1.94 \times 10^{-9} s$

(c) $3.3 \times 10^{-5} s$ (d) $2.3 \times 10^{-6} s$

6. Consider charges q,-*q* and *q* placed at vertices of an equilateral triangle as shown in figure. Calculate force on -*q* charge due toother



1) $\frac{q^2}{2\pi\varepsilon_0\ell^2}$ 2) $\frac{q^2}{4\pi\varepsilon_0\ell^2}$ 3) $\frac{\sqrt{2}q^2}{\pi\varepsilon_0\ell^2}$ 4) $\frac{\sqrt{3}q^2}{4\pi\varepsilon_0\ell^2}$

7. Which among the given statements is incorrect statement?

(a) For every positive point charge, electric field lines will be directed radially outwards from charge.

(b) Magnitude of electric field E will depend on distance form point charge

(c) The electric field due to a point charge has spherical symmetry

(d) A test charge q experiences electric force $\vec{F}$ at a point then electric field intensity is defined as $\vec{E} = \frac{\vec{F}}{q^2}$

8. A proton and an electron are released form rest in uniform electric field then the correct Statement among the following is

(a) Time required to fall through certain distance is more for an electron

(b) The force experiences by proton will be more

(c) Magnitude of acceleration experienced by proton is more

(d) KE gained by both charges in moving through same distance are equal

9. Regarding electric lines of force, the correct statement is/are

(a) Field lines carry information about direction of electric field

(b) Relative density of field lines at different points indicates relative strength of electric field at these points

(c) The field lines crowd where field is weak and spaced apart where field in strong

(d) Beth (a) and (b) are correct

10. The incorrect statement among the following statements is

(a) Electric field lines can never cross each other

(b) Electrostatic field lines do not form any closed loop

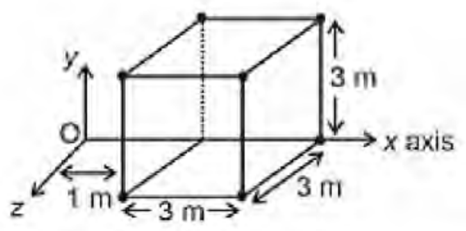
(c) In charge free region, electric field lines can be taken to be continuous curve

(d) Field lines around a system of two positive charges is straight and parallel lines pictorially

11. A dipole consist of two charges q and -q separated by a distance 2a. The electric field of this dipole at distance r from centre of dipole at a point ***A*** on axis is

1) $\frac{2p}{4\pi\varepsilon_0 r^2}$ 2) $\frac{2p}{4\pi\varepsilon_0 (r^2+a^2)^{\frac{3}{2}}}$ 3) $\frac{p}{4\pi\varepsilon_0 r^3}$ 4) $\frac{2pr}{4\pi\varepsilon_0 (r^2-a^2)^2}$

12. Electric field components are $E_x = 100x^{\frac{1}{2}}, E_y = E_z = 0$. Calculate net electric flux though the cube placed in electric field at shown position.



(a) 900Nm^{2}C^{-1} (b) 1800Nm^{2}C^{-1} (c) 600 Nm^{2}C^{-1} (d) 3600 Nm^{2}C^{-1}

13. An infinite long straight wire has linear charge density$\lambda = 4 \times 10^5 Cm^{-1}$. The electric force experienced by a proton at perpendicular distance of 10 mm from axis of wire is

(a) 1.25 **x** 10^{-4} N (b) 1.68 **x** 10^{-3}N

(c) 2.8 **x** 10^{-6} N (d) 1.15 **x** 10^{-1} N

14. Coulomb's law of electrostatic for the force between two point charges most closely resembles

(a) Law of conservation of charges

(b) Law of conservation of energy

(c) Newton's second law of motion

(d) Newton's law of gravitation

15. A point charge q of mass m is placed in front of a uniformly charged infinite sheet and released. The surface charge density of sheet is C m^{-2}. The kinetic energy of charge after t second is

1) $\frac{q^2\sigma^2 t^2}{4\varepsilon_0^2 m}$ 2) $\frac{q^2\sigma^2 t^2}{\varepsilon_0^2 m}$ 3) $\frac{q^2\sigma^2 t^2}{8\varepsilon_0^2 m}$ 4) $\frac{q^2\sigma^2 t^2}{4\varepsilon_0^2 m}$

16. An electric dipole consists of two equal and opposite charges 002 μC separated by 2 mm. The dipole is placed is uniform electric field of 10^7 N C^{-1}. Maximum torque exerted by field on dipole is

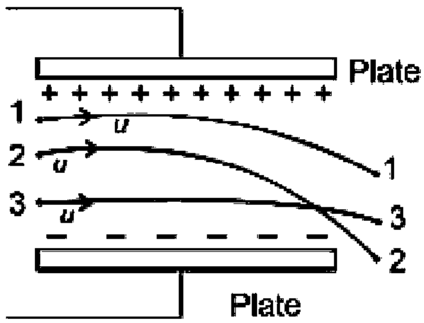
(a) 2×10^{-4} Nm (b) 4×10^{-4} Nm

(c) 8×10^{-4} Nm (d) 2×10^{-6} Nm

17. A thin spherical shell is given a charge $q = \mathbf{4}\ \mu$C, uniformly distributed over its surface. Consider a point P outside the shell at distance of 2 m from surface. If the radius of shell is 1 m, what is electric field at point *P?*

(a) 4kNC^{-1} (b) 2kNC^{-1} (c) 9 kN C^{-1} (d) 36 kN C^{-1}

18. Figure shows track of three positive charged particles through uniform electric field E. All charges are equal in value. Which charge particle has more initial kinetic energy on entering horizontally between the plate?



(a) Particle 1 (b) Particle 2

(c) Particle 3 (d) Both 1 and 2 have equal initial KE

19. A uniformly charged conducting sphere of 3 m diameter has a Surface charge density of 90μ C/m^2. What is total electric flux leaving the surface of sphere?

(a) $1.76 \times 10^8 N$ m$^2 C^{-1}$ (b) $2.87 \times 10^8 N$ m$^2 C^{-1}$

(c) $5.2 \times 10^8 N$ m$^2 C^{-1}$ (d) $4.52 \times 10^6 N$ m$^2 C^{-1}$

20. Incorrect statement among the following is

(a) Gauss's law is useful in calculating electric field when system has some symmetry

(b) Gaussian surface can pass through a continuous charge distribution

(c) Gauss's law is based on inverse square dependence of electric field on distance

(d) In situation when surface is so chosen that some charges are outside and some inside, electric field (whose flux appears on left side of Gauss's equation) is only due to the charges inside the closed surface

- Answer Keys –

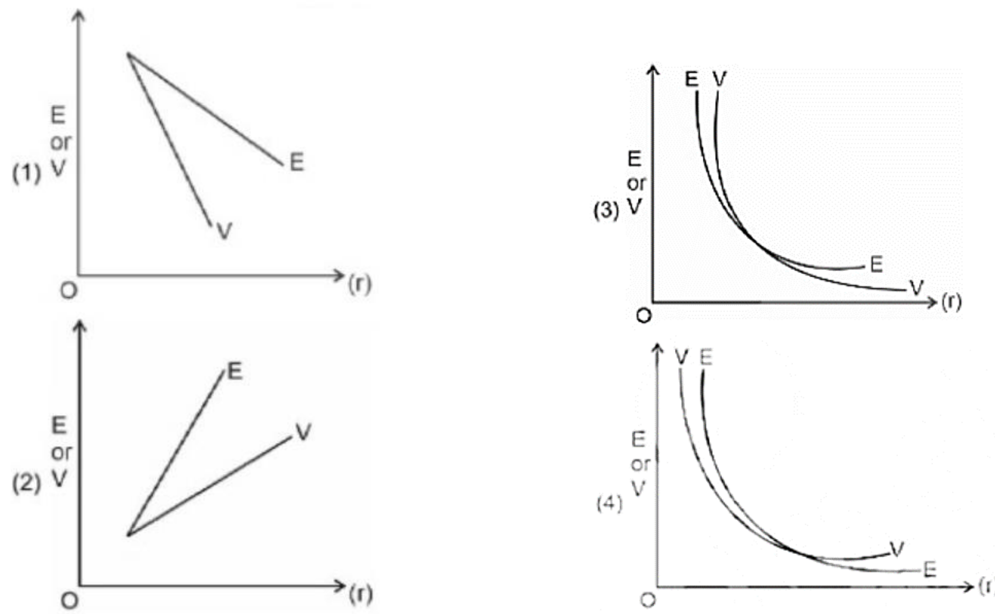
1) b	2) b	3) c	4) a	5) b	6) d	7) d	8) d	9) d	10) d
11) d	12) a	13) d	14) d	15) c	16) b	17) c	18) c	19) b	20) d

Chapter 2 : Electrostatic Potential and Capacitance

1. An electric point charge q = 6 μ C is placed at origin of x - y Co-ordinate axis. Calculate electric potential due to the charge at point P(12m, 16m) in free space.

   (a) 1.2 kV (b) 2.3 kV (c) 3.7 kV (d) 2.7 kV

2. The comparative graph of potential and electric field due to a point charge at a distance r from it is best shown by graph.



3. A point charge $Q = 4\times10^{-7}$ C is placed at a point in free space. How much work is required to bring a charge 2nC from infinity to a point 9cm from charge Q ?

   a) 3×10^{-4} J b) 8×10^{-5} J c) 2×10^{-5} J d) 5×10^{-5} J

4. Which among the following statements is an incorrect statement ?

   (a) The electric dipole potential falls off, at large distance, as $1/r^1$

   (b) The electric potential due to dipole in the equatorial position is zero

   (c) The electric potential due to dipole has axial symmetry about dipole moment vector p

   (d) Electric potential on dipole axis is maximum.

5. Two charges 6 nC and -4 nC are located 15 cm apart. At what point on line joining two charges is electric potential zero?

(a) 6 cm from 6 nC charge (b) 45 cm from 6 nC charge

(c) 38 cm from 6 nC charge (d) 9 cm from -4 nC charge

6. The incorrect statement regarding equipotential surface

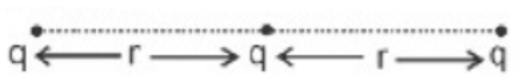
(a) Equipotential surface through a point is normal to electric field at that point

(b) An equipotential surface is a surface with a constant value of potential at all points on the surface

(c) Equipotential surfaces of a single point charge are concentric spherical surfaces centred at the charge

(d) For uniform electric field along x-axis, equipotential surfaces are planes parallel x - y plane

7. Work done by external agent in assembling three identical charges from infinity to given locations is



a) $\frac{5}{8\varepsilon_0}\frac{q^2}{r}$ b) $\left(\frac{5}{8\pi\varepsilon_0}\frac{q^2}{r}\right)$ c) $\frac{5}{2\pi\varepsilon_0}\frac{q^2}{r}$ d) $\frac{3q^2}{8\pi\varepsilon_0 r}$

8. Two point charges $7\,\mu C$ and $-2\,\mu C$ are placed at position (–9cm, 0) and (9cm, 0) respectively. How much work is required to separate two charges infinitely away from each other

a) 0.2 J b) 0.5 J c) 0.6 J d) 0.7 J

9. A dipole with dipole moment 310^{-9} C m is placed in external uniform field of E = 4 10^5 N C^{-1} . Calculate amount of work done by field in rotating the dipole from $\theta = 60°$ to 0°. (θ is angle between electric field E and dipole moment vector)

(a) 200 μ J (b) 600 μ J (c) 300 μ J (d) 90 μ J

10. When a conductor is placed inside uniform electric field. Then

(a) At the surface of conductor, electrostatic field is normal to the surface at every point.

(b) Inside the conductor, electrostatic field is zero.

(c) The electrostatic potential is constant throughout the volume of conductor and has the same value on its surface

(d) All of above are correct

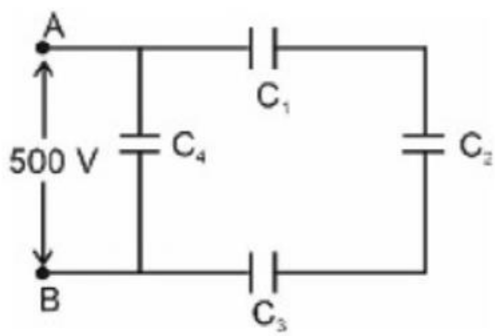
11. Two conductors are separated by distance of 1 cm in air. The dielectric strength of air is about 310^6 Vm^{-1}. What maximum safe potential difference can be applied across conductors?

(a) $3\times10^4 V$ (b) $6\times10^4 V$ (c) $3\times10^6 V$ (d) $1.5\times10^4 V$

12. A slab of material having dielectric constant K = 1.5 has the same area as of a plates of parallel plate capacitor but has thickness $\frac{3}{4}$ of plate separation is introduced between the plates of the capacitor having capacitance C. On introducing slab, capacity becomes factor of

a) $\frac{12}{7}C$ b) $\frac{5}{7}C$ c) $\frac{6}{7}C$ d) $\frac{4}{3}C$

13. A network of four capacitors each $10\,\mu F$ are connected as shown with 500V supply. Calculate the ratio of charges stored on C_4 and C_2



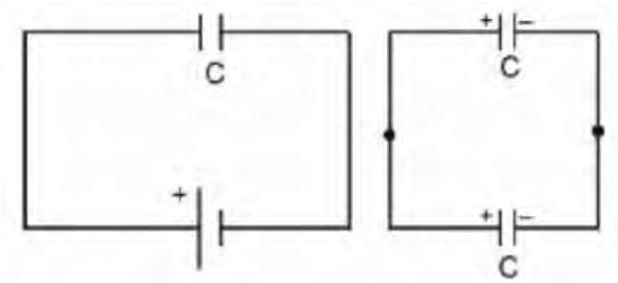
(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) 3

14. A 900 pF parallel plate capacitor is charged by 100 V ideal battery. The space between the plates is 1cm. How much electrostatic energy is stored per unit volume of empty space of capacitor?

(a) $4.42\times10^{-4} Jm^{-3}$ (b) $8.85\times10^{-6} Jm^{-3}$

(c) $2.21\times10^{-7} Jm^{-3}$ (d) $6.2\times10^{-6} Jm^{-3}$

15. A 90 pF capacitor is charged by a 10 V battery. The capacitor is then disconnected from battery and connected to another charged 90 pF capacitor. Final electrostatic energy stored by the system is



(a) 225 pJ (b) 2.25 nJ (c) 4.5 pJ (d) 4.5 nJ

16. A parallel plate capacitor is charged by a battery. Now battery is removed and medium between the plates of the capacitor is filled with an insulating material of dielectric constant K, then

(a) Electric field due to charged plates induces a net dipole moment in the dielectric (insulating material)

(b) Net potential difference between the plates is reduced

(c) Capacitance C decreases from initial value C_0 to (C_0/K)

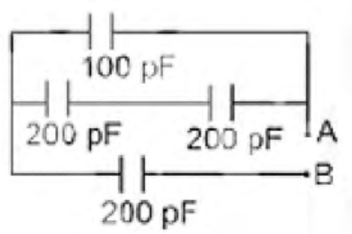
(d) Both (a) and (b) are correct

17. A parallel plate capacitor with each plate of area $6\times10^{-3}\,m^2$ has plate separation of 3 mm. A 3 mm thick mica sheet of dielectric constant K = 6 was inserted between the plates. If this capacitor is connected to 100 volt supply, what is charge on positive plate of capacitor?

(a) $1.92\times10^{-9}C$ (b) $1.06\times10^{-8}C$

(c) $4.2\times10^{-8}C$ (d) $4.36\times10^{-7}C$

18. Equivalent capacitance of the network across points A and B is



(a) 200pF (b) 150pF (c) 100 pF (d) 700 pF

19. A spherical capacitor consists of two concentric spherical conductors held in position by filling insulating material of dielectric constant 6. The inner sphere has radius of 10 cm and outer has 40 cm. The capacitance of spherical capacitor is

(a) 100 pF (b) 108 pF (c) 88.8 pF (d) 73.3 pF

20. A parallel plate capacitor is to be designed with a voltage rating of 2 kV, using a material of dielectric constant 3 and dielectric strength about 12 x 10^6 Vm^{-1}, for safety we should like the field never exceed 20% of dielectric strength. What minimum area of plate is required to have capacitance of 60 pF?

- Answer Keys –

1) d	2) d	3) b	4) d	5) b	6) d	7) b	8) d	9) b	10) d
11) a	12) d	13) d	14) a	15) b	16) d	17) b	18) c	19) c	20) c

Chapter 3 : Current Electricity

1. Estimate the average drift speed of conduction electrons in a conductor of cross-sectional area 10^{-7} m^2 carrying current of 1.5 A. The number density of conduction electrons is 8.5 $x10^{28}$ m^{-3}

(a) 2.2 mm s^{-1} (b) 1.1 mms^{-1}

(c) 3.3 mm s^{-1} (c) 0.1 mm s^{-1}

2. Average collision time for electrons in a conductor under a certain potential difference is found to be 10^{-15} s. The mobility of electron in metal conductor is

(a) 1.5 x $10^{-3}m^2/Vs$ (b) 2.2 x 10^{-3} m^2/Vs

(c) 2.9 x 10^{-3} m^2/Vs (c) 1.75 x 10^{-4} mWs

3. A charged particle is having drift velocity of 7.5×10^{-4} m s^{-1} in an electric field of 3×10^{-9} V m^{-1}. The electron mobility is

(a) $2.5\times10^{4}m^2V^{-1}s^{-1}$ (b) $2.5\times10^{5}m^2V^{-1}s^{-1}$

(c) $2.25\times10^{-13}m^2V^{-1}s^{-1}$ (c) $4.1\times10^{3}m^2V^{-1}s^{-1}$

4. Arrange following materials in correct order of their conductivity. Nichrome, Copper, Germanium, Silver.

(a) Silicon > Germanium > Nichrome > Copper

(b) Silver > Copper > Germanium > Nichrome

(c) Silver > Copper > Nichrome > Germanium

(c) Germanium > Nichrome > Copper > Silver

5. The resistivity of alloy manganin

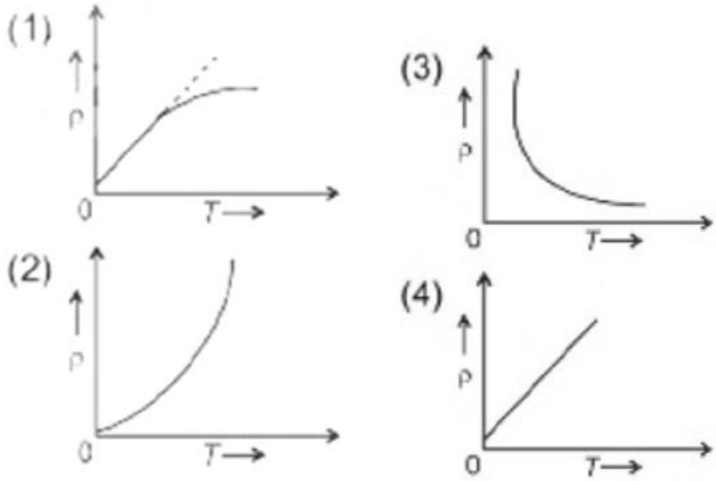
(a) Increases rapidly with increase of temperature

(b) Decreases linearly with increase in temperature

(c) Increases rapidly with decrease in temperature

(c) Is nearly independent of temperature

6. The graph of resistivity versus temperature for copper is best represented by graph shown below. The correct graph is



7. A resistor is marked with rings coloured as brown, black, green and gold. The resistance in ohm is

(a) $(3\times10^{6}\pm5\%)\Omega$ (b) $(1.10\times10^{5}\pm5\%)\Omega$

(c) $(10^{6}\pm5\%)\Omega$ (c) $(8.5\times10^{6}\pm5\%)\Omega$

8. Which among the following statements is correct?

(a) In a metal, number density is independent of temperature

(b) With increase in temperature, relaxation time in metal decreases

(c) For semiconductors and insulators number density increases with increase in temperature

(c) All the above

9. Nichrome has resistance of 75.3 Ω at 30^{n}C. The resistance of nichrome becomes 85.8 Ω when current passes through it, if average temperature coefficient of resistance of nichrome is $1.7\times10^{-4}C^{-1}$. The temperature of nichrome now is

(a) 700°C (b) 750 °C (c) 850 °C (c) 900°C

10. The incorrect statement among the following statements is

(a) Emf of a cell is the potential difference between its positive and negative electrodes in an open circuit

(b) Internal resistance of dry cells is much higher than common electrolyte cells.

(c) The terminal potential difference of a cell can be zero

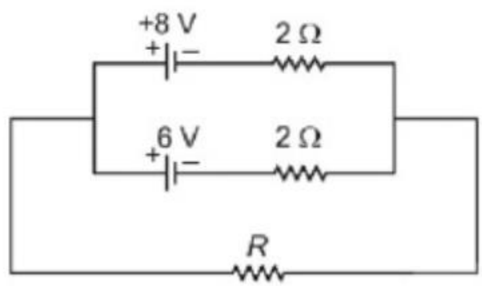
(c) When current passes from positive to negative terminal of a cell inside it, terminal potential difference is less than its emf.

11. When a current of 2 A flows in a battery from its negative to positive terminal, the potential

difference across it is 12 V. If a current of 3 A is flowing in opposite direction it produces a potential difference of 15 V. the emf of the battery is

(a) 12.6 V (b) 13.5 V (c) 14.0V (c) 13.2 V

12. In the combination of two cells **in** parallel by joining positive terminals together and similarly two negative ones, the value of $\frac{E_{eq}}{r_{eq}}$ in circuit is



1) 7A 2) 10A 3) 2A 4) 8A

13. When a metal conductor connected to right gap of meter bridge is heated, the balancing point from left end

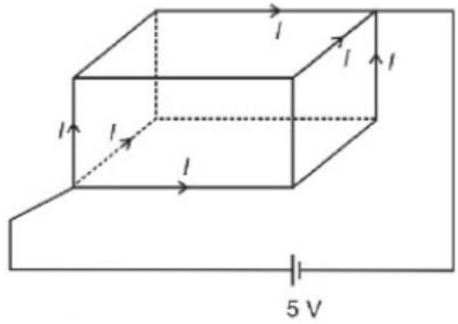
(a) Shifts towards left (b) Shifts towards right

(c) Remains unchanged (d) Shift to zero position

14. Resistance P, Q, S and *R* are arranged in clockwise cyclic order to form a balanced wheatstone bridge. The ratio of electric power consumed in the branches (P + Q) and (R + S) is

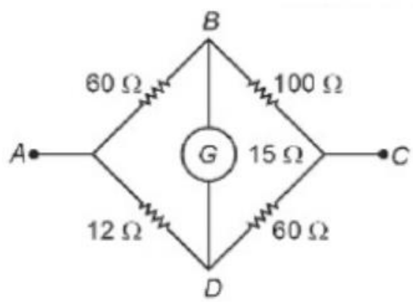
a) 1 : 1 b) R : P c) $R^2 : P^2$ d) Q:S

15. A battery of e.m.f. 5 V and negligible internal resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors of network each of resistance 1 Ω. The current along one edge of the cube is



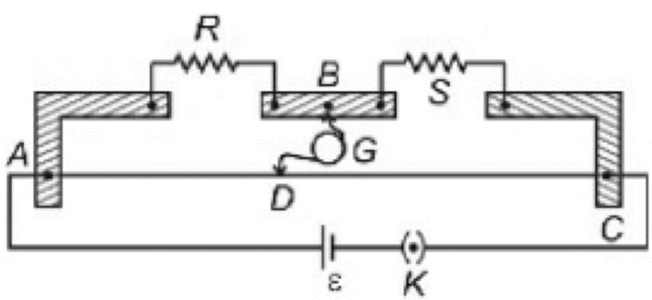
a) 1A b) 2A c) 3A d) 4A

16. Four arms of wheat-stone bridge have the following resistances. AB - $60\,\Omega$, BC = $100\,\Omega$, CD = $60\,\Omega$, DA= $12\,\Omega$. A galvanometer of $15\,\Omega$ is connected across BD. Calculate the value of additional resistance connected across CD to balance the bridge.



(a) 12 Ω (b) 15 Ω (c) 18 Ω (c) 30 Ω

17. In a Meter Bridge null point is found to be at 30 cm from end A. If now a resistance of 10 Ω is connected in parallel with S, the null point occurs at 65 cm, value of S is nearly



(a) 20 Ω (b) 28 Ω (c) 33 Ω (c) 38 Ω

18. In a potentiometer of 8 wires, the balance point is obtained on fifth wire. To Shift balance point to 6^{th} wire, we should

(a) Decrease resistance in main circuit

(b) Increase resistance in main driver circuit

(c) Decrease resistance in series with cell whose emf is tc measure

(d) Taking driver battery with higher emf

19. A potentiometer with driver battery of emf 2 V is used for determination of internal resistance of 1.5 V cell. The balance point of the cell in open circuit is 225 cm. When a resistance of 7.0 Ω is used in external circuit across of the cell, the balance point shifts to 210 cm length of potentiometer wire. The internal resistance of the cell is

(a) 1 Ω (b) 0.5 Ω (c) 2 Ω (c) 5 Ω

20. Pick out wrong statement about the KirchhofTs laws of electric circuit.

(a) Outgoing currents adds up and are equal to incoming currents at a junction

(b) Electric potential in electric circuit is position dependent. Starting with any point if we come back to same point, total potential change must be zero

(c) Junction rule is based on conservation of energy law

(d) Bending or reorienting the wire does not change the validity of KirchhofTs junction rule.

- Answer Keys -

1) b	2) d	3) b	4) c	5) d	6) b	7) c	8) d	9) c	10) d
11) d	12) a	13) a	14) b	15) b	16) d	17) c	18) b	19) b	20) c

Chapter 4 : Moving Charges and Magnetism

1. A current element $\Delta l = dx\hat{i}$ (where dx = 1 cm) is placed at the origin and carries a large current of 10 A. The magnetic field on y-axis at distance of 50 cm from it is

(a) 2×10^{-8}T (b) 2×10^{-5}G (c) 4×10^{-8}T (d) 3×10^{-5}G

2. Consider a tightly wound 100 turn coil of radius 12 cm carrying current of 10 A. What is magnetic field at centre of this coil.

(a) 1.2×10^{-3}T (b) 5.2×10^{-3}T (c) 4.6×10^{-5}T (d) 1.9×10^{-6}T

3. A straight wire carrying current of **15** A is bent into a semicircular arc of radius **2.5** cm. The magnetic field at the centre of semicircular arc is

(a) 1.88×10^{-4}T (b) 2.6×10^{-4}T (c) 3.77×10^{-4}T (d) 5.2×10^{-4}T

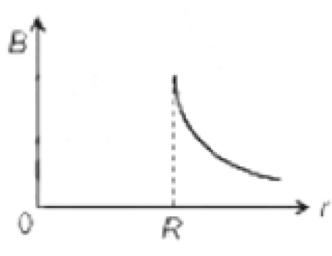
4. Consider a tightly wound 200 turns coil of radius 10 cm carrying current of 10 A. The magnitude of magnetic field at the centre of the coil is

(a) $2\pi\times10^{-4}$T (b) $4\pi\times10^{-3}$T (c) $6\pi\times10^{-4}$T (d) $3\pi\times10^{-3}$T

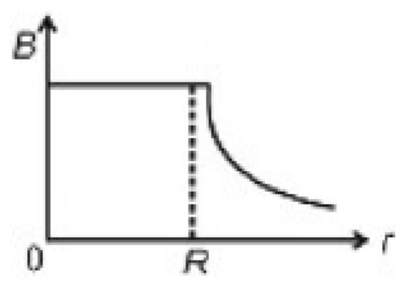
5. A long straight wire of circular cross-section of radius 5 cm is carrying a steady current of 20 A, uniformly distributed over its cross-section. The magnetic field induction at 2 cm from the axis of the wire is

(a) 1.6×10^{-4}T (b) 2.8×10^{-2}T (c) 3.3×10^{-6}T (d) 3.2×10^{-5}T

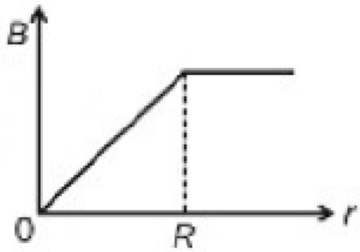
6. A long straight cylindrical wire carries current I and current is uniformly distributed across cross-section of conductor. Figures below shows a plot of magnitude of magnetic field with distance from centre of the wire. The correct graph is

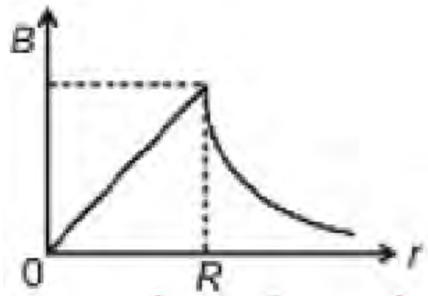


(a)



(b)

(c) 

(d) 

7. A closely wound solenoid 80 cm long has 5 layers of winding of 400 turns each. The diameter of solenoid is 1.8 cm. If it carries current of 8 A then magnitude of magnetic field intensity inside solenoid near its centre is

(a) 1.62×10^{-4}T (b) 25.13×10^{-3}T (c) 3.1×10^{-2}T (d) 16.8×10^{-3}T

8. A circular coil of 30 turns and radius 8 cm carries a current of 6 A. It is suspended in a uniform horizontal magnetic field of 1.0 T. The field lines make an angle of 60° with the normal of the coil. The magnitude of counter torque that must be applied to prevent the coil from turning is

(a) 3.133 Nm (b) 0.236 N m (c) 30.8 N m (d) 35 N m

9. In a chamber, a uniform magnetic field of 1.2 T is maintained. An electron is shot into the field with a speed of 3.2×10^6 m s^{-1} normal to the field. The radius of circular orbit in which it starts circular path is ($m_0 = 9.1 \times 10^{-31}$ kg)

(a) 15.16 μm (b) 627 μm (c) 12.42 μm (d) 22.4 μm

10. Two moving coil galvanometers M_1 and M_2 have the following particulars. $N_1 = 30$, $B_1 = 0.25$ T, $A_1 = 7.2 \times 10^{-3}$ m^2, $G_1 = 10\Omega$ and $N_2 = 60$, $B_2 = 0.50$ T, $A_2 = 1.8 \times 10^{-3}$ m^2, $G_2 = 5\Omega$ respectively. The spring constants are identical to both galvanometers. The ratio of their current sensitivity is

(a) 1:1 (b) 2:1 (c) 4 : 1 (d)1:4

11. A toroid ring has inner radius 21 cm and outer radius 23 cm in which 4400 turns of wire are wound. If the current in the wire is 10 A, then magnetic field inside the core of the toroid will be

(a) 4.4×10^{-4}T (b) 4×10^{-2}T (c) 6.6×10^{-4}T (d) 12.6×10^{-3}T

12. Two concentric circular coils X and Y of radius 20 cm and 25 cm respectively lie in the same vertical plane. Coil X has 40 turns and coil Y has 100 turns. If coil X and Y carries currents of 18 A each but in opposite sense, the net magnetic field due to the coils at their centre is]

(a) 3.12×10^{-4}T (b) 1.2×10^{-5}T (c) 7.2×10^{-4}T (d) 2.26×10^{-3}T

13. A galvanometer has resistance of $60\,\Omega$. It is converted in to an ammeter by connecting a shunt resistance of $1.2\,\Omega$. Its range becomes

(a) 68 (b) 50 (c) 51 (d) 60

14. To convert a galvanometer into a voltmeter of large range, we connect a resistance with galvanometer. The resistance

(a) Is connected in parallel and of higher value

(b) Is connected in series and of lower value

(c) Is connected in parallel and of lower value

(d) Is connected in series and of higher value

15. Magnetic moment associated with an electron moving at speed *v* in a circular orbit of radius *r* is (in magnitudes)

(a) evr (b) $\frac{evr}{2}$ (c) $\frac{evr}{4}$ (d) $\frac{ev^2}{2r}$

16. The horizontal component of earth's magnetic field at a certain place is 3.2 x 10^{-5} T and field is directed from south to North. A long straight conductor is carrying a current of 3 A. What is force per unit length experienced by it when it is placed on horizontal table and current in wire is from west to east?

(a) 9.6 X 10^{-6} Nm^{-1} upwards (b) 9.6 X 10^{-5} Nm^{-1}. downwards

(c) 3.6 X 10^{-5} Nm^{-1}, upwards (d) 9.6 X 10^{-5} Nm^{-1}, horizontal

17. Two long straight parallel wires A and B carrying current of 20 A and 10 A is same direction are separated by a distance of 5 cm. The force of 15 cm section of wire B is

(a) 1.5×10^{-3}N ,attractive (b) 1.6×10^{-4}N , repulsive

(c) 1.2×10^{-3}N, attractive (d) 1.2×10^{-4}N, attractive

18. A cyclotron's oscillatory frequency is 10 MHz. What should be the operating magnetic field for accelerating deuterons?

(a) 0.96 T (b) 1.52 T (c) 0.46 T (d) 1.32 T

19. A charge $q = 1.6 \times 10^{-12}$ C moving with speed of v m s^{-1} crosses electric field $|\vec{E}| = 6 \times 10^4$ Vm^{-1} and magnetic field $|\vec{B}| = 1.2T$. The electric field and magnetic fields are crossed and velocity *v* is also perpendicular to both. If the charge particle crosses both fields undeflected, the value of v is

(a) 7.2×10^5 (b) 7.2×10^4 (c) 5×10^5 (d) 5×10^4

20. A proton is moving with speed of 2 x 10^5 m s^{-1} enters a uniform magnetic field *B* = 1.5 T. At the entry velocity vector makes an angle of 30° to the direction of the magnetic field. The pitch of helical path it

describes is nearly

(a) 6.25 mm (b) 4.37 mm (c) 7.25 mm (d) 1.67 mm

- Answer Keys -

1) c	2) b	3) a	4) b	5) d	6) d	7) b	8) a	9) a	10) a
11) b	12) d	13) c	14) d	15) b	16) a	17) d	18) d	19) d	20) c

Chapter 5 : Magnetism and Matter

1. The net magnetic flux through any closed surface is

 (a) Always positive (b) Always negative

 (c) May be positive or negative (d) Always zero

2. The vertical plane which passes through the imaginary line joining the magnetic north & the south poles is known as

 (a) Geographical meridian (b) Magnetic meridian

 (c) Magnetic declination (d) Magnetic dip

3. Which of the following quantities include in the element of earth's magnetic field?

 (a) The declination (b) Angle of dip

 (c) Horizontal component of earths magnetic field

 (d) All of the above

4. The magnetic needle shown in the figure has magnetic moment $6.7\times10^{-2}\,\mathrm{A\,m^2}$ and moment of inertia $7.5\times10^{-6}\,\mathrm{kg\,m^2}$. It performs 10 complete oscillations in 6-70 s. The magnitude of magnetic field is

 (a) 0.02 T (b) 0.01 T (c) 0.03 T (d) 0.05 T

5. A short bar magnet placed with its axis at 53° with an external field of 600 G experiences a torque of 0.024 N m. Magnetic moment of the magnet is

 (a) $0.4\mathrm{Am^2}$ (b) $0.8\mathrm{Am^2}$ (c) $0.6\mathrm{Am^2}$ (d) $0.5\mathrm{Am^2}$

6. A magnetic needle is placed in an external magnetic field at an angle Owith the field. Needle is in most stable position if the value of is

 (a) 180° (b) 90° (c) 0° (d) 60°

7. In the magnetic meridian of a certain place, the horizontal component of earth's magnetic field is 0.48 G and the dip angle is 53°. Magnetic field of the earth at this location is

 (a) 0.3G (b) 0.8 G (c) 0.64 G (d) 0.96 G

8. Which of the following is a correct relation?

(a) $\mu_r = \chi\mu$ (b) $\mu_r = 1+\chi$ (c) $\mu_r = 1-\chi$ (d) $\mu_r = \frac{1}{\chi}$

9. A solenoid has a core of a magnetic material with relative permeability 500. Number of turns in the solenoid are 1000 per metre and carry a currents of 5 A. Magnetic intensity H will be.

(a) 5×10^3 A/m (b) 2.5×10^6 A/m

(c) 10^5A/m (d) 250 A/m

10. Which of the following is not a diamagnetic material?

(a) Bismuth (b) Copper (c) Nitrogen (STP) (d) Sodium

11. According to Curie's law for paramagnetic material

(a) $\mu_0 = \frac{C\chi}{T}$ (b) $\chi = C\mu_0 T$ (c) $\chi = \frac{C\mu_0}{T}$ (d) $\mu_0\chi = CT$

12. The temperature of transition from ferromagnetic to paramagnetic is called the

(a) Transition temperature (b) Inversion temperature

(c) Curie temperature (d) Neutral temperature

13. Suitable materials for permanent magnets, should have

(a) High retentivity and low coercivity

(b) Low retentivity and high coercivity

(c) High retentivity and high coercivity

(d) Low retentivity and low coercivity

14. Curie temperature for cobalt is

(a) 1394 °C (b) 1394 K (c) 1043 °C (d) 1043 K

15. At a certain place a freely suspended magnetic needle makes 20 oscillations per minute. At another place where the magnetic field is 4 times, time period of same needle will be

(a) 10 s (b) 1 s (c) 1.5 s (d) 3 s

16. Correct dimensional formula for the permeability of free space is

(a) $[MLT^{-2}A^{-2}]$ (b) $[ML^{-1}T^{-2}A^{3}]$ (c) $[M^{-1}L^{2}T^{-2}A]$ (d) $[ML^{3}T^{-3}A^{2}]$

17. Which of the following relation is correct? (symbols have their usual meaning)

(a) $B = \mu_0(1+\chi)H$ (b) $B = \mu_0\mu_r H$ (c) $B = \mu_0(H - M)$

(d) Both (a) and (b)

18. The phenomenon of perfect diamagnetism in superconductors is called

(a) Dynamo effect (b) Meissner effect

(c) Stark effect (d) Zeeman effect

19. A closely wound solenoid of 3000 turns and area of cross- section 1.610^{-4} m^2, carrying a current of 5.0 A, is suspended through its centre. Magnetic moment associated with the sclenoid is

(a) 12.8 Am^2 (b) 5.6 A m^2

(c) 4.8Am^2 (d) 2.4 Am^2

20. Electromagnets are used in

(a) Electric bells (b) Cranes to lift machinery

(c) Loudspeaker (d) All of the above

- Answer Keys -

1) d 2) b 3) d 4) b 5) d 6) c 7) b 8) b 9) a 10) d

11) c 12) c 13) c 14) b 15) c 16) a 17) d 18) b 19) d 20) d

Chapter 6 : Electromagnetic Induction

1. Direction of current induced in a wire by moving it in a uniform magnetic field is found using

   (a) Newton's laws (b) Lenz's law

   (c) Ampere's rule (d) Right hand grip rule

2. A metallic plate is getting heated. It cannot be due to

   (a) A direct current passing through plate

   (b) An alternating current passing through it

   (c) It is placed Static in Space varying magnetic field but does not vary with time

   (d) It is placed in time varying magnetic field

3. A rectangular coil expands on pulling from two diagonal edges in a region of magnetic field and no emf is induced in the coil. This can be because of

   (a) Magnetic field is constant

   (b) Magnetic field is in the plane of rectangular coil

   (c) Magnetic field has a perpendicular component to the plane of coil whose magnitude is decreasing

   (d) There is a uniform magnetic field perpendicular to plane of coil

4. The self-inductance L of a solenoid of length l and area of cross section A, with fixed number of turns per unit length increases as

   (a) l and A increases

   (b) l decreases and A increases

   (c) Both l and A decreases

   (d) l increases and A decreases

5. The mutual inductance of pair of co-axial neighbouring coils

   (a) Increases when they are brought nearer

   (b) Increases when one of them is rotated about an axis

   (c) Is independent of current passing through coils

   (d) Both (a) and (c) are correct

6. A square loop of side length L meter lies in x-y plane in a region, where the magnetic field is given by $\vec{B} = B_0(\hat{i} + 2\hat{j} + 3k)\,T$, Bo is positive constant. The magnitude of magnetic flux passing through square is

(a) $5B_0L^2$Wb (b) $3B_0L^2$Wb (C) $\sqrt{14}B_0L^2$Wb (D) B_0L^2Wb

7. A 20 cm long conductor carrying a current of 10 A is kept perpendicular to magnetic field

of 0.6T. The mechanical power required to move conductor with a speed of 1 ms^{-1} is

(a) 1.2 W (b) 1.5 W (c) 0.6 W (d) 0.4 W

8. A square loop of edge 20 cm and resistance of 1 Ω is placed vertically in horizontal plane.

A uniform magnetic field of 0.5T is set up across the plane in the direction at 45° to the plane. The magnetic field is decreased to zero in 0.2 s, at a steady rate. Calculate magnitude of current induced in this time interval.

(a) 20 mA (b) 50 mA (c) 60 mA (d) 70 mA

9. A circular loop with its plane parallel to plane of paper is entering into uniform magnetic field directed into the plane of paper perpendicularly. The loop is moved at constant speed V. Then

(a) No. emf will be induced in the coil

(b) Induced emf is constant in magnitude only

(c) Induced emf is varying with time

(d) Induced emf is constant in magnitude as well as in direction

10. A metallic rod of length 20 cm is rotated with, frequency of 50 rev/s with one end pivoted at the centre and other end at circumference of circular metallic ring of radius 20 cm about

an axis passing through centre and perpendicular to plane of the ring. A constant and uniform magnetic field 1.5 T parallel to axis is present everywhere. What is emf induced between centre and periphery of circular ring.

(a) 2.6 V (b) 9.4 V (c) 4.7 V (d) 12.3 V

11. A cycle wheel with 20 metallic spokes each 1 m long is rotated with speed of 60 rad/s in

a plane normal to horizontal component of earth's magnetic field B_H = 0-5 G at a place.

The emf induced between axle and rim of wheel is

(a) 1.5 mV (b) 12.3 mV (c) 3.0 mV (d) 0.75 mV

12. A conducting arm ***AB*** of length 30 cm moves on conducting rails held parallel. A uniform

magnetic field 6 = 0.2 T exists perpendicular to planes of rails. Only the conducting arm has resistance of $0.5\,\Omega$. The arm is pulled out with constant speed of 20 ms^{-1}, how much force is required parallel to rails to keep it moving at same speed.

(a) 0.14 N (b) 8 N (c) 16 N (d) 0.25 N

13. Which statement regarding eddy currents among the following is incorrect?

(a) If rectangular slots are made in copper plate, the magnitude of eddy currents will decrease

(b) Dissipation of heat produced is proportional to strength of eddy currents

(c) Dead beat galvanometer has fixed core made of non-magnetic metallic material

(d) Magnetic brakes in train use the application of eddy current

14. Two circular coils one of small radius r and other of larger radius R $(r \ll R)$ are placed

co-axially with centres coinciding. The mutual inductance of the arrangement is

(a) $\frac{\mu_0 \pi R^2}{2r}$ (b) $\frac{\mu_0 \pi r^2}{2R}$ (c) $\frac{\mu_0 \pi r R}{(r+R)}$ (d) $\frac{2\mu_0 \pi r^2}{R}$

15. A long solenoid is of length 1.25 m and 600 turns per unit length. It is connected to a source which establishes a current of 2A in circuit. Magnetic energy stored in the solenoid coil with cross-sectional area 0.1 $m^2$is

(a) 0.1 J (b) 0.4 J (c) 0-6 J (d) 1.2 J

16. A rectangular coil of 100 turns with area 0.1 m^2 is rotated at 10 revolution per second and paced in a uniform magnetic field of 0.01 T perpendicular to axis of rotation of the coil. The maximum voltage generated in coil is

(a) 3.14 V (b) 6.28 V (c) 9.42 V (d) 31.4 V

17. Two thin cylindrical pipes of equal internal diameters made of aluminum and plastic are taken. The pipes are kept vertical. A small cylindrical magnet without touching sides of wall of pipe is allowed to fall one by one. Then correct observations are

(a) Magnet takes longer time to cross aluminum pipe

(b) Magnet takes longer time to cross plastic pipe

(c) Eddy currents are generated in aluminum pipe but not in plastic

(d) Both (a) and (c) are correct

18. Which of the following statement is wrong?

(a) In ac generator when flux through coil is maximum, emf induced is minimum

(b) Maximum emf is induced when plane of col is parallel to magnetic field

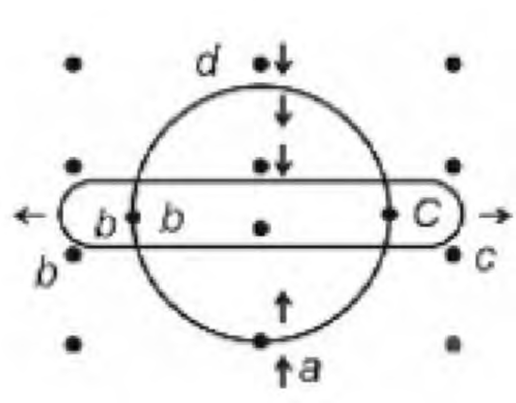
(c) The emf induced changes periodically with time if coil is rotated at uniform rate

(d) The frequency of rotation of armature coil is 60 Hz in India and 50 Hz in USA

19. A pair of adjacent coils has mutual inductance of 1.5 H. If the Current in one coil changes from 0 to 10 A in 0.5 s. the rate of change of flux linkage with other coil is

(a) 20 V (b) 30 V (c) 4 V (d) 5 V

20. A circular coil is being deformed into a narrow straight wire at regular stretch. Then



(a) The direction of induced current is clockwise

(b) The direction of induced current is anticlockwise

(c) Magnetic flux through coil increases

(d) The amount of charge flowing in coil depends on time

- Answer Keys -

1) b 2) c 3) b 4) a 5) d 6) b 7) a 8) d 9) c 10) b

11) a 12) a 13) b 14) b 15) a 16) b 17) d 18) d 19) b 20) b

Chapter 7 : Alternating Current

1. A $\frac{10}{\pi}\mu F$ capacitor is connected to a 200 V, 50 Hz ac source. The capacitive reactance of the circuit is

(a) 1000 Ω (b) 500 Ω (c) 212 Ω (d) 100 Ω

2. A light bulb is rated at 100 W for a 220 V, 50 Hz supply. The rms current through the bulb is

(a) $\frac{5}{110}$ A (b) $\frac{5}{11}$ A (c) $\frac{3}{11}$ A (d) $\frac{4}{11}$ A

3. An ac signal (sinusoidal) output from a device is shown in the figure. The average value and rms value respectively in the given case are

(a) $\frac{I_0}{\pi}, \frac{I_0}{\sqrt{2}}$ (b) $\frac{2I_0}{\pi}, \frac{I_0}{\sqrt{2}}$ (c) $\frac{2I_0}{\pi}, \frac{I_0}{2}$ (d) $\frac{I_0}{\pi}, \frac{I_0}{2}$

4. The instantaneous values of alternating current and voltage in an ac circuit are given $i = \frac{1}{\sqrt{2}}\sin(100\pi t)A$ and $\varepsilon = \sqrt{2}\sin\left(100\pi t + \frac{\pi}{3}\right)V$. The average power dissipated through the circuit is

(a) $\frac{\sqrt{3}}{2}$ W (b) $\frac{1}{4}$ W (c) $\frac{1}{8}$ W (d) $\frac{\sqrt{3}}{4}$ W

5. For a series LCR circuit, the power dissipated at resonance is

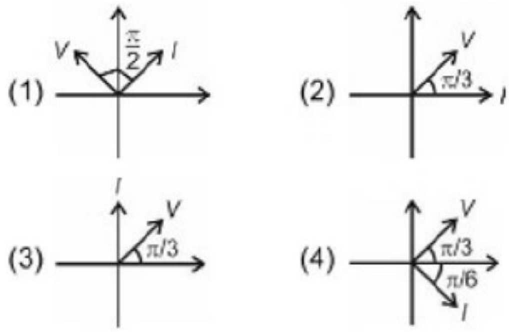
(a) $\frac{v^2}{(X_L - X_C)}$ (b) $I^2\omega L$ (c) $I^2(X_L - X_C)$ (d) $I_{rms}^2 R$

6. The primary winding of a transformer has 200 turns whereas its secondary winding has 2000 turns. If the primary is connected to an ac Source of 20 V and 60 Hz, then secondary will have output of

(a) 200 V and 6 Hz (b) 2 V and 60 Hz

(c) 200 V and 60 Hz (d) 2 V and 6 Hz

7. An ac supply is connected across a series LCR circuit. If capacitor is removed then which of the following phasor diagram may be correct?



8. The analogue of displacement x in mechanical system (spring block) is P in electrical system (LC oscillation). Then P is [

(a) Inductance (L) (b) Charge (q)

(c) Current (I) (d) Capacitance (C)

9. A capacitor (C), initially charged upto q_m is connected to an inductor (L). The differential equation of LC oscillator is

(a) $\frac{d^2q}{dt^2}+q=0$ (b) $\frac{dq}{dt}+q=0$

(c) $\frac{dq}{dt}+\frac{q}{LC}=0$ (d) $\frac{d^2q}{dt^2}+\frac{q}{LC}=0$

10. For pure resistive ac circuit the phase angle between voltage and current and power factor are respectively.

(a) 0°,1 (b) 0°,0 (c) 90°, 1 (d) 90°, 0

11. A resistor of $100\,\Omega$ is connected in series with series combination of inductor and capacitor. If X_L and Xc are the reactances of inductor and capacitor respectively, then reactance of circuit will be

(a) $|X_L+X_C|$ (b) $|X_L-X_C|$ (c) $\sqrt{X_L^2+X_C^2}$ (d) $\sqrt{X_LX_C}$

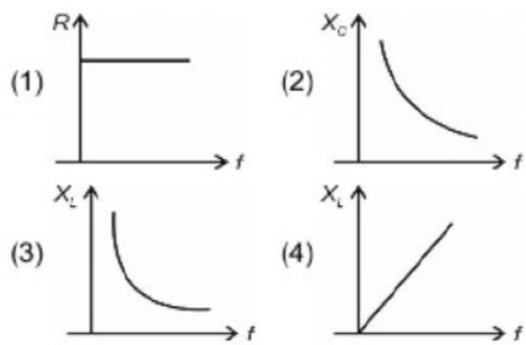
12. The quantity which measures the sharpness of resonance is

(a) Quality factor (b) Peak factor (c) Form factor (d) Ripple factor

13. A steady current of 2 A flowing through a resistor produces a heat of 100 W. To produce a heat of 400 W by supplying an ac current through the same circuit, the value of peak current will be

(a) 4 A (b) 5.6 A (c) 2.8 A (d) 8 A

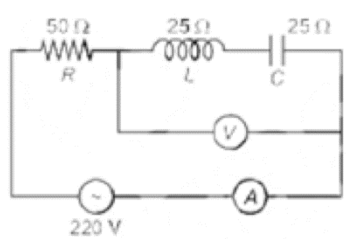
14 The variation of impedance of an ac circuit (having one of the element) with frequency of source is given for different elements. Choose the incorrect plot.



15. Consider a series LCR circuit in which reactance and resistance are 100 each. When the circuit is connected to ac source 220 V, 50 Hz, then current drawn from the source is

(a) $2.2\sqrt{2}$A (b) $1.1\sqrt{2}$A (c) $3.3\sqrt{2}$A (d) 2.2A

16. In the circuit shown in the figure. The voltmeter and ammeter reading will respectively be (source, voltmeter and ammeter are ideal)



1) $0\text{V}, 2\sqrt{2}\text{A}$ 2) $0\text{V}, 4.4\text{A}$ 3) $110\text{V}, 2\sqrt{2}\text{A}$ 4) $110\text{V}, 3\text{A}$

17. In an oscillating L-C circuit, Q_m is the maximum charge on the capacitor. If at any time, the energy stored in capacitor and Inductor are equal, then charge stored on the capacitor at that instant is

1) $\frac{Q_m}{\sqrt{2}}$ 2) $\frac{Q_m}{2}$ 3) $\frac{Q_m}{3}$ 4) $\frac{Q_m}{\sqrt{3}}$

18. For an ideal transformer, which of the following option is correct?

(Symbols have their usual meaning)

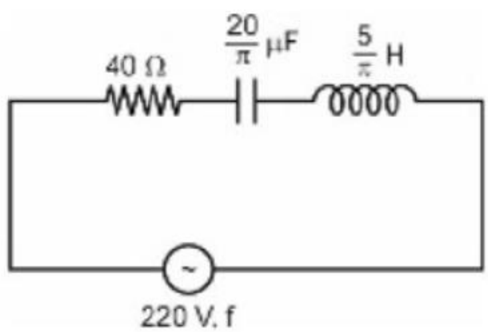
1) $\frac{I_S}{I_P} = \frac{N_S}{N_P}$ 2) $\frac{I_S}{I_P} = \frac{V_S}{V_P}$ 3) $V_S I_S = V_P I_P$ 4) $\frac{V_S}{V_P} = \frac{N_P}{N_S}$

19. A radio can tune over the frequency range (800 - 1200) kHz. If LC circuit has an effective inductance of 200 μH- What should be the range of its variable capacitor?

(a) 100 pF - 280 pF (b) 88 pF - 198 pF

(c) 4C pF - 80 pF (d) 200 pF - 400 pF

20. The figure shows a series *LCR* circuit connected to a variable frequency and 220 V source. The source frequency which drives the circuit in resonance will be



(a) 25Hz (b) 100Hz

(c) 50 Hz (d) 80Hz

- Answer Keys -

1) a 2) b 3) b 4) b 5) d 6) c 7) b 8) b 9) d 10) a

11) b 12) a 13) b 14) c 15) b 16) b 17) a 18) c 19) b 20) c

Chapter 8 : Electromagnetic Waves

1. The correct order of arrangement of electromagnetic waves according to their frequency is

   (a) Radio waves > Microwaves > γ -rays > U.V. rays

   (b) Radio waves > U.V. rays > Microwaves > γ -rays

   (c) γ -rays > Microwaves > U.V. rays > Radio waves

   (d) γ -rays > U.V. rays > Microwaves > Radio waves

2. The electromagnetic radiations used in radar system is

   (a) Gamma rays (b) Radio waves

   (c) Infrared (d) Microwaves

3. Microwaves oven works on the principle of

   (a) Giving rotational energy to water molecules

   (b) Giving vibrational energy to water molecules

   (c) Giving translational energy to water molecules

   (d) Both (a) and (b) are correct options

4. The RMS value of electric field of light coming from sun is 400 N C^{-1}. Total energy density of electromagnetic waves is

   (a) $1.42\times10^{-6}\,Jm^{-3}$ (b) $1.92\times10^{-6}\,Jm^{-3}$ (c) $2.6\times10^{-5}\,Jm^{-3}$ (d) $8.85\times10^{-7}\,Jm^{-3}$

5. Cellular phones use radio waves to transmit voice communication in

   (a) Frequency modulated radio bands (b) Ultra high frequency bands

   (c) Short wave bands (d) Amplitude modulated bands

6. Which of the following is not an electromagnetic wave?

   (a) Heat rays (b) X-rays (c) -rays (d) β -rays

7. Which among the following statement is incorrect?

   (a) Wavelength of X-rays can range from l0 nm to l0^{-4} nm.

   (b) X-rays are used in treatment of certain form of cancer

   (c) X-rays are produced by bombarding a metal target by high energy electrons

(d) X-rays are used to observe growth of crops

8. Which among the following statement may be incorrect?

(a) Infrared detectors are used in earth satellites

(b) Electronic devices emit infrared radiations and are used in remote switches

(c) U.V. lamps are used in physical therapy

(d) Visible range of many insects extend well into ultraviolet waves

9. The instantaneous magnitudes of electric field E and magnetic field B vectors in electromagnetic wave propagating in vacuum are related as

1) $E = \frac{c}{B}$ 2) $E = cB$ 3) $E = \frac{B}{c}$ 4) $EB = c^2$

10. A plane electromagnetic wave E = 100 sin $(5 \times 10^8 t + 3x)$ V/m is propagating through *a* medium. The refractive index of the medium is

(a) 1.6 (b) 1.7 (c) 1.8 (d) 1.9

11. Light with energy flux 1.2 W/m^2 falls on a non-reflecting surface at normal incidence. The pressure on the plate is

(a) $3 \times 10^{-8} Nm^{-2}$ (b) $2 \times 10^{-8} Nm^{-2}$ (c) $4 \times 10^{-9} Nm^{-2}$ (d) $2 \times 10^{-9} Nm^{-2}$

12. What is peak electric field produced by the radiations coming from 100 W bulb at a distance 3 m. Assuming that bulb is point source with efficiency of 2.5%?

(a) 2.9 V/m (b) 3.1 V/m (c) 1.6 V/m (d) 4.07 V/m

13. In electromagnetic wave, if peak value of magnetic field Is 1.4 10^{-8} T, then RMS value of electric field will be

(a) 4.07 V/m (b) 2.9 V/m (c) 6.2 V/m (d) 3.4 V/m

14. Light with an energy flux of 6 W/cm^2 falls on a non reflecting surface at normal incidence.

If surface has an area of 50 cm^2. What is total momentum transferred in one minute to the surface (for complete absorption)?

(a) 6 x 10^{-5} kg m s^{-1} (b) 3 x 10^{-5} kg m s^{-1}

(c) 2×10^{-5} kg m s^{-1} (d) 6.4 kg m s^{-1}

15. The electric field component propagating along x-axis is given as $E_y = 30\sin(4.5\times10^2 x + 1.5\times10^{11} t)$ V/m. The frequency of propagating wave is

(a) 5 GHz (b) 17.6 GHz (c) 23.9 GHz (d) 15.4 GHz

16. A capacitor is made of two circular plates each of radius 7 cm and separated by 2 cm. The capacitor is being charged by an external source. The charging current is constant and equal to 0.2 A. What is the rate of change of potential deference between the plates?

(a) 1.62 10^{10}V/S (b) 2.94$10^{10}$V/S (c) 3.54 10^{10}V/s (d) 3.24 10^{10}V/S

17. A radio is tuned to station in the 30 MHz to 54 MHz. What is corresponding wavelength band?

(a) AM band (b) FM band (c) Short band (d) UHF band

18. Which among the following statement is incorrect in electromagnetic spectrum?

(a) Long distance radio broadcast use short waves

(b) X-rays astronomy is possible from satellite orbiting earth

(c) Microwaves range from 400 nm to 0.6 nm

(d) Snakes are sensitive to infrared waves

19. Correct match of column I with column II is 283]

C-l(waves)	**C-ll (Production)**
A. Infra-red	P . Rapid vibration of electrons in aerials
B. Radio	Q . Electrons in atoms emit light when they move from higher to lower energy level.
C. Light	R . Klystron valve
D. Microwave	S . Vibration of atoms and molecules

(a) A-P, B-R, C-S, D-Q (b) A-S, B-P, C-O, D-R

(c) A-Q, B-P. C-S, D-R (d) A-S. B-R. C-P, D-Q

20. Find the incorrect statement among the following.[

(a) Accelerated charge particles radiate electromagnetic waves

(b) Visible radiations emitted by atoms is much longer in wavelength than atomic size

(c) X-rays are emitted from heavy atoms

(d) Radio waves are produced by atomic nucleus

- Answer Keys -

1) d 2) d 3) d 4) a 5) b 6) d 7) d 8) c 9) b 10) c

11) c 12) b 13) b 14) a 15) c 16) b 17) c 18) c 19) b 20) d

Chapter 9 : Ray Optics and Optical Instruments

1. Which of the following statements is wrong for an image formation of a real object?

   (a) The magnification produced by convex mirror is always less than one

   (b) A virtual, inverted, same size image can be obtained using plane mirror

   (c) A virtual, erect, magnified image can be formed using a concave mirror

   (d) A real, inverted, same sized image can be formed using a convex mirror

2. Advanced sunset and delayed sunset is due to

   (a) Atmospheric reflection (b) Atmospheric refraction

   (c) Atmospheric scattering (d) Atmospheric dispersion

3. If μ_a, μ_b and μ_c are refractive indices of media A,B and C respectively such that $\mu_a > \mu_b > \mu_c$, total internal reflection can take place when a ray of light travels from

   (a)C to A (b) C to B (c) B to A (d) B to C

4. Which of the following concept is used in optical fibre?

   (a) Refraction of light (b) Scattering of light

   (c) Dispersion of light (d) Total internal reflection

5. In the position of minimum deviation when a ray of yellow light passes through the prism, then its

   (a) Angle of incidence is less than angle of emergence

   (b) Angle of incidence is greater than emergent angle

   (c) Sum of angle of incidence and emergent angle is equal to 90°

   (d) Angle of incidence is equal to angle of emergence

6. The focal length of a lens depends upon

   (a) Nature of material of lens (b) Colour of light

   (c) Medium in which lens is placed (d) All of these

7. A screen is placed at a distance of 40 cm away from an illuminated object. A converging lens is placed between the source and screen and it is attempted to form the image of the source on the screen. If no lens position could be found, the focal length of the lens

   (a) Should be greater than 10 cm (b) May be 6 cm

   (c) May be infinity (d) Must be less than 10 cm

8. In a compound microscope, the intermediate image is

(a) Virtual, erect and magnified (b) Real, erect and magnified

(c) Real, inverted and magnified (d) Virtual, erect and reduced

9. Mark the correct option among following statements.

(a) If far point come closer to eye, the defect is farsightedness.

(b) If near point goes ahead (away from eye), the defect is called myopia.

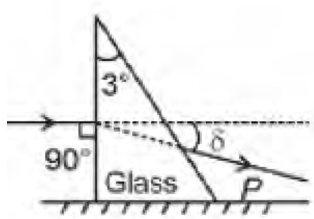
(c) If defective far point is 1 m away from eye, divergent lens should be used

(d) If near point is 1 m away from eye, divergent lens should be used

10. P is a small angled prism of angle 3° made from material of refractive index 1.2. A ray of

light is incident on it as shown in figure. The angle of deviation for the rays refracted from

prism is



(a) 2° (b) 3° (c) 0.8° (d) 0.6°

11. When white light enters a prism, it gets split into its constituent colours. This is due to

(a) Scattering of light (b) Dispersion of light

(c) Reflection of light (d) Diffraction of light

12. A compound microscope consists of an objective lens of focal length 1 cm and an eye piece with focal length of 2.0 cm and tube has length 20 cm. What is its magnification?

(a) 100 (b) 200 (c) 220 (d) 250

13. With regards to a telescope, which statement is incorrect.

(a) Telescope is used to provide angular magnification of distant objects

(b) Telescope has objective lens of large power

(c) Final image of refracting telescope is inverted

(d) With larger diameter of objective fainter objects can be observed

14. Match the elements of List-I with List-II

List - I	**List-II**
(A)Simple microscope	(E) Image magnified, inverted and virtual
(B)Compound microscope	(F) Image virtual, erect and high resolution
(C)Astronomical telescope	(G) Virtual, inverted and high resolution
(D)Terrestrial telescope	(H) Image virtual, erect and enlarged

(a) A-H, B-F, C-E, D-G (b) A-H, B-E, C-G, D-F

(c) A-H, B-E, C-F, D-G (d) A-F, B-G, C-E, D-G

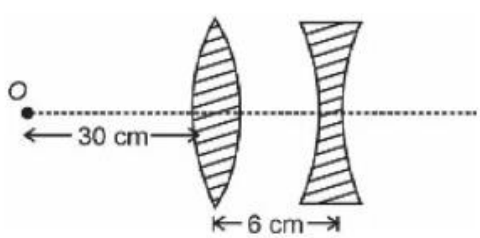
15. A simple magnifier has converging lens of focal length 2.5 cm. What is its linear magnification for the image formed at near point?

(a) 6 (b) 9 (c) 11 (d) 16

16. A prism has prism angle of 60° and its absolute refractive index is 1.76. The prism is dipped in a transparent liquid of refractive index x. If the angle of minimum deviation is found to 46° in liquid, what is x?

(a) 1.1 (b) 1.3 (c) 1.4 (d) 1.5

17. Find the position of the image formed by lens combination with convex lens of focal length 10 cm and concave lens of focal length 12 cm. The object is kept at 30 cm from the convex lens as shown



(a) 36 cm to right of convex lens (b) 36 cm to right of concave lens

(c) 16 cm to left of concave lens (d) 20 cm to right of convex lens

18. A small pin fixed on table top is viewed from above from a distance of 40 cm. By what distance would pin appear to be raised if viewed from the same point through a 12 cm thick glass slab held parallel to the table? Refractive index of glass is 1.5

(a) 4 cm (b) 5 cm (c) 6 cm (d) 8 cm

19. Biconvex lenses are to be manufactured from glass of refractive index 1.5 with both faces of same radii of curvature. The radius of curvature required if focal length is 15 cm will be

1) 10 cm 2) 15 cm 3) 20 cm 4) 25 cm

20. A light pipe is made of glass fibre of refractive index 1.57. The outer covering of the pipe is made of a material of refractive index 1.36. The range of angles of incident rays with the axis of the pipe for which total internal reflection inside the pipe take place is nearly

1) $0° < i < 38°$ 2) $0° < i < 90°$ 3) $0° < i < 60°$ 4) $0° < i < 53°$

- Answer Keys -

1) d 2) b 3) d 4) d 5) d 6) d 7) a 8) c 9) c 10) d

11) b 12) d 13) b 14) b 15)c 16) a 17) b 18) a 19) b 20) a

Chapter 10 : Wave Optics

1. The phenomenon of diffraction takes place for

   (a) Sound waves only (b) Light waves only

   (c) Matter waves only (d) All type of waves

2. If Young's double slit experiment uses a monochromatic light, the shape of fringes formed on the screen is

   (a) Parabola (b) Straight line (c) Circle (d) Hyperbola

3. A diffraction pattern is obtained by using beam of red light. What will happen, if red light is replaced by the blue light?

   (a) Bands disappear

   (b) Bands become broader and farther apart

   (c) Diffraction bands becomes narrow and crowded

   (d) No change takes place

4. Which of the following is correct for light diverging from a point source? [

   (a) The intensity changes in proportion to the distance squared

   (b) The wavefront is parabolic

   (c) The intensity changes inversely proportional to distance squared

   (d) The intensity changes inversely proportional to distance

5. In Young's double slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The width of bright fringe is measured to be 1.2 cm. The wavelength of light used in the experiment is

   (a) 2.4×10^{-6}m (b) 3×10^{-7}m

   (c) 1.5×10^{-7}m (d) 5×10^{-7}m

6. The angle between the axis of two polaroids is 30°. The ratio of intensities of the emergent and unpolarised incident light will be

   (a) 1 : 4 (b) 1 : 3 (c) 3 : 4 (d) 3 : 8

7. In Young's double slit experiment, the phase difference between two waves reaching at a point is $\pi/3$. The intensity of this point expressed as a fraction of maximum intensity I_o is

(a) $\frac{3}{2}I_0$ (b) $\frac{I_0}{2}$ (c) $\frac{4}{3}I_0$ (d) $\frac{3}{4}I_0$

8. When a low flying aircraft passes overhead, we sometimes notice a slight shaking of the picture in our TV, screen. This is because of .... between the direct signal and

reflected signal

(a) Interference (b) Diffraction (c) Polarisation (d) Refraction

9. The idea of secondary wave wavelets for the propagation of the light wave was first given

by

(a) Fresnel (b) Newton

(c) Maxwell (d) Htygen

10. The ratio of the amplitude of the two sources producing interference is 3 : 5, the ratio of intensities at maxima and minima is [

(a) 25:6 (b) 5 : 3 (c) 16: 1 (d) 25 : 9

11. Colours of the soap bubble is due to

(a) Interference (b) Heat radiation

(c) Polarisation (d) Absorption

12. Intensity of a bright fringe in a single slit diffraction pattern on a screen

(a) Is same for all bright fringes

(b) Increases and decreases alternatively as we move away from central fringe

(c) Decreases as we move away from central bright fringe

(d) Increases as we move away from central bright fringe

13. Wavefronts associated with point source of wave is

(a) Spherical (b) Planar (c) Cylindrical (d) Ellipsoid

14. Light of wavelength 600 nm is incident on an aperture of size 2mm. The distance upto which light can travel such that its spread is less than the size of aperture is

(a) 12.13 m (b) 6.67 m (c) 3.33 m (d) 2.19 m

15. The slits in Young's double slit experiment are illuminated by light of wavelength 6000 A. If the path difference at the central bright fringe is zero, then the path difference at fourth bright fringe is

(a) 2.4×10^{-6}m (b) 1.2×10^{-6}m (c) 10^{-6}m (d) 0.5×10^{-6}m

16. The refractive index of a medium is $\sqrt{3}$. If the unpolarised light is incident on it from air at the polarizing angle of the medium, the angle of refraction is

(a) 60° (b) 45° (c) 30° (d) 0°

17. When interference of light waves takes place

(a) Energy is created in the region of maximum intensity

(b) Energy is destroyed in the region of minimum intensity

(c) Conservation of energy hold good and energy is redistributed

(d) Conservation of energy does not hold good

18. Two faints separated by a distance of 0.1 mm can just be inspected in a microscope when light of wave length 6000 Å is used. If the light of wavelength of 8000 Å is used, then the limit of resolution will be

(a) 0.8 mm (b) 1.2 mm (c) 0.1 mm (d) 0.13 mm

19. Transverse nature of light was confirmed by the phenomena of

(a) Reflection of light (b) Diffraction of light

(c) Interference of light (d) Polarisation of light

20. A light of wavelength 550 nm coming from a distant Star. The limit of resolution of a telescope whose objective has a diameter of 2 m is

(a) 3.38×10^{-7}rad (b) 3.35×10^{-5}rad

(c) 3.35×10^{-6}rad (d) 2.15×10^{-7}rad

- Answer Keys -

1) d 2) d 3) c 4) c 5) a 6) d 7) d 8) a 9) d 10) c

11) a 12) c 13) a 14) b 15) a 16) c 17) c 18) d 19) d 20) a

Chapter 11 : Dual Nature of Radiation and Matter

1. Work function depends on

(a) Metal only (b) Nature of surface only

(c) Both metal and nature of surface (d) Threshold frequency

2. Saturation photoelectric current

(a) Increase with increase in plate potential

(b) Increase with decrease in plate in plate potential

(c) Is independent of plate potential

(d) Increase with increase in frequency

3. Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3}W. The number photons emitted per second by source is

(a) 5.0×10^{15} (b) 5.0×10^{16} (c) 5.0×10^{17} (d) 5.0×10^{18}

4. A particle is moving three times as fast as an electron. The ratio of de-Broglie wavelength of particle to that of electron is 1.813×10^{-4}. The particle may be

(a) Proton **(b)** Deutron (c) a-particle (d) Triton

5. An electron microscope uses electrons accelerated by a voltage of 50 kV. how does the resolving power of this electron microscope compare with that of an optical microscope which uses yellow light?

(a) 10^4 times (b) 10^5 times (c) 10^6 times (d) 10^3 times

6. A particle is dropped from a height H. The de-Broglie wavelength of the particle as a function of height is proportional to

(a) H (b) $H^{1/2}$ (c) H° (d) $H^{-1/2}$

7. A proton and an a-particle are accelerated through the same potential difference. The ratio of de-Broglie wavelength λ_p to that λ_α is

(a) $\sqrt{2}:1$ (b) 2 : 1 (c) $2\sqrt{2}:1$ (d) $1:\sqrt{2}$

8. Which of the following statements is incorrect about the photons?

(a) Momentum of photon is (b) Rest mass of photon is zero

(c) Photons exert no pressure (d) Energy of photon is frv

9. The wavelength of matter wave is independent of

(a) Mass (b) Velocity (c) Kinetic energy (d) Charge

10. Which experiment best support the theory that matter has wave nature?

(a) Photoelectric effect (b) α -scattering experiment

(c) Davisson and Germer experiement (d) Compton effect

11. Which among the following phenomenon shows particle nature of light?

(a) Photoelectric effect (b) Interference

(c) Polarization (d) Matter waves

12. Which of the following device is some times called electric eye?

(a) Light emitting diode (b) Photocell

(c) Electric generator (d) Integrated chip

13. For a certain metal, incident frequency v is five times of threshold frequency v_0 and maximum speed of coming out photoelectrons is 8 X 10^6 m/s. If $\nu = 2v_0$, the maximum speed of photoelectrons will be

(a) 4 x 10^6 m/s (b) 6 x 10^6 m/s (c) 3 x 10^6 m/s (D) 1 x 10^6 m/s

14, An electron is moving with an initial velocity $\vec{v} = v_0\hat{i}$ enters in a uniform magnetic field $\vec{B} = B_0\hat{j}$. Then its de-Broglie wavelength

(a) Increase with time (b) Decrease with time

(c) Remains constant (d) Increases and decreases periodically

15. For a wavelength of 400 nm, kinetic energy of emitted photoelectron is twice that for a wavelength of 600 nm from a given metal. The work function of metal is [

(a) 1.03 eV (b) 2 11 eV (c)4.14eV (d) 2.43 eV

16. The linear momentum of a 3 MeV photon is

(a) 0.01 eV s m^{-1} (b) 0.02 eV s m^{-1}

(c) 0.03 eV s m^{-1} (d) 0.04 eV s m^{-1}

17. A particle of mass 4m at rest decays into two particles of mass m and 3m. The ratio of de-

Broglie wavelength of two particles will be

(a) $\frac{1}{2}$ (b) 4 (c) 2 (d) 1

18. In a photon particle collision (such as photon electron collision). Which of the following may not be conserved?

(a) Total energy (b) Number of photons

(c) Total momentum (d) None of above

19. If the momentum of an electron is changed by P, then the de-Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be

(a) 200P (b) 400P (c) $\frac{P}{200}$ (d) 100P

20. The phenomena of photoelectric effect was first explained by

(a) Albert Einstein (b) Heinrich Hertz

(c) Wilhelm Hallwachs (d) Philipp Lenard

- Answer Keys –

1) c 2) c 3) a 4) a 5) b 6) d 7) c 8) c 9)d 10) c
11)a 12) b 13) a 14) c 15) a 6) a 17) d 18) b 19) a 20) a

Chapter 12 : Atoms

1. The thickness of gold foil used in α-particle scattering experiment was

(a) 2.1×10^{-7} m (b) 2.1×10^{-3} m (c) 3.1×10^{-10} m (d) 2.1×10^{-12} m

2. In α-particle scattering experiment number of α-particles scatter by more than 1° is about

(a) 0.3% (b) 0.24% (c) 0.20% (d) 0-14%

3. In α-particle scattering experiment, number of α-particles deflected by more than 90° is

(a) 1 in 8000 (b) 1 in 2000

(c) 1 in 1000 (d) 1 in 10,0000

4. Rutherford's experiments suggested that the size of nucleus is about

(a) 10^{-14}m to 10^{-11}m (b) 10^{-16}m to 10^{-13}m

(c) 10^{-15}m to 10^{-14}m (d) 10^{-15}m to 10^{-10}m

5. In which of the following, will the radius of the first orbit (n = 1) be minimum?

(a) Doubly ionized lithium (b) Singly ionized helium

(c) Deuterium atom (d) Hydrogen atom

6. If 13.6 eV energy is required to separate a hydrogen atom into a proton and electron, then the velocity of revolving electron is

(a) 1.2 x 10^{s} m/s (b) 2.2 x 10^{6} m/s

(c) 3.2 x 10^{6} m/s (d) 1.8 x 10^{6} m/s

7. An electron in a hydrogen atom makes a transition from n = n_1 to n = n_2. The time period of revolution of the electron in the initial state is eight times that in final state. The possible value of n_1 and n_2 are

(a) $n_1 = 4, n_2 = 2$ (b) $n_1 = 8, n_2 = 2$

(c) $n_1 = 8, n_2 = 1$ (d) $n_1 = 6, n_2 = 2$

8. If muonic hydrogen atom is an atom in which a negatively charged muon (μ) of mass about 207m_e revolve around a proton, then first Bohr radius of this atom is (radius of electron orbit is 0.53 Å)

(a) 2.56×10^{-10} m
(b) 2.56×10^{-11} m
(c) 2.56×10^{-12} m
(d) 2.56×10^{-13} m

9. The minimum energy that must be given to a hydrogen atom in ground state so that it can emit an Hy line in Balmer series.

(a) 12.4 eV
(b) 10.2 eV
(c) 13.06 eV
(d) 12.75 eV

10. A hydrogen atom initially in the ground state absorbs a photon and is excited to n = 4 level, then the wavelength of photon is nearly

(a) 790 Å (b) 870 Å (c) 970 Å (d) 1070 Å

11. The wavelength of first line of Lyman series is 1215 A, the wavelength of first line of Balmer series will be

(a) 4545 Å (b) 5295Å (c) 6563 Å (d) 6750 Å

12. The ratio of the speed of electron in the ground state of hydrogen atom to the speed of light in vacuum is

(a) $\frac{1}{2}$ (b) $\frac{2}{237}$ (c) $\frac{1}{137}$ (d) $\frac{1}{237}$

13. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be

(a) One (b) Two (c) Three (d) Five

14. Bohr's basic idea of discrete energy levels in atoms and process of emission of photons from the higher levels to the lower levels was experimentally confirmed by experiments performed by

(a) Michelson-Morley
(b) Millikan
(c) Joule
(d) Franck and Hertz

15. If E is the energy of n^{th} orbit of hydrogen atom, the energy of n^{th}orbit of He^+ ion will be

(a) E (b) 2 E (c) 3E (d) 4E

16. The shortest wavelength present in, the Paschen series of spectral lines is nearly

(a) 720 nm (b) 790 nm (c) 800nm (d) 820 nm

17. If there are N atoms in a source of Laser light and each atom is emitting light with intensity

I, then the total intensity produced by it is

(a) NI (b) N^2I (c) N^3I (d) N^4I

18. Which of the following statements is true for hydrogen atom? (n is principal quantum number of orbit)

(a) Angular momentum $\propto \frac{1}{n}$

(b) Radius of orbit $\propto \frac{1}{n}$

(c) Magnitude of linear momentum of electron in any orbit $\propto \frac{1}{n}$

(d) Energy Of electron in any Orbit $\propto \frac{1}{n^3}$

19. The first spectral series of hydrogen atom was discovered by

(a) Balmer (b) Lyman (c) Paschen **(d)** Bohr

20. In a hydrogen atom, total energy of electron is

(a) $\frac{e^2}{4\pi\varepsilon_0 r}$ (b) $\frac{-e^2}{4\pi\varepsilon_0 r}$ (c) $\frac{-e^2}{8\pi\varepsilon_0 r}$ (d) $\frac{e^2}{8\pi\varepsilon_0 r}$

- Answer Keys -

1) a	2) d	3) a	4) c	5) a	6) b	7) a	8) d	9) c	10) c
11) c	12) c	13) c	14) d	15) d	16) d	17) b	18) c	19) a	20) c

Chapter 13 : Nuclei

1. The atomic masses of various elements expressed in atomic mass unit (u) are close to being integral multiples of mass of

(a) A hydrogen atom (b) A proton

(c) A neutron (d) Both (b) and (c)

2. The density of nuclear matter

(a) Increases with mass number (b) Decreases with mass number

(c) Is independent of mass number (d) Increases up to mass number 56 then decreases

3. For thermonuclear fusion reaction, the estimated temperature of the system should be about

(a) $3\times10^{3}\,K$ (b) $3\times10^{9}\,K$ (c) $1\times10^{5}\,K$ (d) $3\times10^{6}\,K$

4. Nuclear force is

(a) Attractive for distance, $r = 0.5$ fm (b) Repulsive for distance, $r < 0.8$ fm

(c) Attractive for distance, r $<$ 0.8 fm (d) Repulsive for distance, $r > 0.8$ fm

5. The SI unit of activity is

(a) Becquerel (b) Curie (c) Rutherford (d) Both (a) and (b)

6. The mass of iron nucleus is 55.85u and $A = 56$. The nuclear density of iron is

(a) $2.5\times10^{15}\,kg/m^{3}$ (b) $2.3\times10^{16}\,kg/m^{3}$ (c) $2.3\times10^{17}\,kg/m^{3}$ (d) $3.5\times10^{16}\,kg/m^{3}$

7. 1 curie is equal to

(a) $3.7\times10^{7}\,Bq$ (b) $3.7\times10^{10}\,Bq$ (c) $3.7\times10^{8}\,Bq$ (d) $3.7\times10^{6}\,Bq$

8. The half life of $_{92}U^{238}$ undergoing -decay is 4.5 x 10^9 years. The activity of 4 g sample of

$_{92}U^{239}$ is

(a) 1.23 x 10^4Bq (b) 1.23 x 10^5 Bq (c) 4.9 x 10^4 Bq (d) 4.9 x 10^5 Bq

9. 1 mg radium has 2.68 x 10^{18} atoms. Its half life is 1620 years. How many radium atoms will disintegrate from 1 mg of pure radium in 3240 years.

(a) 2.01×10^{9} (b) 2.01×10^{18} (c) 0.67×10^{18} (d) 1.04×10^{9}

10. In a sample of radioactive material, what fraction of the initial number of active nuclei will remain undisintegrated after half of the half life of the sample?

(a) $\frac{1}{4}$ (b) $\frac{1}{2\sqrt{2}}$ (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}-1$

11. The natural boron of atomic mass 10.81 u is found to have two isotopes ^{10}B and ^{11}B. The ratio of abundance of isotopes of natural boron should be nearly

(a) 11 : 10 (b) 81 : 19 (c) 10: 11 (d) 19:81

12. The energy liberated in a single uranium fission is about

(a) 200 MeV (b) 235 MeV (c) 20 MeV (d) 100 MeV

13. Pick out the incorrect statement from the following.

(a) β^- emission from the nucleus is always accompanied with a neutrino

(b) The energy of the α -particle emitted from a given nucleus is constant

(c) γ -ray emission makes the nucleus more stable

(d) Nuclear force is charge-independent

14. The radius of a spherical nucleus as measured by electron scattering is 3.6 fm. What is the mass number of the nucleus most likely to be?

(a) 27 (b) 40 (c) 56 (d) 120

15. The number of β^-—particles emitted by a radioactive substance is twice the number of α-particles emitted by it. The resulting daughter is an

(a) Isomer of parent (b) Isotone of parent

(c) Isobar of parent (d) Isotope of parent

16. In nuclear reactors, the controlling rods are made of

(a) Cadmium (b) Graphite (c) Krypton (d) Plutonium

17. A nucleus with mass number 220 initially at rest emits an α-particle. If the Q-value of reaction is 5.5 MeV, the kinetic energy of a-particle is

(a) 4.4 MeV (b) 5.4 MeV (c) 5.0 MeV (d) 4.8 MeV

18. Choose the incorrect nuclear fusion reactions among the following

1) ${}_1^1H + {}_1^1H \rightarrow {}_1^2H + e^+ + v + 0.42\,MeV$ 2) ${}_1^2H + {}_1^2H \rightarrow {}_2^3H + n + 3.27\,MeV$

3) ${}_1^2H + {}_1^2H \rightarrow {}_1^3H + {}_1^1H + 4.03\,MeV$ 4) $e^+ + e^- \rightarrow \gamma$

19. Fission of nuclei is possible because the binding energy per nucleon in them

(a) Decreases with mass number at low mass numbers

(b) Increases with mass number at low mass numbers

(c) Increases with mass number and high mass numbers

(d) Decreases with mass number at high mass numbers

20. Consider α, β -particles and γ -rays. The increasing order of penetration power is

1) α, β, γ 2) γ, β, α 3) β, α, γ 4) β, γ, α

- Answer Keys -

1) a	2) c	3) b	4) b	5) a	6) c	7) b	8) c	9) c	10) c
11) d	12) a	13) a	14) a	15) d	16) a	17) b	18) d	19) d	20) a

Chapter 14 : Semiconductor Electronics

1. Which of the following is correct range of resistivity for the semiconductor material?

(a) $(10^{-2}$ to $10^{-8})\Omega$ m (b) $(10^{-5}$ to $10^{6})\Omega$ m (c) $(10^{11}$ to $10^{19})\Omega$ m

(d) $(10^{5}$ to $10^{16})\Omega$ m

2. A material has band gap energy (E_9) greater than 2 eV. The material

(a) Must be conductor (b) Must be semiconductor

(c) Must be insulator (d) May be semiconductor

3. A sample of semiconductor material having hole as minority carrier is of

(a) p-type (b) n-type (c) Intrinsic (d) Data is insufficient

4. An intrinsic semiconductor sample is doped with both pentavalent and trivglent dopants. If N_a is number of acceptor atoms per unit volume, N_d is number of donor atoms per unit volume and n and h are electron and hole concentrations, then

(a) $N_a + N_d = n + h$ (b) $N_a + n = N_d + h$

(c) $N_d + n = N_a + h$ (d) $N_a^2 + N_d^2 = n^2 + h^2$

5. A pure Si crystal has 5×10^{28} atoms/m^3. It is doped by 1 ppm concentration of As atom. The number of holes per unit volume is (consider $\mathbf{n_i}$ = 1.5 x 10^{16} m^{-3})

1) $4.5\times10^{9}\ m^{-3}$ 2) $4\times10^{9}\ m^{-3}$ 3) $2\times10^{9}\ m^{-3}$ 4) $2.25\times10^{10}\ m^{-3}$

6. Consider the following statements

(a) Zener diode is fabricated by lightly doped p-n junction

(b) After breakdown of Zener diode the current in the circuit is limited by external resistance

Choose the correct statement(s)

(a) (a) only (b) (b)only (c) Both (a) and (b)

(d) Neither (a) nor(b)

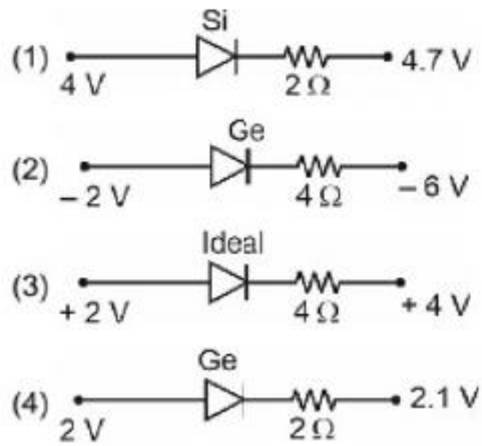
7. The semiconductor used for fabrication of visible LEDs must at least have a band gap

(a) 1.1 eV (b) 1.21 eV (c) 1.8 eV (d) 2.4 eV

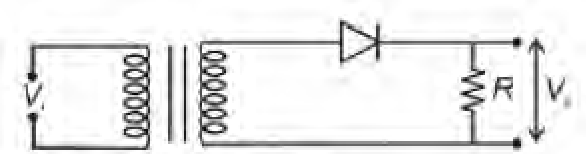
8. The V-I characteristics of photodiode lies in

(a) I quadrant (b) II quadrant (c) III quadrant (d) IV quadrant

9. Which of the following diode is in forward bias condition? (When current is flowing)



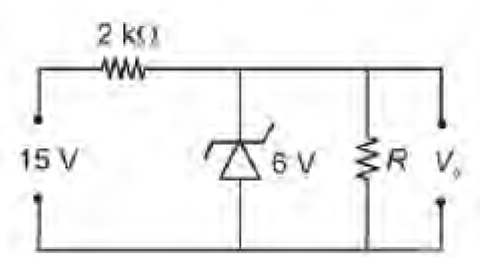
10. The output across the load ***R*** is



(a) Half wave rectified(b) Full wave (centre tap) rectified

(c) Quarter wave rectified (d) AC

11. The value of output voltage Vb in the circuit as shown in the figure is

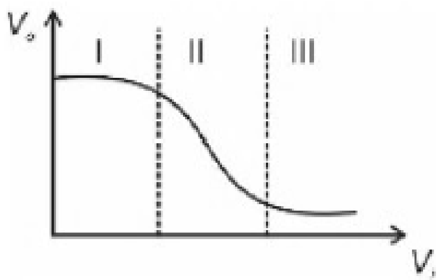


1) 9V 2) 4.5 V 3) 12V 4) 6V

12. An n-p-n transistor is configured in CE configuration. The input resistance is $2\,k\Omega$ and load is $10\,k\Omega$. If $\alpha = 0.99$, then voltage gain will be

1) 495 2) 990 3) 1000 4) 500

13. The transfer characteristics of a CE amplifier is shown in the figure. The transistor works as an amplifier in region



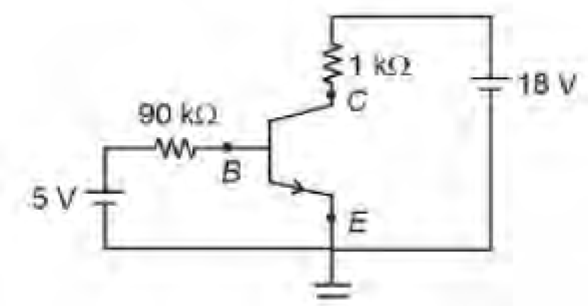
1) I 2) II 3) III 4) In both (I) an d(III)

14. The input signal given to a CE amplifier having voltage gain 100 is $V_i = (20mV)\cos\left(10t + \frac{\pi}{6}\right)$. The corresponding output signal will be

1) $(2V)\cos\left(10t + \frac{\pi}{6}\right)$ 2) $(2V)\cos\left(10t - \frac{\pi}{6}\right)$

3) $(2V)\cos\left(10t + \frac{7\pi}{6}\right)$ 4) $(2000V)\cos\left(10t + \frac{2\pi}{3}\right)$

15. A common emitter amplifier is shown in the figure. If $\beta = 200$ and $V_{BE} = 0.5$ V, then value of I_C and V_{CE} respectively will be



(a) (10 mA, 10 V) (b) (10mA,8V)

(c) (5mA.8V) (d) (10 mA, 18 V)

16. Which of the following relations is/are correct? (Symbols have their usual meaning)

1) $A_v = \beta \frac{R_{out}}{R_{in}}$ 2) $A_p = \beta^2 \frac{R_{out}}{R_{in}}$ 3) $\beta = \frac{\alpha}{1-\alpha}$ 4) All of these

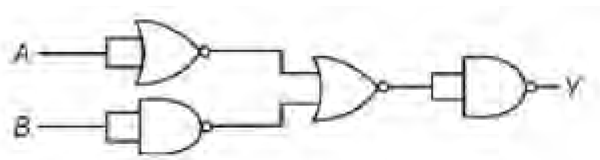
17. A transistor with CE configuration can be realized as

(a) NOT gate (b) AND gate (c) OR gate (d) NOR gate

18. A p-n photodiode is fabricated from a semiconductor with band gap of 2.0 eV. The maximum wavelength of a incident radiation that can be detected is

(a) 7200 A (b) 6200 A (c) 6200 nm (d) 7200 nm

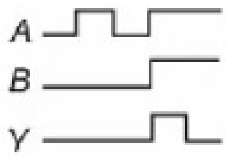
19. The name of logic gate represented by the following symbol is



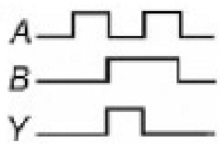
1) NOR 2) OR 3) AND 4) NAND

20. If A and B are inputs to a NAND gate and Y is output, then choose the correct option.

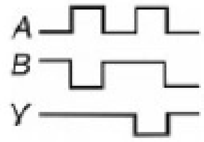
(1)



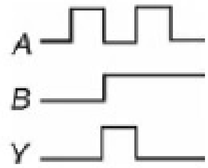
(2)



(3)



(4)



- Answer Keys -

1) b	2) d	3) b	4) b	5) a	6) b	7) c	8) c	9) b	10) a
11) d	12) a	13) b	14) c	15) b	16) d	17) a	18) b	19) d	20) c

CHEMISTRY

Brief Profile of the Author:

Dr C K Manjunath is having 24 years of academic experience, served as Principal, Administrator and Professor of Various institutions in Udupi and Mangalore. He has worked as author and Editor for Pearson publications, New Delhi. He is a Trainer and has Conducted Training for CBSE/ ICSE/ State board Teachers and Principals across India. He counsels students in career building and learning Disability. He has delivered more than 600 lectures on Dr APJ Kalam and his vision. He is awarded with special accolades as Best Teacher, Orator, Principal, Administrator and Trainer by prestigious organizations.

Dr C K Manjunath
Professor of Chemistry
Head Training and Placement
Shri Madhwa Vadiraja Institute of Technology and Management,
Bantakal, Udupi-574 115.

9742503226/ckmanju74@gmail.com

UNIT 1 : SOME BASIC CONCEPTS OF CHEMISTRY

Q1. Which carbon isotope is used in obtaining relative atomic masses?

1. Carbon-12 2. Carbon-13 3. Carbon-14 4. None of the above

Answer: (a), The carbon-12 isotope is used to obtain relative atomic masses.

Q2. What is the relation between the molar mass and the vapour density of a gas?

1. Molar mass = Vapour density / 2 2.Molar mass = 2 × Vapour density
2. Molar mass = Vapour density 3. No relation

Answer: (b), Molar mass = 2 × Vapour density.

Q3. How many significant figures are there in 7070×10^7?

1. Two 2. Four 3. Seven 4. Can't be determined

Answer: There are four significant figures in 7070×10^7.

Q4. What do you mean by the term significant figure?

Answer: Significant figures refers to the digits that carry a meaning towards the resolution of the measurement.

For example, 3600 has two significant figures. In contrast, 36.00 has four significant figures.

Q5. What is gay lussac's law of combining volumes?

Answer: The gay lussac's law of combining volumes states that the relative volumes of gases are in the ratio of small whole numbers at constant temperature and pressure.

Q6. What is the volume of $6.022 \text{ X } 10^{23}$ molecules of hydrogen at NTP?

1. 22.4 litres 2. 11.2 litres 3. 1 litre 4. 2 litres

Answer: (a), $6.022 \text{ X } 10^{23}$ molecules of hydrogen contain 22.4 litres of hydrogen.

Q7. What is the molarity of a solution containing 5.85 g of NaCl(s) in a 500 mL solution?

Answer: Given

Mass of solute = 5.85 g

Volume of solution 500 ml

Molar mass of NaCl = 23 + 35.5 = 58.5

No. of moles of solute = Mass of solute / Molar mass of solute

No. of moles of solute = 5.85 / 58.5

No. of moles of solute = 0.1

Molarity = No. of the mole of solute / Volume of solution

Molarity = 0.1 / 0.5 = 0.2 mol / L

Q8. What is the mass of one atom of C-12 (in grams)?

Answer: Mass of 1 mole of C-12 atoms = 12 g

1 mole of C-12 atoms contains 6.022×10^{23} atoms.

Thus, the mass of one atom of C-12 will be = $12 / (6.022 \times 10^{23})$.

Mass of one atom of C-12 = 1.99×10^{-23} g

Q9. What is the law of multiple proportions?

Answer: Law of multiple proportions was given by English chemist John Dalton. He states that when two elements combine to form one or more compounds. Then the weight of one element that combines with the fixed weight of other elements is in the small whole-number ratio.

Q10. What are the postulates of dalton's atomic theory?

Answer: The postulates of dalton's atomic theory are mentioned below.

- He states that the atom is indivisible, i.e. we can not further subdivide it.
- He states that all atoms of the same element are identical.
- He states that different elements have different types of atoms.
- Compounds are formed when atoms of different elements join in a simple whole-number ratio.

Q11. What are the demerits of dalton's atomic theory?

Answer: The demerits of dalton's atomic theory are mentioned below.

- He states that an atom is indivisible, but we can further sub-divide the atom into electron protons and neutrons.
- He states that atoms of different elements combine in a simple whole-number ratio, but this concept failed to explain sugar molecule combination ($C_{12}H_{22}O_{11}$).
- He failed to explain the existence of isotopes, isobars and allotropes.

Q12. Match the following.

Column I	Column II
1 mol of any gas	**3 mol**
88 g of CO_2	**1 mol**
5.6 litres of O_2 at STP	**0.25 mol**
6.022×10^{23} molecules of H_2O	**2 mol**
96 g of O	**6.022×10^{23} molecules**

Answer:

Column I	Column II
1 mol of any gas	**6.022×10^{23} molecules**
88 g of CO_2	**2 mol**
5.6 litres of O_2 at STP	**0.25 mol**
6.022×10^{23} molecules of H_2O	**1 mol**
96 g of O	**3 mol**

Q13. What are the differences between molarity and molality?

Answer:

No.	Molarity	Normality
1.	**Molarity is the number of moles of compound present in 1 litre of solution.**	**Molality is the number of moles of solute present in 1 kilogram of a solvent.**
2.	**Its unit is mol / L.**	**Its unit is mol / kg.**
3.	**It is dependent on the temperature, volume and solubility of the solute.**	**It depends on the mass and is independent of temperature and volume.**

Q14. What are the differences between molarity and normality?

Answer:

Sl. No.	Molarity	Normality
1.	Molarity is the number of moles of compound present in 1 litre of solution.	Normality is the gram equivalent of solute present in 1 litre of solution.
2.	Its unit is mol / L.	Its unit is eq / L or meq / L.
3.	It does not depend on the type of reaction the solute undergoes.	It depends on the kind of reaction the solute undergoes.
4.	It is dependent on the temperature, volume and solubility of the solute.	It is dependent on reactive species present in the solution.

Q15. Match the following physical quantities with their corresponding units.

Column I	Column II
Luminous intensity	mol / L
Mole	kg
Pressure	Unitless
Mole fraction	Pascal
Mass	mol
Molarity	Candela

Answer:

Column I	Column II
Luminous intensity	Candela
Mole	mol
Pressure	Pascal
Mole fraction	Unitless
Mass	kg
Molarity	mol / L

UNIT 2: STATES OF MATTER

1. The vapour pressure of water at 300 K in a closed container is 0.4 atm. If the volume of container is doubled, its vapour pressure at 300 K will be
   (a) 0.8 atm (b) 0.2 atm (c) 0.4 atm (d) 0.6 atm
   Answer : (c) 0.4 atm

2. The state of matter that shows the uniformity of behavior :
   (a) Solid Liquid (b) Liquid (c) Gas (d) None of the Above
   Answer : (c) Gas

3. A gas deviates from ideal behavior at a high pressure because its molecules:
   (a) Attract one another (b) Show the Tyndall Effect (c) Have kinetic energy (d) Are bound by covalent bonds
   Answer : (a) Attract one another

4. The value of universal gas constant R depends on
   (a) Temperature of Gas (b) Volume of Gas (c) Number of Moles of Gas (d) Units of Volume,Temperature and Pressure
   Answer : (d) Units of Volume, Temperature and Pressure

5. In van der Waal equation of state of gas laws, the constant b is a measure of
   (a) Intermolecular collisions per unit volume (b) Intermolecular attraction (c) Volume occupied by the molecules (d) Intermolecular repulsions
   Answer : (c) Volume occupied by the molecules

6. The states of matter having no definite shape but definite volume:
   (a) Gas (b) Liquid (c) Solid (d) None of the Above
   Answer : (b) Liquid

7. The rise or fall of a liquid within a tube of small bore is called:
   (a) Surface Tension (b) Capillary Action (c) Viscosity (d) Formation of Curvature
   Answer : (b) Capillary Action

8. Falling drop of water is spherical due to:
   (a) Hydrogen Bonding (b) Surface Tension (c) Capillary Action (d) VIscosity
   Answer : (b) Surface Tension

9. The rates of diffusion of gases are inversely proportional to square root of their densities . This statement refers to :
   (a) Daltons Law (b) Grahams Law (c) Avogadros Law (d) None of the Above
   Answer : (b) Grahams Law

10. The law, which states that at constant temperature, the volume of a given mass of gas is inversely proportional is pressure, is known as:
(a) Boyles law (b) Charles law (c) Combine gas law (d) Avogadro's law
Answer : (a) Boyles law

11. When you heat a sample of gas, what happens to the particles that make up the gas?
(a) The particles move faster (b) The particles break apart (c) The particles get smaller (d) The particles become more dense
Answer : (a) The particles move faster

12. Which of the following is not a type of van der Waal's forces?
(a) Ion - dipole forces (b) London forces (c) Dipole-induced dipole forces (d) Dipole - dipole forces
Answer : (a) Ion - dipole forces

13. The interaction energy of London force is inversely proportional to sixth power of the distance between two interacting particles but their magnitude depends upon
(a) polarisability of interacting particles (b) strength of permanent dipoles in the particles (c) mass of interacting particles (d) charge of interacting particles
Answer : (a) polarisability of interacting particles

14. Dipole-induced dipole interactions are present in which of the following pairs
(a) HCl and He atoms (b) H2O and alcohol (c) Cl2 and CCl4 (d) None of these
Answer : (a) HCl and He atoms

15. Which of the following exhibits the weakest intermolecular forces?
(a) He (b) H2O (c) NH3 (d) None of these
Answer : (a) He

16. Which of the following is the correct order of thermal energy in three states of matter? (a) Solid < Liquid < Gas (b) Liquid < Solid < Gas (c) Liquid < Gas < Solid (d) Gas < Solid < Liquid
Answer : (a) Solid < Liquid < Gas

17. Which one of the following statements is not correct about the three states of matter i.e., solid, liquid and gaseous?
(a) Gases like liquids possess definite volumes (b) Molecules of a solid possess vibratory motion (c) The density of solid is highest whereas that of gases is lowest (d) Molecules of a solid possess least energy whereas those of a gas possess highest energy
Answer : (a) Gases like liquids possess definite volumes

18. Which is lighter than dry air?
(a) Moist air (b) SO_2 (c) Cl_2 (d) O_2
Answer : (a) Moist air

19. The beans are cooked earlier in pressure cooker, because -
(a) Boiling point increases with increasing pressure (b) Boiling point decreases with increasing pressure (c) Extra pressure of pressure cooker softens the beans (d) Internal energy is not lost while cooking in pressure cooker
Answer : (a) Boiling point increases with increasing pressure

20. The compressibility factor for H_2 and He is usually:
(a) >1 (b) =1 (c) <1 (d) either of these
Answer : (a) >1

21. Boyle's law is applicable in :
(a) Isobaric process (b) Isochoric process (c) Isothermal process (d) Adiabatic process
Answer : (c) Isothermal process

22. With the increase of pressure, the mean free path:
(a) decreases (b) increases (c) becomes zero (d) remains the same
Answer : (a) decreases

23. Air at sea level is dense. This is a practical application of:
(a) Boyle's law (b) Charles' law (c) Avogadro's law (d) Dalton's law
Answer : (a) Boyle's law

24. The gas among the following can be most steadily liquefied is –
(a) NH_3 (b) Cl_2 (c) SO_2 (d) CO_2
Answer : (c) SO_2

25. If 300 ml of a gas at 27°C is cooled to 7°C at constant pressure, its final volume will be- (a) 135 ml (b) 540 ml (c) 350 ml (d) 280 ml
Answer : (d) 280 ml

UNIT 3: ATOMIC STRUCTURE

Answers to Multiple Choice Questions

MCQ (Type-I)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.
1	(iii)	2	(ii)	3	(iv)	4	(iv)	5
7	(iv)	8	(iv)	9	(iii)	10	(ii)	11
13	(iii)	14	(ii)	15	(iv)	16	(ii)	

Type-II)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	(iii), (iv)	2	(i), (iv)	3	(ii), (iii)
4	(i), (iii)	5	(i), (iv)		

Multiple Choice Questions (Type-I)

1. Which of the following conclusions could not be derived from Rutherford's α -particle scattering experiment?

   (i) Most of the space in the atom is empty.

   (ii) The radius of the atom is about 10^{-10} m while that of nucleus is 10^{-15} m.
   (iii) Electrons move in a circular path of fixed energy called orbits.

   (iv) Electrons and the nucleus are held together by electrostatic forces of attraction.

2. Which of the following options does not represent ground state electronic configuration of an atom?

   (i) 1s2 2s2 2p6 3s2 3p6 3d8 4s2

   (ii) 1s2 2s2 2p6 3s2 3p6 3d9 4s2

   (iii) 1s2 2s2 2p6 3s2 3p6 3d10 4s1

   (iv) 1s2 2s2 2p6 3s2 3p6 3d5 4s1

3. The probability density plots of 1s and 2s orbitals are given in Fig. 2.1:

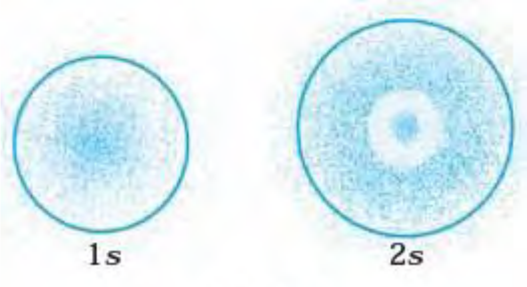


Fig. 2.1

The density of dots in a region represents the probability density of finding electrons in the region.
On the basis of above diagram which of the following statements is incorrect?

(i) 1s and 2s orbitals are spherical in shape.

(ii) The probability of finding the electron is maximum near the nucleus.

(iii) The probability of finding the electron at a given distance is equal in all directions.

(iv) The probability density of electrons for 2s orbital decreases uniformly as distance from the nucleus increases.

4. Which of the following statement is not correct about the characteristics of cathode rays?

(i) They start from the cathode and move towards the anode.

(ii) They travel in straight line in the absence of an external electrical or magnetic field.

(iii) Characteristics of cathode rays do not depend upon the material of electrodes in cathode ray tube.

(iv) Characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube.

5. Which of the following statements about the electron is incorrect?

(i) It is a negatively charged particle.

(ii) The mass of electron is equal to the mass of neutron.

(iii) It is a basic constituent of all atoms.

(iv) It is a constituent of cathode rays.

6. Which of the following properties of atom could be explained correctly by Thomson Model of atom?

(i) Overall neutrality of atom.

(ii) Spectra of hydrogen atom.

(iii) Position of electrons, protons and neutrons in atom.

(iv) Stability of atom.

7. Two atoms are said to be isobars if.
   (i) they have same atomic number but different mass number.
   (ii) they have same number of electrons but different number of neutrons.
   (iii) they have same number of neutrons but different number of electrons.
   (iv) sum of the number of protons and neutrons is same but the number of protons is different.

8. The number of radial nodes for 3p orbital is __________.
   (i) 3 (ii) 4 (iii) 2 (iv) 1

9. Number of angular nodes for 4d orbital is __________.
   (i) 4 (ii) 3 (iii) 2 (iv) 1

10. Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons?
    (i) Pauli's exclusion principle. (ii) Heisenberg's uncertainty principle.
    (iii) Hund's rule of maximum multiplicity. (iv) Aufbau principle.

11. Total number of orbitals associated with third shell will be __________.
    (i) 2 (ii) 4 (iii) 9 (iv) 3

12. Orbital angular momentum depends on __________.
    (i) l (ii) n and l (iii) n and m (iv) m and s

13. Chlorine exists in two isotopic forms, Cl-37 and Cl-35 but its atomic mass is 35.5. This indicates the ratio of Cl-37 and Cl-35 is approximately
    (i) 1:2 (ii) 1:1 (iii) 1:3 (iv) 3:1

14. The pair of ions having same electronic configuration is __________.
    (i) Cr^{3+}, Fe^{3+} (ii) Fe^{3+}, Mn^{2+} (iii) Fe^{3+}, Co^{3+} (iv) Sc^{3+}, Cr^{3+}

15. For the electrons of oxygen atom, which of the following statements is correct?
    (i) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.
    (ii) An electron in the 2s orbital has the same energy as an electron in the 2p orbital.
    (iii) Z_{eff} for an electron in 1s orbital is the same as Z_{eff} for an electron in a 2s orbital.

(iv) The two electrons present in the 2s orbital have spin quantum numbers mS but of opposite sign.

16. If travelling at same speeds, which of the following matter waves have the shortest wavelength?

(i) Electron (ii) Alpha particle (He2+) (iii) Neutron (iv) Proton

Multiple Choice Questions (Type-II)

In the following questions two or more options may be correct.

1. Identify the pairs which are not of isotopes?

(i) $^{12}_{6}X$, $^{13}_{6}Y$

(ii) $^{35}_{17}X$, $^{37}_{17}Y$

(iii) $^{14}_{6}X$, $^{14}_{7}Y$

(iv) $^{8}_{4}X$, $^{8}_{5}Y$

2. Out of the following pairs of electrons, identify the pairs of electrons present in degenerate orbitals :

(i) (a) $n = 3,\ l = 2,\ m_l = -2,\ m_s = -\frac{1}{2}$

(b) $n = 3,\ l = 2,\ m_l = -1,\ m_s = -\frac{1}{2}$

(ii) (a) $n = 3,\ l = 1,\ m_l = 1,\ m_s = +\frac{1}{2}$

(b) $n = 3,\ l = 2,\ m_l = 1,\ m_s = +\frac{1}{2}$

(iii) (a) $n = 4,\ l = 1,\ m_l = 1,\ m_s = +\frac{1}{2}$

(b) $n = 3,\ l = 2,\ m_l = 1,\ m_s = +\frac{1}{2}$

(iv) (a) $n = 3,\ l = 2,\ m_l = +2,\ m_s = -\frac{1}{2}$

(b) $n = 3,\ l = 2,\ m_l = +2,\ m_s = +\frac{1}{2}$

3. Which of the following sets of quantum numbers are correct?

	n	l	m_l
(i)	1	1	+2
(ii)	2	1	+1
(iii)	3	2	–2
(iv)	3	4	–2

4. In which of the following pairs, the ions are iso-electronic?

(i) Na^+, Mg^{2+} (ii) Al^{3+}, $O^–$

(iii) Na^+, O^{2-} (iv) $N^{3–}$, $Cl^–$

5. Which of the following statements concerning the quantum numbers are correct?

(i) Angular quantum number determines the three dimensional shape of the orbital.

(ii) The principal quantum number determines the orientation and energy of the orbital.

(iii) Magnetic quantum number determines the size of the orbital.

(iv) Spin quantum number of an electron determines the orientation of the spin of electron relative to the chosen axis.

UNIT 4 : CHEMICAL BONDING AND MOLECULAR STRUCTURE

1) The number of moles of AgClprecipitated when excess of AgNO3 solution is added to one mole of [Cr(NH3)4Cl2]Cl solution is
a) One b) three c) two d) four

Answer :

The complex has only one mole of ionisable chlorine, the chlorine outside the square bracket. [Cr(NH3)4Cl2]Cl]

Ans : (a)

2) The octahedral and paramagnetic complex is
a) $[Fe(CN)6]^{3-}$ b) $[Fe(CN)6]^{4-}$ c) $[Cu(NH3)4]^{+2}$ d) $[Ni(CN)4]^{-2}$

Answer :

Charge on Fe is Fe^{+3}

Electronic Configuration of Fe^{+3} [Ar]

When strong ligands CN^- approach pairing of electron taken place but still contains one unpaired electron hence paramagnetic

Ans : (a)

3) Ionisable and non ionisable valency of copper in $[Cu(NH_3)_4]SO_4$
a) 4 and 2 b) 2 and 4 c) 2 and 2 d) 1 and 4

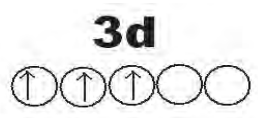
Answer :

Ionisable valency = O.No.=2; Non ionisable is co-ordination no.=4

Ans : (b)

4) Which of the following complex will give white precipitate with BaCl2(aq)?
a) $[Cr(NH_3)_5SO_4]Cl$ b) $[Co(NH_3)4SO_4]NO_2$
c) $[Cr(NH_3)_5Cl]SO_4$ d) both (1) and (3) Ans : (c)

5) The number of d-electrons in $[Cr(H_2O)_6]^{+3}$[Z of Cr=24] is
a) 2 b) 3 c) 4 d) 5 **Answer :**Electronic configuration of Cr^{+3} is [Ar]



since H_2O is a weak field ligand number of unpaired electrons remain unchanged. Ans : (b)

6) The donor atoms in EDTA are
a) two N and two O b) two N and four O c) four N and two O

d) three N and three O Ans : (b)

7) Which of the following ligands is not chelating?
c) EDTA b) en c) oxlate d) pyridine Ans : (d)

8) The IUPAC name of $[CoCl(NO_2)(en)_2]Cl$ is
a) Chloronitrobis (ethylenediamine) cobalt (III) chloride
b) Chloronitrobis (ethylenediamine) cobalt (II) chloride
c) chlorobis (ethylene diamine) nitrocobalt (III) chloride
d) bis (ethylenediamine) chloronitrocobalt (III) chloride

Ans : (c)

9) The IUPAC name for the complex [CrCl2 (H2O)4]NO3 is
a) Dichlorotetraaquachromium (III) nitrate
b) Tetraaquodichlorochromate (III) nitrate
c) dichlorotetraaqueous-chromium (IV) nitrate
d) tetraaquadichlorochromium (III) nitrate

Ans : (d)

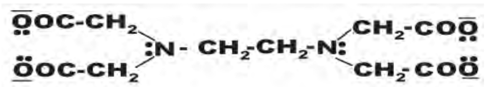
10) The chemical formula for iron hexacyanoferrate (II) is
a) $Fe[Fe(CN_6)]$ b) $Fe3[Fe(CN)_6]$ c) $Fe3[Fe(CN)_6]_4$

d) $Fe4[Fe(CN)_6]_3$**Ans : (d)**

11) The compound $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_3Cl_3]3H_2O$ are example of
a) linkage isomerism b) hydrate isomerism
b) ligand isomerism d) ionization isomerism

Ans : (b)

12) The complex ions
a) $[Co(NH_3)_5(NO_2)]^{2+}$ and $[Co(NH_3)_5(ONO)]^{2+}$ are a) ionization isomers



b) linkage isomers c) coordination isomers d) geometrical

Ans : (b)

13) The possible number of ionization isomers for the complex [MCl2Br2]SO4 is
a) 3 b) 2 c) 4 d) 5 Ans : (a)
14) The effective atomic number of iron (at. No.26) in the complex
K4 [Fe(CN)6] is
a) 24 b) 35 c) 36 d) 18 Ans : (c)
15) Coordination number and oxidation number of Cr in K3 [Cr(C2O4)3] are, respectively
a) 4 and +2 b) 6 and +3 c) 3 and +3 d) 3 and 0 Ans : (b)
16) In which of the following complex the central metal ion is not in a state of d2sp3 hybridized state
a) [CoFe6]3- b) [Co(NH3)6]3+ c) [Fe(CN)6]3- d) [Cr(NH3)6]3+

Ans : (a)

17) Which of the following is paramagnetic?
a) $K_4[Fe(CN)_6]$ b) $K_3[Fe(CN)_6]$ c) $[Ni(CO)_4]$ d) $[Co(NH_3)_6]Cl_3$

Ans : (b)

18) In the complex $[Ni(H_2O)_2(NH_3)_4]^{2+}$, the number of unpaired electron is
a) 0 b) 1 c) 3 d) 2 Ans : (d)

19) Which one of the following is not expected to show paramagnetism?
a) $[Ni(H_2O)_6]^{2+}$ b) $Ni(CO)_4$ c) $[Ni(NH_3)_4]^{2+}$ d) $[Co(NH_3)_6]^{2+}$

Ans : (b)

20) Which complex has square planar structure?
a) $Ni(CO)_4$ b) $[NiCl_4]^{2+}$ c) $[Ni(H_2O)_6]^{2+}$ d) $[Cu(NH_3)_4]^{2+}$

Ans : (d)

21) Amongst the following complex ions, which one has the highest paramagnetism?
a) $[Cr(H_2O)_6]^{3+}$ b) $[Fe(H_2O)_6]^{2+}$ c) $[Cu(H_2O)_6]^{2+}$ d) $[Zn(H_2O)_6]^{2+}$

Ans : (b)

22) The compounds $[Co(NH_3)_5(Br)]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples of
a) geometrical isomerism b) linkage isomerism c) ionization isomerism
b) optical isomerism Ans : (c)

23) In $[Co(NH_3)_6]Cl_3]$ the number of covalent bonds is
a) 6 b) 3 c) 9 d) 18 Ans : (d)

24) Which of the following statements is incorrect?

a) $K_3[Fe(CN_6)$ the ligand has satisfied only the secondary valency of ferric ion

b) $K_3[Fe(CN_6)$ the ligand has satisfied both primary and secondary valencies of ferric ion

c) $K_4[Fe(CN_6)$ the ligand has satisfied both primary and secondary valencies of ferrous ion

d) $[Cu(NH_3)_4]SO_4$, the ligand has satisfied only the secondary valency of copper ion

Ans : (a)

25) Among $[Ni(CO)_4]$, $[Ni(CN)_4]^{-2}$ and $[NiCl_4]^{-2}$ species, the hybridisation states at the Ni atom are respectively

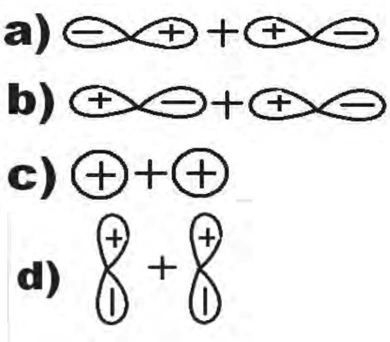
a) sp^3, dsp^2, dsp^2 b) sp^3, dsp^2sp^3 c) sp^3, sp^3, dsp^2

d) dsp^2, sp^2, sp^3 Ans : (b)

26) Which of the following is not an atomic orbital?

a) s b) p c) f d) V Ans : (d)

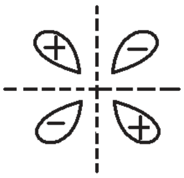
27) In the following set ups which will give ABMO?



Ans : (b)

28) Number of nodal planes in S*2px orbitals are

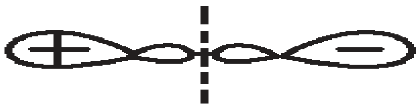
a) 1 b) 2 c) 3 d) zero



S*2px

Ans : (b)

29) The diagram shows



a) Vns b) V*ns c) Vnpz d) V*npz

Ans : (d)

UNIT 5 : CHEMICAL THERMODYNAMICS

1) ....not an example of open systems.
a) Plants b) Animals c) Human beings d) Tea in closed cup
Answer : d) Tea in closed cup

2) isolated system includes.....with surrounding.
a) exchange of energy b) exchange of matter
C) both exchange of energy & matter d) none of these
Answer :d) none of these

3).......is an example of set of extensive properties.
a) Mass, volume, temperature, heat capacity
b) Heat capacity, volume, pressure, temperature
c) Mass, volume, internal energy, entropy
d) entropy, enthalpy, temperature, pressure
Answer :**c) Mass, volume, internal energy, entropy**

4) Extensive property is....
a) additive b) non-additive c)density
d) pressure **Answer : a) additive**

5) Statistical thermodynamics is a branch of.......of the system
a) microscopic properties b) macroscopic properties
c)physical properties d) chemical properties
Answer : a) microscopic properties

6) Mass is....
a) non-state function b) intensive property
C) state function d) not an extensive property
Answer : C) state function

6) if pressure and volume of the system remains constant, this is known as....
a) chemical equilibrium b) thermal equilibrium
c) mechanical equilibrium d) all
Answer : c) mechanical equilibrium
7) For isothermal process...is correct.
a) $\Delta U \neq 0$ b) $\Delta \neq T$ c) $q=0$ d) $\Delta U=0$ **Answer :a) $\Delta U \neq 0$**

8) For isobaric process.. is Correct.
a) $P = 0$ b) $\Delta V=0$ c) $\Delta U=0$ d $\Delta P=0$ **Answer** : **d) $\Delta P=0$**

9) For isochoric process.... iS correct.
a) $V=0$ b) $\Delta \neq 0$ c) $\Delta V=0$ d) all of these **Answer :d) all of these**

10) For adiabatic process.
a) $\Delta q \neq 0$ b) $\Delta T=0$ c) $q=0$ d)$\Delta U=0$ **Answer : c) q=0**

11) For adiabatic process..
a) $\Delta T=0$ b) $\Delta U=0$ c) $\Delta U\neq 0$ d) $q \neq 0$ **Answer :c) $\Delta U\neq 0$**

12) A reversible process Occurs at ...
a) slow rate b) very slow rate c) fast rate d) very fast rate
Answer :b) very slow rate

13).... not feature of reversible process
a) Driving and opposing forces are in differ
b) Process can be reversed at any finite steps
c) Maximum work can be drawn from reversible process
d) process can be reversed at any point
Answer :b) Process can be reversed at any finite steps

14) Thermodynamics does not consider
a) initial and final state b) time factor c) bulk of matter
d) energy change **Answer :b) time factor**

15) A system which can neither exchange a matter nor energy with the surroundings is called,
a) isolated system b) Opern system c) Closed system
d) Ideal system **Answer** :**a) isolated system**

16) Water at its freezing point,in a closed insulated vessel, represents a an_____
a) open system b) heterogeneous system
c) closed system d) homogeneous System **Answer :b) heterogeneous system**

17) An isolated system is one,
a) Which can transfer neither matter nor energy to and from its surroundings
b) Which can transfer both energy and matter
c) Which can transfer matter only d) Which can transter energy only
Answer : a) Which can transfer neither matter nor energy to and from its surroundings

18) Thermodynamics is based on study of...... of the system
a) microscopic properties b) macroscopic properties
c) physical properties d) chemical properties
Answer :b) macroscopic properties

19) Boiling tea in a tea pot which is not closed is a/ an,
a) closed system b) Open system
c) isolated system d) homogeneous system **Answer : b) Open system**

20) An example of closed system is,
a) hot water present in an open beaker
b) some amount of water present in equilibrium with its vapour in a closed and insulated beaker c) some amount of hot water enclosed in a Closed container
d) ice kept in open beaker
Answer :c) some amount of hot water enclosed in a Closed container

21) A System is used to be in thermodynamics equilibrium when....
a) the temperature of the system is non uniform and different from the temperature of the surrounding b) the mechanical properties is non uniform throughout the system c) the state function of the system do not change with time
d) only pressure of the reaction is at equilibrium
Answer :**c) the state function of the system do not change with time**

22) Which of the following is intensive property?
a) Temperature b) Density c) molarity d) all **Answer** :**d) all**

23) When compositions of the system does not change with time, then the system is in........ equilibrium.
a) thermal b) chemical c) mechanical d) physical
Answer :b) chemical

24) Which of the following is extensive property?
a) Mass b) Mole c) Volume d) All are correct
Answer :d All are correct

25) Temperature and heat are,
a) Extensive properties b) Intensive properties
c) Intensive and extensive properties respectively
d) Extensive and intensive propertes respectively
Answer :c) Intensive and extensive properties respectively

26) A system which can exchange energy with the Surroundings but no matter is called
a) a heterogenous system b) an open system
c) closed system d) an isolated system **Answer :c) closed system**

27) Mark the false statement regard lay thermodynamic processes-
a) a reversible change is a change in which the pressure remains constant
b) an adiabatic change is a change in which the System is completely isolated in the thermal sense. c) in an isochoric process, the volume of the System remains constant d) all the nautral processes are irreversible
Answer : a) a reversible change is a change in which the pressure remains constant
28) Melting of ice at room temperature is....... process.
a) spontaneous b) non spontaneous c) exotheric
d) both (a) and (b) **Answer : a) spontaneous**

29) Which of the following is spontaneous endothermic process?
a) conversion of N2,O4, to NO2, b) low of heat from cold object to hot object
c) separation of Ar and Kr d) heat transfer from ice to room temperature at 25 C
Answer : **a) conversion of N2,O4, to NO2**

30) Entropy is....
a) state function b) non- state function c) relates orderly arrangement
d) relates freezing of liquid water **Answer : a) state function**

31) The unit of entropy is.....
a) JK-1 b) cal K c) Jk d) cal-1 K **Answer** : **a) JK-1**

32) Which of the following is correct
a) qp+qv =ΔnRT b) qreve= TΔS c) Δn= nR(g) - nP(g)
d) ΔG= + WRT **Answer** : **b) qreve= TΔS**

33) Δ**S> 0 for.....**
a) freezing of a liquid b) sublimation of solid
c) liqification of a gas d) condensation of a gas
Answer : b) sublimation of solid

34) Which of the following is correct ?
a) Sether*(l)* = SCH3OH *(l)* b) Sether(l) > SCH3OH*(l)*
c) SCH3OH*(l)* > Sether*(l)* d) none of the above
Answer : b) Sether*(l)* > SCH3OH*(l)*

35) N2O4(g) has higher entropy than NO
a) due to more complexity of N2,04,
b) more contribution of vibrational motion of N2,04
c) both (a) and (b) d) more complexity of NO **Answer : c) both (a) and (b**)

36) For which of the following , ΔS is positive
a) 3O2(g) ---> 2O3(g) b) I2(s)+aq-----> I2(aq)
c) H2O(g)-----> H2O*(l)* d) 2H2(g) + O2(g)----> 2H2O*(l)*
Answer : **b) I2(s)+aq-----> I2(aq**)

37) Heat of reactions are generally represented at ..
a) 273 K and 1atm b) 298 K and 2 atm
c) 1atm and 298 K d) 300 K and 1 atm **Answer** : **c)1 atm and 298 K**

38) For writing thermodynamics equation which of the following is not correct.
a) Reaction is represented by balanced chemical equation
b) Enthalpy changes are measured at 300 K and atm pressure
c) Enthalpy of elements in their standard physical states is zero
d) The enthalpy of any compound is equal to its heat of formation
Answer :**a) Reaction is represented by balanced chemical equation**

39) ΔcH° of any element or compound is.....
a) always positive b) always zero c)always negative
d) both (a) and (b) **Answer** : **c)always negative**

40) Enthalpy of hydration is always ..
a) Exothermic b) Endothermic Zero c) always negative
d) Both (a) and (c) **Answer : a) Exothermic**

41) Which of the following is endothermic...
a) ΔcH° b) ΔLH° c) ΔatmH° d) ΔfH° **Answer** : **c) ΔatmH°**

42) Which of the following is correct for enthalpy of formation of compounds ?
a) always exothermic b) always endothermic
c) may be exothermic or endothermic d) unpredictable
Answer : c) may be exothermic or endothermic

43) The correct order of increasing energy content is
a) lit-atm <calorie<joule < erg b) joule<calorie <erg< lit-atmm
c) lit-atm> calorie> > erg d) erg >calorie >lit-atm >joule
Answer : **c) lit-atm> calorie> joule > erg**

44) The general gas constant (R) is equal to.....
a) 4.184 J b) 1.987j c) 0.0821 lit –atm d) 8.314 cal
Answer : **a) 4.184 J**

45) One calorie is equal to,
a) 4.184 x 10 J b) 107J c) 4.184 J d) 24.2J
Answer : c) 4.184 J

46) In an isothermal expansion of an ideal gas,
a) ΔP=0 b) ΔV=0 c) ΔU=0 d) none of the above
Answer : c) ΔU= 0

46) The work done during expansion in vacuum is zero because,
a) P=0 b) ΔV=0 c) ΔU=0 d) none of above **Answer** : **a) P=0**

47) A gas expands isothermally and reversibly. The work done by the gas is,
a) Zero b) Minimum c) Maximum d)Equal to internal energy change
Answer : c) Maximum
48) Mass and energy are conserved. It is demonstrated by...
a) first law of thermodynamics b) law of conservation of energy
c) modified form of first law of thermodynamics
d) law of conservation of mass
Answer : c) modified form of first law of thermodynamics

49) It is a general principal that the less energy a system contains, it is....
a) more unstable b) unstable C) less stable
d) more stable **Answer :d) more stable**

51) The process in which work is done at the expense of internal energy is....
a) isobaric b) adiabatic c) isochoric d) isothermal **Answer :b) adiabatic**

52) Following gases have equal masses at the same temperature, pressure and volume. The maximum work is done by....
a) nitrogen b) hydrogen sulphide c) ammonia d) chlorine
Answer :c) ammonia

53) Theoretical basis of Hess's law is....
a) law of conservation of energy
b) heat of ionization of strong acids and strong bases
C) variation in heat of reaction
d) Kirchoff's law
Answer : a) law of conservation of energy

54) The energy required per mole to separate molecules from each other is called....
a) potential energy b) binding energy C) internal energy
d) intramole energy **Answer : C) internal energy**

55) Entropy change of the system and the surrounding in equilibrium..
a) decrease b) increase C) is constant d) either increase or decrease
Answer : C) is constant

56) In general, an exothermic reaction will become a spontaneous one, if
a) temperature is zero b) temperature is low c) temperature is high
d) temperature is constant **Answer : b) temperature is low**

57) when H2SO4 is added to water the solution becomes hot, the reaction is...
a) an exothermic b) an irreversible C) a reversible
d) an endothermic **Answer : a) an exothermic**

58) which law of thermodynamics help in calculating Entropy at different temperature...
a) 1st law b) 2nd law C) 3rd law d) none of the above
Answer : C) 3rd law

59) The standard heat of formation at 101.3 kNm-2 and 298 K is arbitarily taken to be zero for....
a) solid bromine b) liquid bromine C) gaseous bromine molecules
d) gaseous bromine atoms **Answer : b) liquid bromine**

60) Assuming enthalpy of combustion of hydrogen at 273 K is -286 kJ and Enthalpy of fusion of ice at the same temperature to be + 6.0 kJ, calculate Enthalpy change during formation of 100 g of ice
a) +292 kJ b) +1622 kJ C) -292 kJ d) -1622 kJ **Answer : d) -1622 kJ**

UNIT 6: SOLUTIONS

1) The total volume of the solution may not be equal to the sum of volumes of solute and solvent. This is because.....
a) volume depends on temperature
b) solute particles may occupy empty space structure of liquids
C) solute particles are larger in size than solvent
d) all of these
Answer : b) solute particles may occupy empty space structure of liquids

2) 6g of urea was dissolved in 500 g of water. The percentage by mass of urea in solution is...
a) 0.118 % b) 1.18 % c) 2.01 % d) 1.45 %
Answer :b) 1.18 %

3) 54cm3 of ethyl alcohol was dissolved in 400 cm of water to form 454 cm3 of solution of ethyl alcohol. the Percentage by volume of ethyl alcohol in water is
a) 0.118% b) 1.45 % c) 11.8 % d) 2.01 %
Answer : c) 11.8 %

4) 23 g of ethyl alcohol is dissolved in 54 g of water. The mole fraction of ethyl alcohol in water is.....
a) 0.143 b) 0.110 c) 0.013 d) 1.12
Answer :a) 0.143

5) 23 g of ethyl alcohol is dissolved in 54 g of water. The mole fraction of water in solution is.....
a) 0.1429 b) 0.8571 c) 0.1872 d) 0.3128
Answer : b) 0.8571

6) 35% (W/W) solution of ethylene glycol in water is used as antifreezer in automobiles in radiators as a coolent it lowers the freezing point of water to -17.6"C. The mole fraction of ethylene glycol is....
a) 0.927 b) 0.378 c) 0.8648 d) O.1351 **Answer :d) O.1351**

7) The number of moles of the solute present in 1 dm3 volume of the solution is known as....
a) molarity b) molality C)normality d) formality
Answer :a) molarity

8) The physical properties of Solutions are mainly originated by intermolecular forces of attraction between......
a) solute molecules b) solvent molecules c) molecules in mixture
d)ideal solution **Answer :b) solvent molecules**

9) A coarse mixture is formed when the sizes of the constituent components are relatively.....
a) bigger b) small c) very small d) all
Answer : a) bigger

10) The highest temperature at which vapour pressure of a liquid can be measured is......
a) inversion temperature b) critical temperature
c) boiling point of liquid d) critical solution temperature
Answer :c) boiling point of liquid

11. Colloidal particles carry the charge....
a) negative b) positive c) positive or negative d) no charge
Answer :d) no charge

12) Identify the incorrect statement about true solution...
a) The size of solute particle is 108 cm b) It is homogeneous
c) It is heterogeneous d) cant be separated into its components
Answer :c) It is heterogeneous

13. A homogeneous mixture of two or more substances whose composition is not mixed and vary within the certain limit is known as.....
a) True solution b) Ideal solution c) A colloidal dispersion
d) A coarse mixture **Answer :a) True solution**

14. The homogeneous solution is formed due to force of attraction between the molecules or particles of......
a) solute only b) solvent only c) solute and solvent
d) all of these **Answer : c) solute and solvent**

15. The process in which there is the interaction between the solvent (water) and solute molecules to form the aggregates is known as.......
a) hydration b) solvation c) aquation d) both (a and (b)
Answer : d) both (a and (b).

16. The extent to which solute dissolves in solvent to form homogeneous solution depends on.....
a) Nature of solute b) Nature of solvent c)Nature of solution
d) both (a) and (b) **Answer :d) both (a) and (b)**

17. Water is called universal solvent. Most of the polar solutes dissolves into it because........
a) it is polar b) it is non polar c) it has high di-electric consta
d) both a and c **Answer :d) both a and c**

18) identify the incorrect statement
a) solution may be binary, ternary or quaternary
b) solutions prepared in water are non aqueous
c) solution prepared in solvent other than water a non-aqueous
d components of true Solutions can't be separated by filtration
Answer : b) solutions prepared in water are non aqueous

19) On the basis of physical states of solute and solvent, the possible number of types of solutions are.......
a) 4 b) 3 c) 9 d) 5 **Answer : c) 9**

20) Sodium amalgam and silver amalgam are the following types of solution.......
a) solid in liquid b) solid in solid c) liquid in solid
d) Solid in mercury **Answer : c) liquid in solid**

21) Liquid in gas solution is.......
a) Hg in Zn b) dry air c) ethanol in water d) moisture in dry air
Answer : d) moisture in dry air

22) The properties ot the solution depend upon the nature of........
a) solute b) solvent c) solution d) all of these **Answer : c) solution**

23) Hydrogen in palladium is a kind of.....
a) liquid in solid solution b) gas in solid solution c) solid in gas solution
d) gas solution **Answer : b) gas in solid solution**

24. Ethanol present in water is a.......
a) liquid solution b) liquid in liquid solution c)solid in liquid solution
d) both'a' and 'b **Answer : d) both 'a' and 'b**

25) The amount of solute dissolved in a specific amount the solvent is known as.....
a) dilution b) dil . solutions c) conc. Solution d) concentration
Answer : d) concentration

26.) concentration of the Solutions may be expressed may percentage......
a) molarity b) molality c) percentage d) any of these
Answer : d) any of these

27. concentration of the solution cannot be expressed in.......
a) mole fraction b) mili gram c) normality d) ppm
Answer : d) ppm

28) The process of fractional crystallisation can be carried out only if there exists......
a) difference in the solubility of the components
b) the same solubility of the components c) both 'a' and 'b
d) none of these **Answer : a) difference in the solubility of the components**

29) From the solution of mixture of KNO, and NaNO, almost 90 % of total dissolved KNO , can be crystallized out by cooling to......
a) 50' C b) 10'C c) 0' C d) 25C
Answer : c) 0' C

30) The technique of crystallisation is useful if the substance is.......
a) highly soluble at lower temperature

b) less soluble at high temperature c) highly soluble at higher temperature
d) all of these **Answer : c) highly soluble at higher temperature**

31) The solubility of gas in liquid increases with.......
a) decrease in pressure b) increase in pressure c) increase in temperature
d) none of above **Answer : b) increase in pressure**

32) Solubility of solid in liquid is......
a) increases with increase in pressure b) increases with decrease in pressure
c) becomes zero with any change d) none of above
Answer : d) none of above
33) Oxygen molecules has less solubility in water. This is because the oxygen molecule is.......
a) non polar in nature b) polar in nature c) strong electrolyte
d) amphoteric in nature **Answer : a) non polar in nature**

34) Aluminum Bronze contains...
a) Al b) Cu c) Mn d) all **Answer : d) all**

35) an alloy of with tin and copper is called.....
a) Bronze b) manganin c) Duralumin d) Babbitt metal
Answer : d) Babbitt metal

36) The colligative properties of the solution depends on.....
a) nature of the solute particles b) number of solute particles
c) nature of solvent d) both b and c **Answer : d) both b and c**

37) colligative properties are mainly used to determine.....
a) Molar mass of non-electrolyte solute b) Molar mass of solvent
c) The boiling point of solvent d) Freezing point of solvent
Answer : a) Molar mass of non-electrolyte solute

38) The relations derived by measuring colligative properties hold good for the dilute solutions having concentration .....
a) less than 2 M b) less than 0.2 M c) greater than 0.2 M
d) greater than 2 M **Answer : b) less than 0.2 M**

39) Which of the following is not a colligative property......
a) Elevation in boiling point b) Depression in freezing point
c) Relative lowering of vapour pressure d) Vapour pressure
Answer : d) Vapour pressure

40) Among the following liquids, the slightly volatile is....
a) Ethyl acetate b) Ethyl alcohol
c) Lubricating oil d) Acetone **Answer : c) Lubricating oil**

41) During the evaporation of liquid, the equilibrium is established between the two phases of the substance.These phases are.........
a) both liquid b) liquid and its vapour c) two vapours d) all of these
Answer : b) liquid and its vapour

42) At equilibrium........
a) rate of evaporation > rate of condensation
b) rate of evaporation < Rate of condensation
c) rate of evaporation=rate of condensation= 0
d) rate of evaporation = rate of condensation
Answer : d) rate of evaporation = rate of condensation

43) The vapour pressure of the solution does not depend......
a) Nature of solvent b) Temperature
c) nature of solute d) all of these **Answer : c) nature of solute**

44) 0.05 M urea and 0.05 M sucrose solutions are separated by semipermeable membrane then direction of the flow of solvent is from...
a) urea to sucrose b) sucrose to urea c) no flow ot solvent in either direction
d) none of these **Answer : c) no flow ot solvent in either direction**

45) 3.0 g urea and 17.1 g sucrose are dissolved in lit of water each the solutions so formed are.......
a) isotonic b) hypertonic c) hypotonic d non-hypotonic
Answer : a) isotonic

46) A solution having the osmotic pressure higher than that of another is Known as.......
a) isotonic b) hypotonic c) hypertonic d) normal **Answer : c) hypertonic**

47) A solution having the osmotic pressure lower than that of another is known as........
a) Hypotonic solution b) Isotonic solution c) Hypertonic solution
d) ideal solution **Answer : a) Hypotonic solution**

48) A raw mango kept in a concentrated salt solution, loses water and shrivel into pickle, due to......
a) semipermeable membrane b) osmosis c) Osmotic pressure
d) reverse osmosis **Answer : b) osmosis**

49) The people, eating lot of salt experience......
a) low blood pressure b) Edema c) heart attack d) blindness
Answer : b) Edema

50) ....Common salt solution is isotonic with Blood.
a) 0.91 b) 58.5 c) 5.85 d)9.1 **Answer : a) 0.91**

51) Due to osmosis , a bacterium on candid fruit loses water and.....
a) becomes harmful b) shrivels c) dies d) both b and c
Answer : d) both b and c

52) Due to osmosis , in some trees, water goes upto the height of......
a) 80 cm b) 90 cm c) 100 cm d) 120 cm
Answer : d) 120 cm

53) In plants, the leaves ot the tree loose water to the atmosphere constantly by osmosis
a) osmotic pressure b) transpiration c) concentration
d) osmosis **Answer : b) transpiration**

54) Semipermeable membrane is that which permits the passage of...
a) solute molecules only b) solvent molecules only
c) solute and solvent molecules both d) neither solute nor solvent molecules
Answer : b) solvent molecules only

55) In the phenomenon of osmosis...
a) solvent molecules move from higher concentration to lower concentration
b) solvent molecules move from lower to higher concentration
c) solute molecules move from higher to lower concentration
d) solute molecules move from lower to higher concentration
Answer : b) solvent molecules move from lower to higher concentration

56) Two solutions A and B are separated by a semipermeable ...
membrane. As a result of osmosis, the level of solution A is found to nise. It implies that...
a) solution A is more concentrated than solution
b) solution B is more concentrated than solution A
c) the solute molecules ot A are smaller than those of B
d) the solute molecules of B are smaller than those of A
Answer : a) solution A is more concentrated than solution

57) Which inorganic precipitate acts as a semipermeable membrane?
a) calcium phosphate b) nickel phosphate
c) copper ferrocyanide d) calcium sulphate **Answer : c) copper ferrocyanide**

58) The osmotic pressure of the solution having concentration 0.05 M
a) decreases with increase in temperature
b) increases with increase in temperature
c) does not change with change in temperature
d) Initially decreases and then increases with rise in temperature
Answer : b) increases with increase in temperature

59) The solutions having same osmotic pressure are called...
a)equivalent solutions b) ideal solutions
c) equimolar solutions d) isotonic solutions **Answer : d) isotonic solutions**

60) The osmotic pressure of solution increases if..
a) temperature is decreased b) solution constant is increased
c) number of solute molecules are increased
d) volume is increased
Answer : c) number of solute molecules are increased

UNIT 7 : EQUILIBRIUM

1.A heat engine absorbs heat Q, at temperature T, and heat Q_2 at temperature T_r Work done by the engine is J(Q, + Q_2). This data (2002)
(1)violates 1st law of thermodynamics
(2)violates Is' law of thermodynamics if Q, is -ve
(3)violates 1st law of thermodynamics if Q_2 is -ve
(4)does not violates Is' law of thermodynamics
Ans.(1) Some mechanical energy is always converted (lost) to other forms of energy.

2.If an endothermic reaction is non-spontaneous at freezing point of water and becomes feasible at its boiling point, then (2002)
(1)A H is – ve, A S is + ve
(2)AH and AS both are + ve
(3)AH and AS both are – ve
(4)AH is + ve, AS is – ve
Ans.(2) At low temperature the AS is -ve which makes AG positive (AG = AH-TAS). But at higher temperature AS is +ve which makes the AG negative (condition for spontaneity).

3. For the reactions, $C + O_2 \rightarrow CO_2$; $\Delta H = -393 J$
$2Zn + O_2 \rightarrow 2ZnO$; $\Delta H = -412 J$ (2002)
1) carbon can oxidise Zn
2) oxidation of carbon is not feasible
3) oxidation of Zn is not feasible
4) Zn can oxidise carbon

Ans.(4) AH negative shows that the reaction is spontaneous. Higher value for Zn shows that the reaction is more feasible.

4. If at 298K the bond energies of C – H, C – C, C = C and H – H bonds are respectively 414, 347, 615 and 435 kJ mol^{-1}, the value of enthalpy change for the reaction
$H_2C = CH_{2(g)} + H_{2(g)} \rightarrow H_3C - CH_{3(g)}$ at 298K will be (2003)
1) – 250 kJ
2) + 125 kJ
3) – 125 kJ
4) + 250 kJ

Ans.

(3) $CH_2 = CH_{2(g)} + H_{2(g)} \rightarrow CH_3 - CH_3$

$\Delta H = 1(C{=}C) + 4(C{-}H) + 1(H{-}H) - 1(C - C) - 6$

$(C - H) = 1(C = C) + 1(H - H) - 1(C - C) - 2(C{-}H)$

$\Delta H = 615 + 435 - 347 - 2 \times 414 =$

$1050 - 1175 = -125 kJ$

5. In an irreversible process taking place at constant T and P and in which only pressure - volume work is being done, the change in Gibbs free energy (dG) and change in entropu (dS), satisfy the criteria (2003)

1) $(dS)_V, E > 0$, $(dG)_T, p < 0$

2) $(dS)_V, E = 0$, $(dG)_T, p < 0$

3) $(dS)_V, E = 0$, $(dG)_T, p > 0$

4) $(dS)_V, E < 0$, $(dG)_T, p < 0$

Ans.(1) For spontaneous reaction, dS > 0. AG and dG should be negative, i.e. < 0

6. The correct relationship between free energy change in a reaction and the corresponding equilibrium constant K_c is (2003)

1) $-\Delta G = (RT / n)K_c$ 2) $\Delta G^0 = (RT / n)K_c$

3) $-\Delta G^0 = (RT / n)K_c$ 4) $\Delta G = (RT / n)K_c$

Ans.(3) AG=-2.303 RT logK .

7.The enthalpy change for a reaction does not depend upon (2003)

(1)use of different reactants for the same product

(2)the nature of intermediate reaction steps

(3)the differences in initial or final temperature of involved substances

(4)the physical states of reactants and products

Ans.(2) Hess law of heat summation.

8.The enthalpies of combustion of carbon and carbon monoxide are -393.5 and -283 kj mol*[1] respectively. The enthalpy of formation of carbon monoxide per mole is (2004)

(1)5 kJ 2)-110.5 kJ 3) -676.5 kJ 4) 676.5 kJ

Ans.

(2) $C + O_2 \longrightarrow CO_2 \quad \Delta H = -393.5 \text{ kJ}$

$2CO + ½ O_2 \longrightarrow 2CO_2 \quad \Delta H = -283 \text{ kJ}$

$2C + O_2 \longrightarrow 2CO \quad \Delta H = -110 \text{ kJ}$

9. For a spontaneous reaction the ΔG, equilibrium constant (K) and E^0_{cell} will be respectively (2005)

1) -ve, >1, +ve 2) +ve, >1, -ve

3) -ve, <1, -ve 4) -ve, >1, -ve

Ans.(1) For a spontaneous change AG is negative and Ece„ is positive.

10.Consider the reaction : $N_2 + 3H_2$——— > $2NH_3$ carried out at constant temperature and pressure. If AH and AU are the enthalpy and internal energy changes for the reaction, which of the following expressions is true ?

1) AH = 0 2) AH = AU (2005)

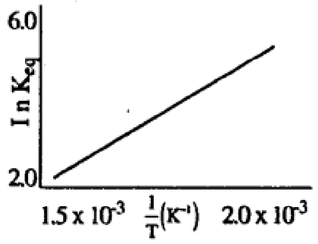
3) AH< AU 4) AH> AU

Ans.

(3) $\Delta H = \Delta U + \Delta nRT$, $\Delta n = -2$

$\Delta H = \Delta U - 2RT$, $\Delta H < \Delta U$

11. A schematic plot of In K_{eq} versus inverse of temperature for a reaction is shown below. The reaction must be (2005)



1) exothermic 2) endothermic

3) one with negligible enthalpy change

4) highly spontaneous at ordinary temperature

Ans.

(1) $K_{eq} = A e^{-\frac{\Delta H}{RT}}$

12. **$(\Delta H - \Delta U)$ for the formation of carbon monoxide (CO) from its elements at 298 K is ($R = 8.314\ J\ K^{-1}\ mol^{-1}$) (2006)**

1) $-1238.78\ J\ mol^{-1}$ 2) $1238.78\ J\ mol^{-1}$
3) $-2477.57\ J\ mol^{-1}$ 4) $2477.57\ J\ mol^{-1}$

Ans.(1) Energy required to get H and C atoms.

13. **The standard enthalpy of formation($\Delta_f H^0$)at 298 K for methane, $CH_4(g)$, is $-74.8\ kJ\ mol^{-1}$. The additional information required to determine the average energy for C – H bond formation would be (2006)**

1) the dissociation energy of H_2 and enthalpy of sublimation of carbon
2) latent heat of vapourization of methane
3) the first four ionization energies of carbon and electron gain enthalpy of hydrogen
4) the dissociation energy of hydrogen molecule

Ans.
(1)

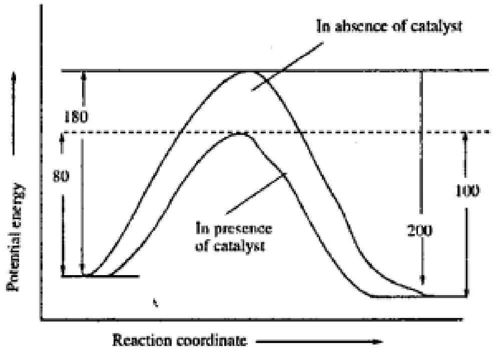
$$\Delta H - \Delta U = \Delta n_g RT = -\frac{1}{2} \times 8.314 \times 298 = -1238.78$$

14. **The energies of activation for forward and reverse reactions for $A_2 + B_2 \rightleftharpoons 2AB$ are $180\ kJmol^{-1}$ and $200\ kJ\ mol^{-1}$ respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by $100\ kJmol^{-1}$. The enthaply change of the reaction ($A_2+B_2 \rightarrow 2AB$) in the presence of catalyst will be (in $Kj\ mol^{-1}$) (2007)**

1) 300 2) 120 3) 280 4) 20

Ans.

(4)



So, $\Delta H_{Reaction} = E_f - E_b = 80 - 100 = -20$

15. Assuming that water vapour is an ideal gas, the internal energy (ΔU) when 1 mol of water is vapourised at 1 bar pressure and 100°C, will be (Given: Molar enthalpy of vapourization of water at 1bar and 373 K=41 kJ mol^{-1} and R = 8.3J mol^{-1}K^{-1}) (2007)

1) 4.100 kJ mol^{-1} 2) 3.7904 kJ mol^{-1}

3) 37.904 kJ mol^{-1} 4) 41.00 kJ mol^{-1}

Ans.

(3) $H_2O(\ell) \xrightarrow{\text{vaporisation}} H_2O(g)$

$\Delta n_g = 1 - 0 = 1$

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta U = \Delta H + \Delta n_g RT$

$= 41 - 8.3 \times 10^{-3} \times 373 = 37.9 \text{kJ mol}^{-1}$

16.Identify the correct statement regarding a spontaneous process (2007)
(1)For a spontaneous process in an isolated system, the change in entropy is positive
(2)Endothermic processes are never spontaneous
(3)Exothermic processes are always spontaneous (4)Lowering of energy in the reaction process is the only criterion for spontaneity

Ans.(1) For a spontaneous process in an isolated system, the change in entropy is positive.

17. In conversion of lime-stone to quick lime, $CaCO_3(S) \rightarrow CaO(s) + CO_2(g)$, the values of ΔH^0 and ΔS^0 are +179.1 kJ mol^{-1} and 160.2 J/K respectively at 298 K and 1 bar. Assuming that ΔH^0 do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is (2007)

1) 1008 K 2) 1200 K 3) 845 K 4) 1118 K

Ans.(4) We know, AG = AH – TAS.So, lets find the equilibrium temperature, i.e., at which AG = 0; AH = TAS;

$$T = \frac{179.1 \times 1000}{160.2} = 1118K$$

So, at temperature above this, the reaction will become spontaneous.

18. Standard entropy of X_2, Y_2 and XY_3 are 60, 40 and 50 JK^{-1} mol^{-1}, respectively. For the reaction, $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3$, $\Delta H = -30$ kJ, to be at equilibrium, the temperature will be (2008)

1) 1250 K 2) 500 K

3) 750 K 4) 1000 K

Ans.

(3) $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3$

$$\Delta S_{reaction} = 50 - \left(\frac{3}{2} \times 40 + \frac{1}{2} \times 60\right) = -40 \text{ Jmol}^{-1}$$

$$\Delta G = \Delta G - T\Delta S$$

at equilibrium $\Delta G = 0$;

$$\Delta H = T\Delta S$$

$$30 \times 10^3 = T \times 40$$

$$\Rightarrow T = 750 \text{ K}$$

19. In a fuel cell methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is: $CH_3OH_{(\ell)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_{2(\ell)}$.
At 298K standard Gibb's energies of formation for $CH_3OH_{(\ell)}, H_2O_{(\ell)}$ and $CO_{2(g)}$ are −166.2, −237.2 and −394.4 kJ mol^{-1} respectively. If standard enthalpy of combustion of methanol is −726 kJ mol^{-1}, efficiency of the fuel cell will be (2009)

1) 80% 2) 87% 3) 90% 4) 97%

Ans.

(4) $CH_3OH_{(\ell)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_{2(\ell)}$

$\Delta H = -726 \text{ kJ mol}^{-1}$

Also $\Delta G_f^0 CH_3OH_{(\ell)} = -1662.\text{kJmol}^{-1}$

$\Delta G_f^0 H_2O_{(\ell)} = -237.2\text{kJmol}^{-1}$

$\Delta G_f^0 CO_{2(\ell)} = -394.4\text{kJmol}^{-1}$

$$\Delta G = \sum \Delta G_r^0 \text{products} - \sum \Delta G_r^0 \text{ reactants}$$

$$= -394.4 - 2\,(237.2) + 166.2$$

$$= -702.6 \text{ kJ mol}^{-1}$$

$$\text{Efficiency of fuel cell} = \frac{\Delta G}{\Delta H} = \frac{702.6}{726}$$

Percent efficiency $0.97 \times 100 = 97\%$

20. On the basis of the following thermochemical data: $\left(\Delta_f G^0 \text{ of } H^+_{(aq)} = 0\right)$

$H_2O_{(\ell)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}; \Delta H = 57.32\text{kJ}$

$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(\ell)}; \Delta H = -286.20\text{kJ}$

The value of enthalpy of formation of OH^- ion at 25°C is (2009)

1) − 22.88 kJ 2) − 228.88 kJ

3) + 228.88 kJ 4) − 343.52 kJ

Ans.

(2) By adding the two given equations, we have

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(\ell)}; \Delta H = -286.20\ kJ$$

Here ΔH_f^0 of $H^+_{(aq)} = 0$

ΔH_f^0 of $OH^- = -228.88$ kJ

21. The standard enthalpy of formation of NH_3 is $-46.0 kJmol^{-1}$. If the enthalpy of formation of H_2 from its atoms is $-436\ kJmol^{-1}$ and that of N_2 is $-712\ kJmol^{-1}$, the average bond enthalpy of N–H bond in NH_3 is (2010)

1) $-964\ kJ\ mol^{-1}$ 2) $+352\ kJ\ mol^{-1}$

3) $+1056\ kJmol^{-1}$ 4) $-1102\ kJ\ mol^{-1}$

Ans.(2) Enthalpy of formation of NH_3=-46 kJ/mole $N_2 + 3H_2$ $2NH_3$ AH_f = -2.x 46kJmol

Bond breaking is endothermic and bond formation is exothermic.Assuming ‘x’ is the bond energy of N-H bond (kJ mol^{-1})
712 + (3 x 436) – 6x = -46 x 2 Therefore, x – 352 kJ/mol

22.For a particular reversible reaction at temperature T, AH and AS were found to be both +ve. If T_e is the temperature at equilibrium, the reaction would be spontaneous when (2010)

1) T > T 2) T > T

3) T is 5 times T 4) T = T

Ans.(2) AG = AH = TAS at equilibrium, AG = 0 .For a reaction to be spontaneous AG should be negative. Therefore, T > T

23.The entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of 10 dm^3 to a volume of 100 dm^3 at 27°C is (2011)

1) 32.3 J moHK^{-1} 2) 42.3 J mol-‘K”^{1}

3) 38.3 J $mol^{-1}K^{-1}$ 4) 35.8 J $mol^{-1}K^{-1}$

Ans.

(3) $\Delta S = 2.303nR\log\left(\frac{V_2}{V_1}\right)$

24. The incorrect expression among the following is (2012)

1) $\frac{\Delta G_{system}}{\Delta S_{total}} = -T$

2) $W_{reversible} = -nRT \ln \frac{V_f}{V_i}$

3) $\ln K = \frac{\Delta H^0 - T\Delta S^0}{RT}$

4) $K = e^{-\Delta G^0 / RT}$

Ans.

(3) $\Delta G^0 = -RT\ell nK_C$

$\Delta H^0 - T\Delta S^0 = -RT\ell nK_C$

$\ell nK_C = \left(T\Delta S^0 - \Delta H^0\right)/RT$

$\Delta G^0 = -RT\ell nK_C$

$\Rightarrow \ell nK_C = -\Delta G^0 / RT$

$\Rightarrow K_C = e^{-\Delta G^0 / RT}$

$\Delta G_{sys} = -T\Delta S_{total}$

$\Rightarrow \Delta G_{sys} / \Delta S_{total} = -T$

25.A position filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0#C. As it does so, it absorbs 208J of heat. The values of q and w for the process will be (2013)(R = 8.314J/molK and
ln 7.5 = 2.01)

(1)q = + 208J, w = – 208 J **(2)q = – 208J, w = – 208 J**
(3)q = – 208J, w = + 208 J **(4)q = + 208J, w = + 208 J**

Ans. (1) Work done by system is negative

26. For complete combustion of ethanol.
$C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(l)}$, the amount of heat produced as measured in bomb calorimeter, is 1364.47 kJ mol^{-1} at 25°C. Assuming ideally the Enthalpy of combustion, Δ_cH, for the reaction will be
(R = 8.314 kJ mol^{-1}) (2014)

1) −1350.50 kJ mol^{-1} 2) −1366.95 kJ mol^{-1}

3) −1361.95 kJ mol^{-1} 4) −1460.50 kJ mol^{-1}

Ans.

(2) $\Delta H = \Delta U + \Delta nRT$

$= -1364 - (1)\ 8.314 \times 298 \times 10^{-3}$

27. The following reaction is performed at 298 K.

$2NO(g) + O_2(g) \rightleftharpoons 2NO\ (g)$

The standard free energy of formation of NO(g) is 86.6 kJ/mol at 298 K. What is the standard free energy of formation of $NO_2(g)$ at 298 K ? ($K_p = 1.6 \times 10^{12}$) (2015)

1) $R(298)ln(1.6 \times 10^{-12}) - 86600$

2) $86600 + R(298)ln(1.6 \times 10^{-12})$

3) $86600 - \dfrac{ln\,(1.6 \times 10^{-12})}{R(298)}$

4) $0.5\left[2 \times 86{,}600 - R(298)ln\left(1.6 \times 10^{-12}\right)\right]$

Ans.

(4) $2NO + O_2 \rightarrow 2NO_2$

$\Delta G = -RT\, ln\ Kp$

$\Delta G = -RTln 1.6 \times 10^{12}$

$\Delta G = 2 \times \Delta G_{NO_2} - 2 \times \Delta G_{NO}$

$\Delta G_{NO_2} = 0.5\left[2 \times 86{,}600 - R(298)ln\left(1.6 \times 10^{-12}\right)\right]$

UNIT 8 : REDOX REACTIONS AND ELECTROCHEMISTRY

Redox Reactions

01. Oxidation number of Fe in $Fe_{0.94}O$ is

a) +2 b) 2 □ 0.94 c) $\frac{0.94}{2}$ d) $\frac{2}{0.94}$

02. In the reaction

$3I_2 + 6NaOH \rightarrow NaIO_3 + 5NaI + 3H_2O$ oxidizing agent is

a) NaOH b) $NaIO_3$ c) I_2 d) NaI

03. Arrange the following compounds in increasing order of oxidation number. $MnCl_2$, MnO_2,

$Mn(OH)_3$, $KMnO_4$

a) $MnCl_2 < MnO_2 < Mn(OH)_3 < KMnO_4$ b) $MnO_2 < MnCl_2 < Mn(OH)_3 < KMnO_4$

c) $Mn(OH)_3 < MnCl_2 < MnO_2 < KMnO_4$ d) $MnCl_2 < Mn(OH)_3 < MnO_2 < KMnO_4$

04. Oxidaiton number o Xe in Ba_2XeO_6 is

a) +8 b) +10 c) +4 d) + 3

05. Arrange ICl, HI, I_2 and HIO_4 in decreasing order of oxidation state of iodine

a) $HIO_4 > ICl > HI > I_2$ b) $ICl > HIO_4 > I_2 > HI$

c) $HIO_4 > ICl > I_2 > HI$ d) $ICl > HIO_4 > HI > I_2$

06. In the reaction, $PCl_3 + Cl_2 \rightarrow PCl_5$

a) PCl_3 is acting as reductant b) Cl_2 is acting as reductant

c) Both PCl_3 and Cl_2 are acting as reductant d) Both PCl_3 and Cl_2 are acting as oxidant.

07. Oxidation number of nitrogen in HNO_3 is

a) + 7 b) +6 c) -7 d) +5

08. Oxidation number of silver in silver amalgam is

a) zero b) +1 c) -1 d) depends on temperature.

09. What is the oxidation number of chlorine in ClO_3^- ?

a) +5 b) +3 c) +4 d) +2

10. Oxidation number of S in $H_2S_2O_8$ is

a) +2 b) +4 c) +6 d) +7

11. The oxidation state of Fe in $K_4[Fe(CN)_6]$ is

a) +2 b) +6 c) +3 d) +4

12. The oxidation number of iron in Fe_3O_4 is

a) +2 b) +3 c) 8/3 d) 2/3

13. Which of the following is not a reducing agent?

a) SO_2 b) H_2O_2 c) CO_2 d) NO_2

14. Which of the following is a redox reaction?

a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$ b) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

c) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + NHOH$ d) $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

15. Among the properties (a) reducing (b) oxidizing (c) complexing, the set of properties shown by CN^- ion towards metal species is

a) a, b b) a, b, c c) c, a d) b, c

16. The brown-ring complex compound is formulated as $[Fe(H_2O)_5(NO)]SO_4$. The oxidation state of iron is

a) 1 b) 2 c) 3 d) 0

17. The oxidation state of the most electronegative element in the products of the reaction between $BaSO_4$ and H_2SO_4 are

a) 0 and -1 b) -2 and -1 c) -2 and 0 d) -2 and +1

18. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are

a) 0, +1 and -2 b) -2 and -1 c) 0, +1 and +2 d) -2, +1 and -2

19. In the reaction $3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$

a) bromine is oxidized and carbonate is reduced b) bromine is reduced and water is oxidized

c) bromine is neither reduced nor oxidized d) bromine is both reduced and oxidized.

20. Amongst the following, identify the species with an atom in +6 oxidation state.

a) MnO_4^- b) $Cr(CN)_6^{3-}$ c) NiF_6^{2-} d) CrO_2Cl_2

21. The pair of the compounds in which both the metals are in the highest possible oxidation state is

a) $[Fe(CN)_6]^{3-}$, $[Co(CN)_6]^{3-}$ b) CrO_2Cl_2, MnO_4^-

c) TiO_3, MnO_2 d) $[Co(CN)_6]^{3-}$, MnO_3

22. Oxygen has an oxidation state of +2 in

a) H_2O_2 b) H_2O c) OF_2 d) SO_2

23. Oxidation state of nitrogen is correctly given for

	Compound	Oxidation state
a)	$[Co(NH_3)_5Cl]Cl_2$	0
b)	NH_2OH	+1
c)	$(N_2H_5)_2SO_4$	+2
d)	Mg_3N_2	- 3

24. Oxidation number of fluorine in F_2O is

a) -1 b) +1 c) +2 d) -2

25. The oxidation state of nitrogen in N_3H is

a) $-\frac{1}{2}$ b) +3 c) -1 d) $-\frac{1}{3}$

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
d	**c**	**d**	**a**	**c**	**a**	**d**	**a**	**a**	**c**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	**c**	**c**	**d**	**c**	**a**	**b**	**a**	**d**	**d**
21	**22**	**23**	**24**	**25**					
b	**c**	**d**	**a**	**d**					

Electrochemistry

1) Identify the incorrect statement....
a) conductors allow the low of electricity through them
b) low of electricity through conductors involve transfer of electrons
c) mechanism of the transfer of electron for all conductors
d) mechanism of the transfer of electron is the same for all conductors
Answer: d) mechanism of the transfer of electron is the same for all conductors

2) Pick out the correct sentence about electronic conductors....
a) the conduction involve transfer of matter
b) conduction involve chemical change
c) the resistance o Conductor decreases with increase in temperature
d) the conductivity increases with increase in temperature
Answer: b) conduction involve chemical change

3) In electrolytic conductors.,....
a) the conduction do not involve the transfer of matter
b) the conduction process do not involve chemical change
c) the resistance decreases with increase in temperature
d) conductivity increases with decrease in temperature
Answer: c)the resistance decreases with increase in temperature

4) An electrolyte........
a) dissociate into ions b) conducts the electricity
C) possess ions even in solid state d) all of these
Answer: d) all of these

5) According to Ohm's law...
a) R=V/I b) V=R/I c) R=VxI d) V=I/R **Answer: a) R=V/I**

6) The electrical conductance (G) is...
a) $G \propto R$ b) $G \propto 1/R$ c) G=VxR d) G=1/R **Answer: a) $G \propto R$**

7) Electrochemistry is the branch of physical chemistry that deals with the study of.......
a) physical change b) chemical change
c) mechanical change d) chemical and electrical change
Answer: d) chemical and electrical change
8) The electricity can be generated by the chemical reactions and the production of chemical reactions by electricity. The basis of these changes are....
a) oxidation reaction b) reduction reaction
c) electrolysis d) redox reaction **Answer: d) redox reaction**

9) The chemical NaOH which is used in the manufacture of soaps, detergents, papers etc. is prepared by the electric current in...
a) aqueous NaCl b) molten NaCl c) H_2O d) aqueous KCl
Answer: a) aqueous NaCl

10) The process of electrolysis is used in...
a) decomposition of H,0 in H, and O, b) electro plating
c) electro-refining d) all of these **Answer: d) all of these**

11) Some statements are given below....
a) oxidation involve loss of electron
b) during Oxidation, Oxidation number decreases.
c) during Oxidation oxidation number increases
d) Reduction involve gain of electron among the above incorrect is/are
a) A and C b) B and D c) only B d) A, B and D **Answer: c) only B**

12) Reduction involves........
a) loss of electron b) gain of electron c) decrease in oxidation number
d) both 'b and c' **Answer: d) both 'b and c'**

13) In case of electronic conductors, the conduction of electricity is due to....
a) flow of electrons b) flow of ions c) flow of matter
d) do not conduct electricity **Answer: a) flow of electrons**
14) in electrolytic conductors, the conduction take place by....
a) flow of ions b) flow of electrons c) flow of atoms d) all of these
Answer: a) flow of ions
15) The substances having the same conductivity to that of water are....
a) KCl b) CH3COOH c) NaCl d) C12H22O11
Answer: d) C12H22O11

16) Conductivity of the solution is directly proportional to....
a) dilution b) resistivity c) number of ions d) all
Answer: c) number of ions

17) The unit of potential difference is.....
a) Joule b) volt c) ampere d) ohm **Answer: b) volt**

18) The unit of conductance is...
a) ohm-1 b) mho- c) S d) amp **Answer: a) ohm-1**

19) The ratio of electrolytic conductivity (K) to the molar concentration (c) of the dissolved electrolyte is known...
a) conductivity b) cell constant b) molar conductivity
d) resistivity **Answer: b) molar conductivity**

20) A conductivity cell dipped in 0.01 M AgNO3, solution at 25 C gives the resistance of 1442 2 Ω. If the conductivity of the cell is 1.248 x 10 9 Ω-1 cm-1 **the cell constant is.......**
a) 2.6 cm-1 b) 3.0 cm-1 c) 4.7cm-1 d) 1.8 cm-1 **Answer: d) 1.8 cm-1**

21) A device used to study chemical reactions electrically is known as....
a) electrolytic cell b) Fuel cell c) electro chemical cell d) dry cell
Answer: c) electro chemical cell

22) The charge transfer through electronic conductors is called...
a) ionic conduction b) electrolytic conduction c) metallic conduction
d) electrode **Answer: c) metallic conduction**

23) in metallic conduction....
a) charge transfer take place through metals b) it involves the flow of electrons
c) no movement of metal atom d) all of these **Answer: d) all of these**

24) Pick out the incorrect statement
a) ionic conduction involves the motion of ions
b) an oxidation half reaction occurs at anode
c) reduction half reaction occurs at anode
d) electrodes may or may not take part in reactions
Answer: c) reduction half reaction occurs at anode

25) In electrolytic cell...
a) non-spontaneous reactions occurs
b) electric.current is passed from external source
c) electrical energy is converted into chemical energy d) all of these
Answer: d) all of these

26) Which of the following solutions will have the highest Specific conductance?
a) 0.001N b) 0.0001 N c) 0.1 N d) 1.0 N
Answer: d) 1.0 N

27) At infinite dilution, the contribution of cation and anion to the molar conductance...
a) depends on the nature of solvent b) independent of each other
c) depends on each other d) none of the above
Answer: b) independent of each other

28) Which of the following is not correct?
a) conductance of a solution increases with dilution
b) molar conductance increases with dilution
c) specific conductance increases with dilution
d) at infinite dilution each ion (cation or anion) play
definite role towards electrical conductance
Answer: c) specific conductance increases with dilution

29) Specific conductance of 0.1 MHNO, is 6,3 x 10%. S cm The molar conductance of the solution is....
a) 315 ohm cm b) 630 ohm-1 cm-1 c) 6300 ohm -1 cm2
d) 100 ohm-1 cm2 **Answer: b) 630 ohm-1 cm-1**

30) Electrochemistry deals with...
a) conversion ot chemical to electrical energy
b) conversion of electrical to Chemical energy c) both 'a' and b
d) conversion ot spontaneous chemical change into spontaneous chemical change
Answer: c) both 'a' and b

31) Fused NaCl conducts electricity due to the presence of....
a) free electrons b) free ions c) tree molecules
d) atoms of Na and Cl **Answer: b) free ions**

32) Sodium metal conducts electricity due to presence of.....
a) free ions b) free atom c) free electrons
d) free molecules **Answer: c) free electrons**

33) Pure water is non electrolyte but conducts electricity on adding small amount of......
a) Sugar b) Alcohol c) Urea d) BaSO4
Answer: d) BaSO4

34) sodium chloride is called an electrolyte, because...
a) its molecule is made up of electrically charged particles
b) it is decomposed, when an electric current is passed through it
C) it breaks up into 1ons, when a current is passed through it
d) it ionizes, when fused or dissolved in a proper solvent
Answer: d) it ionizes, when fused or dissolved in a proper solvent

35) Which one of the following is an electrolyte?
a) CHCl2 b) C6H5,Cl c) C6H6 d) NaCl **Answer: d) NaCl**

36) ionization of an electrolyte in aqueous solution is due to.....
a) instability ot the compound in aqueous medium
b) hydrolysis of the electrolyte
C) decrease in the electrostatic forces of attraction between oppositely charged ions
d) increase in the electrostatic forces of attraction between the ions
Answer: C) decrease in the electrostatic forces of attraction between oppositely charged ions

37) Which one of the following does not conduct electricity?
a) Molten NaCl b) NaCl crystal C) dil. solution of NaCl in water
d) conc. solution of NaCl in water **Answer: b) NaCl crystal**

38) Electrolytic conduction is due to...
a) movement ot the electrolyte through the external wire
b) flow ot electrons through the solution
c) migration of ions to the oppositely charged electrodes
d) tlow of positive ions through the external wire
Answer: c) migration of ions to the oppositely charged electrodes

39) Faraday's First law of electrolysis gives the relation between...
a) amount of a substance deposited or liberated and the quantity ot electricity
b) amount of a substance deposited or liberated and the equivalent weight
c) amount ot a substance deposited or evolved and the concentration ot an electrolyte
d) amount of a substance deposited or evolved and atomic weights
Answer: a) amount of a substance deposited or liberated and the quantity ot electricity

40) The mathematical expression of Faraday's first law of electrolysis is........
a) W=Q b) W-Z x I x t c) W=ZxQ d) both 'b' and c
Answer: d) both 'b' and c

41) Which of the following expression is written properly?
a) I=Qt b) I= t/Q c) I=1/Qt d) I=Q/t
Answer: d) I=Q/t

42) In electrolysis mass of discharged ion is not proportional to.....
a) time b) quantity of electricity c) resistance d) chemical equivalent of ions
Answer: c) resistance

43) A current of I' amperes is passed through the solution of an electrolyte for time t min, when 'm' g of a substance is liberated at the electrode. The electrochemical equivalent of the substance is equal to.....
a) m/ 60It b) It/ 60m c) It/m d) m/It **Answer : a) m/ 60It**

44) The quantity ot the metal deposited at the cathode during electrolysis depends on.....
a) shape af cathode b) concentration of electrolyte
c) only quantity of charge passing through the solution
d) quantity of charge and valency of the metal
Answer: d) quantity of charge and valency of the metal

45) How many coulombs of electricity are consumed when 100 mA current is passed through a solution of AgNO3,for 30 minutes during electrolysis experiment?
a)18000 b) 3000 c) 108 d) 180 **Answer: d) 180**

46) At STP 1.12 litre ot H, is obtained on flowing a current for 965 seconds in a solution. The value of current is....
a) 1.5 b) 2.0 c) 10 d) 1.0 **Answer: c) 10**

47) The atomic weight of Cu is 64. The weight of Cu liberated from CusO, solution by passing a cement of 0.965 ampere ior l000 seconds would be....
a) 0.64 kg b) 0.32 x 10-3 kg c) 0.64 g d)0.32 kg
Answer: b) 0.32 x 10-3 kg

48) The atomic weight of oaxygen is 16 hence the ECE of oxygen in kg per coulomb is....
a) 8:29 x 10-8 b) 8:29 x 10-5 c) 0-008x 96500 d) 96500
Answer: a) 8:29 x 10-8

49) A current of 5 amperes when passed through a solution of AgNO, for 20 minutes deposited 6-0 x 10 kg of Ag. The Z for Ag is equal to...
a) 6000 gm/C b) 1.0x 10 gm/C c) 1.0x 10 kg/C d) 96500 gm/C
Answer: c) 1.0x 10 kg/C

50) The atomic weight of Al is x, the electrochemical equivalent of Al in the solution of Aluminium sulphate will be....
a) 3x/ F b) X/ 3F c)X/F d) 2X/F
Answer: b) X/ 3F

51) Electrochemical cell is a device for....
a) Conversion of potential energy into kinetics
b) Conversion of electrical energy into chemical energy
c) Conversion of chemical energy into electrical energy
d) both b and 'c
Answer: d) both b and 'c

52) Which of the following is also known as electrogenic cell?
a) Galvanic b) Voltmeter c) Electrolytic d) both b and c
Answer: a) Galvanic

53) Which of the following statements is correct?
a) Cathode is positive terminal in an electrolytic cell
b) Cathode is negative terminal in an galvanic cell
c) Reduction occurs at cathode in either of the cells
d) Oxidation occurs at cathode in either of the cells
Answer: c) Reduction occurs at cathode in either of the cells

54) Concentration of Zn2+ and Cu2+ in the Daniel cell increased 10 times, the emf of the cell...
a) increases by 10 times b) decreases by 10 times
c)increases by 1/10 times d) remains constant **Answer: d) remains constant**

55) During the working of the Daniel cell, which of the following happens?
a) The size ot the zinc rod remains same but blue colour of CuSO4, solution becomes faint
b) The size of the zinc rod is reduced and the blue colour of CuSO4, solution becomes faint
c) The size of the zinc rod is reduced but there is no change in the intensity of colour of CuSO, solution
d) The size of zinc rod as well as the intensity of the colour of CusO, solution remain unchanged
Answer: b) The size of the zinc rod is reduced and the blue colour of CuSO4, solution becomes faint

56) The wrong statement regarding Daniel cell is......
a) Zn acts as anode b) Cu acts as positive electrode
c) Electrons flow from Cu to Zn d) Cu acts as cathode
Answer: c) Electrons flow from Cu to Zn

57) The passage of electrons in the Daniel cell, when Zn and Cu electrodes are connected is from......
a) Cu to Zn in the cell b) Cu to Zn outside cell
c) Zn to Cu in the cell d) Zn to Cu outside cell
Answer: d) Zn to Cu outside cell

58) Other things being equal, the life of a Daniel cell may be increased by....
a) keeping temperature high b) using large copper electrodes
C) using large zinc electrodes d) decreasing concentration of Cu-2+ ions
Answer: C) using large zinc electrodes

59) The half cell for which conventional reduction potential is taken to be zero is...
a) calomel b) zn half cell C) N. H. E d) std. Ag half cell
Answer: C) N. H. E

60) cell voltage is....
a) extensive property b) intensive property C) both a and b
d) none of these
Answer: b) intensive property

UNIT 9 : CHEMICAL KINETICS

1) Rate constant in not independent on....
a) concentration of reactants b) concentration of product
c) molecularities of reaction d) temperature **Answer: d) temperature**

2) aA +bB product, if rate= K[A]x [B]y then the following is correct ?
a) x+y=a+b b) x+y≠a+b or x+y=a+b c) X+y=a+b=0
d) x+y= (a + b)2 **Answer: b) x+y≠a+b or x+y=a+b**

3) Rate law is......
a) determined from given chemical equation b) determined theoretically
c) determined experimental d) not determined experimentally
Answer: c)determined experimental

4) For general reaction aA+bB--> product rate =K [A]x [B]y when x=-ve then,
a) rate increases as, [A] increases b) rate decreases as, [A] decreases
c)rate is independent on constant A d) rate decreases as, [A] increases
Answer: d) rate decreases as, [A] increases

5) For the reaction 2H2,O2(g)---> 2H2O(l) +O2(g) rate =........
a) K [H2 O2]1/2 b) K [K [H2 O2]1/3 c) K [H2 O2]1
d) K [H2 O2]2 **Answer: c) K [H2 O2]1**

6) For the reaction, NO2(g) +CO(g)--> NO(g)+CO2(g) Which of the following is correct?
a) rate=K[NO2]1/2[CO] b) rate = K[NO2]2 c)rate= K [CO]1
d) rate= K[NO2]1[CO]1 **Answer: b) rate = K[NO2]2**

7) Which of the following is not correct Stated?
a) rate law estimate rate of reaction
b) rate law estimate concentration of reactants not product
c) rate law estimate mechanism of complex reactant
d) rate law estinate concentration of
products at any time interval during reaction
Answer: b) rate law estimate concentration of reactants not product

8) Chemical reaction is characterized by ..
a) rates of reactions b) feasibility of reactions
c) position of equilibrium d) all above characteristics
Answer: d) all above characteristics

9) Chemical kinetics study deals with.
a) rates of chemical reaction b) mechanism of rate reaction
c) factors affecting rates of reaction d) all
Answer: d) all

10) The half life for Zero order reaction is....
a) At/2K b) [A]o/2At c) [A]o/2 d) [A]o/2K **Answer: d) [A]o/2K**

11)......represents example of zero order reaction
a) decomposition of ammonia gas on platinum Surface
b) decomposition of nitrogen oder on platinum surface
c) decomposition of phosphine gas on tungsten surface
d) all
Answer: d) all

12)......not represents pseudo-order reaction.
a) Acid hydrolysis of ester b) Inversion of cane sugar
c) Decomposition of PCI5 d) Conversion of methyl acetate into methanol and acetic acid in presence of H2SO4
Answer: c) Decomposition of PCI5

13) Rate law and order of reaction can't be calculated by....
a) Molecularity method b) Isolation method
c) initial rate method d Integrated rate law
Answer: a) Molecularity method

14) Molecularity term is applied for....
a) simple reactions b) complex reactions
c) both simples complex reactions d) none of the above
Answer: a) simple reactions

15).....is not a an example of first order.
a) Acid hydrolysis of ester b) Decomposition of N2O5
C) cyclopropene into cyclopropane d) Decomposition of H2O2
Answer: C) cyclopropene into cyclopropane

16) The term (-dc/dt) in rate equation refers to...
a) the concentration of a reactant
b) the decrease in concentration of the reactant with time
c) the velocity constant of reaction d) the concentration of a product
Answer: b) the decrease in concentration of the reactant with time

17) Number of moles of a substance present in one litre of volume is known as...
a) activity b) molar concentration c) active mass
d) concentration **Answer: b) molar concentration**

18) Rate of which reactions increases with temperature...
a) of any b) of exothermic c) of endothermic reaction
d) of reversible reaction **Answer: a) of any**

19) The rate of chemical reaction is directly proportional to....
a) active masses of reactants b) equilibrium constant
c) active masses of products d) pressure
Answer: a) active masses of reactants

20) The rate of a reaction can be increased in general by all the factors except...
a) using a catalyst   b) increasing the temperature
c) increasing the activation energy   d) increasing the concentration of reactants
Answer: c) increasing the activation energy

21) According to rate law, Rate= k[A] [B]2 [C] If C is taken in large excess, then the overall order of the reaction is...
a) 2   b) 4   c) 3   d) 1   **Answer: c) 3**

22) The unit of the velocity constant in case of zero order reaction is...
a) conc. × time-1   b) conc-1. x time   c) conc. X (time)2
d) conc-1. x time-1   **Answer: a) conc. × time-1**

23) If the concentration of a reactant A is doubled and the rate of its reaction increased by a factor of 2, the order of reaction with respect to A is...
a) first   b) zero   c) third   d) second   **Answer: a) first**

24) Some statements are given below about a reaction of 1st order
a) Units of concentration affect the value of k
b) Plot of 't1/2 Vs 'a' is a straight line
parallel to conc. axis
c) Unit of k is mol dm time
d) Hydrolysis of ethyl acetate, using a
mineral acid, is an example of it.
Among the above..
a) only A is false
b) B,C and D are true
c) A, B and D are true
d) A and C are false
Answer: d) A and C are false

25) The unit of rate constant for a zero order reaction is...
a) litre mol-1 sec-1 b) mol litre-1 sec-1   c) mol sec-1
d) litre sec-1 **Answer: b) mol litre-1 sec-1**

26) The rate constant of a reaction has same units the rate of reaction.the reaction is of..
a) first order b) zero order c) second order   d) third order
Answer: b) zero order

27) The rate constant of a reaction is
2.5x 10-2 minutes -1 The order of the reaction is...
a) one   b) zero   c) three   d) two   **Answer: a) one**

28) The decomposition of NH3 on the surface of finely divided Platinum as catalyst..
a) is always a zero order reaction
b) is Zero order at high concentration but 1st order at low temperature
c) is zero order at low concentration but 1st order at high concentration

d) it is always a first order reaction
Answer: b) is Zero order at high concentration but 1st order at low temperature

29) If 'a' is the initial concentration or the reactant, the time taken for completion of the reaction , if it is of....
zero order, will be
a) a/2k b) a/k c) 2a/k d) k/a **Answer: b) a/k**

30) The specific rate constant of a first order reaction depends upon...
a) concentration of the reactants b) concentration of products
c) time d) temperature
Answer: d) temperature

31) A reaction is of first order when...
a) the amount ot product formed increases with linearly with time
b) the rate decreases linearly with time
c) the rate is linearly related to the concentration of the reactant
d) the concentration of the reactant decreases linearly with time
Answer: c) the rate is linearly related to the concentration of the reactant

32) If the concentration is expressed in moles per litre, the unit of the rate constant for a first order reaction is...
a) mole litre sec b) mole litre C) sec-1 d) mole-1
Answer: C) sec-1

33) Order of a reaction is....
a) equal to the sum of the concentration terms in the stoichiometric equation
b) equal to the sum of the concentration terms in the rate equation
C) always equal to the molecularity of
the reaction
d) equal to the sum of the powers of the concentration terms in the rate equation.
Answer: d) equal to the sum of the powers of the concentration terms in the rate equation
34) If the initial concentration is doubled, the time half change is also doubled, the order of the reaction is...
a) 2 b) 3 c) 1 d) 0 **Answer: d) 0**

35) The dimensions of rate constant for a first order reaction involve....
a) time and concentration b) concentration only c) time only
d) neither time nor concentration **Answer: c) time only**

36) The rate of reaction at unit concentration of reactant is called.....
a) average rate b) instantaneous rate c) rate law d) rate constant
Answer: d) rate constant

3**7) Which of the following statements is incorrect...**
a) Rate law expression cannot be obtained from the stoichiometric equation
b)Law of mass action expression can be written
from the balanced equation
c) Specific reaction rate of a reaction is constant at constant temperature

d) Rate of reaction and rate constant have same units
Answer: d) Rate of reaction and rate constant have same units

38) The rate constant of a reaction does not change when....
a) a catalyst is added b) concentrations of the reactants are changed
c)temperature is changed d) a inhibitor is added
Answer: b) concentrations of the reactants are changed

39) The rate at which a substance reacts depends on its....
a) atomic weight b) molecular weight
C) active mass d) equivalent weight
Answer: C) active mass

40) 2A----> B+C would be a zero Order reaction when...
a) the rate of reaction 1s proportional to square of conc. of A
b) the rate of reaction remains same any conC. of A
c) the rate remains unchanged at any-conc. of B and C
d) the rate of reaction doubles if conc. of B is increased to double
Answer: b) the rate of reaction remains same any conC. of A

41) Order of reaction is decided by...
a) temperature b) mechanism of reaction
c)molecularity d) pressure
Answer: b) mechanism of reaction

42) Rate of first order reaction depends upon..
a) time b) concentration of reactant
c) temperature d) all the these
Answer: d) all the these

43) Which of the following is true for order of a reaction?
a) It is equal to the sum of exponents of the molar concentrations of the reactants in the rate equation b) It is always a whole number c) It is never zero
d) t can be determined theoretically
Answer: a) It is equal to the sum of exponents of the molar concentrations of the reactants in the rate equation

44) radioactive decay follows... order kinetics
a) zero b) I c) II d 111
Answer: b) I

45) What is the half life of Cl if its disintegration constant is 2.31 x 10 year 1....
a) 0.3x 104 years b) 0.3 x 102 years c) 0.3 x 108 years
d) 0.3 x 103 years **Answer: d) 0.3 x 103 years**

46) Decomposition of nitrogen pentoxide is known to be a first order reaction. 75 percent of the oxide
had decomposed in the first 24 minutes. At the end of an hour, after the start of the reaction, the amount of oxide left will be...
a) nil b) about 1 % c) about 3 % d) about 2 %

Answer: c) about 3 %

47) The thermal decomposition of a compound is of first order. If a sample of the compound decomposes 50 % in 120 minutes, in what times will it undergo 90 % decomposition...
a) nearly 240 minutes b) nearly 480 minutes
c)nearly 450 minutes d) nearly 400 minutes
Answer: d) nearly 400 minutes

48) The rate constant of a first order reaction is 3x 10-6 per second. If the initial concentration is 0.10 M, the initial rate of reaction is...
a) 3x 10-5Ms-1 b) 3x 10-8 Ms-1
c) 3x 10-6 Ms—1 d) 3x 10-7 Ms-1 **Answer: d) 3x 10-7 Ms**

49) for a chemical reaction...... Can never be a fractional
a) molecularity b) rate constant c) half life d) order
Answer: a) molecularity

50) molecularity of a reaction.....
a) can be zero b) can have a fractional value
C) is always whole numberd) can not be less than 2
Answer: C) is always whole number

UNIT 10 : SURFACE CHEMISTRY

1. Which one of the following is an example of adsorption?

a. ammonia in contact with water b. anhydrous $CaCl_2$ with water
c. silica gel in contact with water vapours d. all of these

Answer: (c)

2. At 15ºC out of H_2, CH_4, CO_2, NH_3, which gas will be adsorbed maximum by charcoal?

a. H_2 b. CH_4 c. CO_2 d. NH_3

Answer: (d)

3. Which of the following colloids are solvent hating?

a. Lyophilic b. lyophobic c. hydrophilic d. none of these

Answer: (b)

4. If the dispersed phase is a liquid and the dispersion medium is solid, the colloid is known as

a. foam b. sol c. emulsion d. gel **Answer: (d)**

5. The process of separating a crystalloid, from a colloid by filtration is called

a. emulsification b. dialysis c. coagulation d. Peptization

Answer: (b)

6. The movement of colloidal particles towards the oppositely charged electrodes on passing electric current is known as

a. Tyndall effect b. Cataphoresis c. Brownian movement
d. None of these **Answer: (b)**

7. An emulsifier is a substance which

a. stabilizes the emulsion
b. coagulates the emulsion
c. retards the dispersion of liquid in liquid
d. causes homogenesis of emulsion

Answer: (a)

8. Homogeneous catalysis does mean

a. Reactants and goods have to be at the same level
b. Catalyst and reactants must be in the same phase
c. The reaction mixture must be formed homogeneously during
d. The reaction mixture distribution must be homogeneous

Answer: (b)

9. Which of the following kinds of catalysis can be explained by the adsorption theory?

a. enzyme catalysis b. homogeneous catalysis c. acid base catalysis
d. heterogeneous catalysis **Answer: (d)**

10. The volume of gases H_2, CH_4, CO_2 and NH_3 adsorbed by 1 gm charcoal at 293 K can be given in the order?

a. $CH_4 > CO_2 > NH_3 > H_2$ b.. $CO_2 > NH_3 > H_2 > CH_4$
c. $NH_3 > CO_2 > H_2 > CH_4$ d. $NH_3 > CO_2 > CH_4 > H_2$ **Answer: (d)**

11. What is called the boundary that separates the phases in two bulks ?

a. Line b. Point c. Slash d. Interface **Answer : (d)**

12. On which does the interface depend ?

(a) on the volume of molecules in the bulk phase

(b) on the weight of molecules in the bulk phase

(c) on the number of molecules in the bulk phase

(d) on the physical state of molecules in the bulk phase

Answer: (a)

13. Which of the following is not an example of surface phenomenon ?

(a) Dissolution (b) Corrosion (c) Electrode reaction

(d) Homogeneous catalysis **Answer: (d)**

14. How many Pascal high vacuum is required for obtaining completely pure surface of metals ?

(a) 10-8 to 10-9

(b) 10-8 to 10-10

(c) 10-6 to 10-9

(d) 10-8 to 10-7

Answer: (a)

15. What is the phenomenon called when the molecules adsorbed on the surface are released by any reason ?

(a) Sorption

(b) Desorption

(c) Adsorption

(d) Precipitation

Answer: (b)

16. Because of adsorption _____

(a) Surface energy decreases

(b) Surface energy increases

(c) The value of surface energy becomes zero

(d) No change takes place

Answer: (a)

17. By which other name the adsorption of gases on the solid surface is known?

(a) Evaporation (b) Surface tension

(c) Condensation (d) Sorption

Answer: (c)

18. What is the substance that is adsorbed called ?

(a) Adsorbent (b) Adsorbate
(c) Absorsent (d) Absorbite **Answer: (b)**

19. Which of the following substances is not an adsorbent ?

(a) Sugar (b) Clay
(c) Silica gel (d) Alumina **Answer: (a)**

20.2020. What type of attraction forces are present between adsorbent and adsorbate in physisorption ?

(a) van der Waals (b) Strong chemical
(c) Gravitation (d) Metallic bond **Answer: (a)**

21. The correct ascending order of adsorption of the following gases on the same mass of charcoal at same temperature and pressure is

(a) CH4 < H2 < SO2 (b) H2 < CH4 < SO2
(c) SO2 < CH4 < H2 (d) H2 < SO2 < CH4 **Answer: (b)**

22. The formation of micelles takes place only above

(a) Inversion temperature (b) Boyle's temperature
(c) Critical temperature (d) Kraft temperature **Answer: (d)**

23. Collodion is 4% solution of which one of the following in alcohol-ether mixture.

(a) Nitroglycerin (b) Cellulose acetate
(c) Glycol dinitrate (d) Nitrocellulose **Answer: (d)**

24. Freundlich adsorption isotherm is given by the expression xm = k p1/n which of the following conclusions can be drawn from this expression.

(a) When 1n = 0, the adsorption is independent of pressure.
(b) When 1n = 0, the adsorption is directly proportional to pressure.
(c) When n = 0, xm vs p graph is a line parallel to x-axis.
(d) When n = 0, plot of xm vs p is a curve.
Answer: (a)

25. H2 gas is adsorbed on activated charcoal to a very little extent in comparison to easily liquefiable gases due to.

(a) very strong van der Waal's interaction
(b) very weak van der Waals forces
(c) very low critical temperature
(d) very high critical temperature **Answer: (b)**

UNIT 11 : CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

1. Zone refing is used for the

1) Concentration of ore 2) Reduction of metal oxide
3) Purification of metal 4) Purification of ore.

2. The substance not likely to contain $CaCO_3$ is

1) Dolomite 2) A marble statue
3) Calcined gypsum 4) Sea shell

3. Gold is leached out from the native ore by treating with a solution of

1) Sodium thiosulphate 2) Sodium hydroxide
3) Sodium chloride 4) Sodium cyanide.

4. Cinnabar is an ore of

1) Hg 2) Cu 3) Pb 4) Zn

5. In blast furnace, the highest temperature is

1) Slag zone 2) Reduction zone
3) Combustion zone 4) Fusion zone

6. The ore which contains copper and iron is

1) Cuprites 2) Chalcocite
3) Chalcopyrite 4) Malachite

7. Chromium is obtained by reducing purified chromites ore with

1) Red hot coke 2) Gaseous hydrogen
3) Aluminum powder 4) Carbon monoxide

8. An ore of iron containing $FeWO_4$ is concentrated by

1) Magnetic separation 2) Froth flotation
3) Electrostatic method 4) Gravity separation

9. Alkali metals are generally extracted by

1) Reduction method 2) Double decomposition method
3) Displacement method 4) Electrolytic method

10. Magnesium is not present in

1) Cryolite 2) Dolomite
3) Carnallite 4) Epsom salt

11. Which is the most abundant metal in earth's crust?

1) Al 2) Fe
3) Na 4) Ca

12. Matte contains mainly

1)Cu2S and FeS 2) CuS andFe2S3
3) Fe 4) Cu2S

13. The process of converting hydrated alumina into anhydrous alumina is called

1) Roasting 2) Calcinations
3) Dressing 4) Smelting

14. Froth flotation process is used for the metallurgy of

1) Chloride ore 2) Amalgams
3) Oxide ores 4) Sulphide ore

15. Flux is used to

1) Remove silica 2) Remove silica and undesirable metal oxide
3) Remove all impurities from ores 4) Reduce metal oxide

16. The maximum number of electrons in the nth orbit is

1)n2 2)2n
3)2n2 4)3n2

17. The number of unpaired electrons in nitrogen atom is

1) 6 2) 8
3) 7 4) 3

18. When the azimuthal quantum number (l) =3, m can have

1) 1 value 2)3 value
3) 5 value 4)7 value

19. An element M has an atomic mass 19 and atomic number 9, its ion is represented by

1) M+ 2)M2+
3) M- 4M2-

20. The principal quantum number of an atom represents

1) Size of orbital 2) Spin angular momentum
3) Orbital angular momentum 4) Space orientation of orbital

21. The two electrons present in an orbital are distinguished by

1) Principal quantum number 2) Azimuthal quantum number
3) Magnetic quantum number 4) Spin quantum number

22. The g sub shell is characterized by

1) n=5 2) m=3
3) l=4 4) l=5

23. The number of 2p electrons having Spin quantum number s=-1/2 are

1)6 2)0
3)2 4)3

24. The de-Broglie equation treats an electron to be

1) A particle 2) A wave
3) Both 4) None

25. What is packet of energy called?

1) Electron 2) Photon
3) Positron 4) Proton

26. When an electron of hydrogen atom returns to L shell from higher energy level, we get which Series of lines

1) Lyman series 2) Balmer series
3) Paschen series 4) Brackett series

27. The number of degenerate orbitals in the d-sub shell is

1)3 2)7
3)5 4)1

28. The atomic number of an element is 17.The number of orbitals containing electron pairs in the Valence shell is

1)3 2)6

3)2 4)8

29. Which of the following will have largest size?

1) Br 2) Cl

3) I 4) F

30. Which of the following has zero electronegativity?

1) Oxygen 2) Fluorine

3) Nitrogen 4) Neon

31. Diagonal relationship is shown by

1) Be and Al 2) Li and Na

3) Be and Mg 4) Be and Ca

32. The molecule with highest percentage of ionic character is

1) HBr 2)HI

3) HF 4) HCl

33. Which of the following element will have lowest first ionization energy?

1) Mg 2) Rb

3) Li 4) Cs

34. The second ionization energy is always grater than the first ionization energy.

This is because

1) The effective nuclear charge increases

2) The number of shells decreases

3) The number of protons increases

4) none of these

35. Which of the following is the man made element?

1) Ra 2) U

3) Np 4) C-14

36. Among Na+, Na, Mg and Mg2+ largest particle is

1) Mg2+ 2) Mg
3) Na 4) Na

37. Which of the following metal requires radiation of minimum frequency to cause electron emission?

1) Na 2) K
3) Mg 4) Ca

38. Collective name given to the element with outer shell electronic configuration ns2 np6 is

1) Halogens 2) Transition elements
3) Alkaline earth metals 4) Nobel gases

39. Which of the following does not have any unit?

1) Electron affinity 2) Ionization energy
3) Atomic radii 4) Electronegativity

40. The oxidation number of Cr in CrO5 is

1) +3 2) +5
3) +6 4) 0

41. The element which can have highest oxidation state is

1) C 2) N
3) F 4) Cl

42. The oxidation number of Fe in Fe (CO) 5 is

1) +4 2) +2
3) +6 4)0

43. Oxygen has +2 oxidation states in

1) H2O2 2) H2O
3) OF2 4) SO2

44. The oxidation number of nitrogen is fraction in

1) NH4+ 2) NH3
3) HN3 4) N2H2

45. Oxidation is the removal of electrons. The strongest oxidizing agent is

1) Iodine 2) Oxygen

3) Chlorine 4) Fluorine

46. The oxidation number of C in C6H12O6 is

1)0 2)4

3)2 4)1

47. The oxidation number of oxygen inO2PtF6 is

1) 0 2) +1/2

3) +1 4)-1/2

48. The nitrogen can have oxidation number-3 to+5; identify the compound having nitrogen in+1 state

1) N 2O5 2) N2O

3) NO 4) N2

49. The conversion of C12H22O11 to CO2 is

1) Oxidation 2) reduction

3) None 4) both

50. The equivalent mass of potassium permanganate in basic medium is

1) 158 2) 31.6

3) 52.7 4) none

Key answers

1)3. 2)3. 3)4. 4)1. 5)3. 6)3. 7)3. 8)1. 9)4. 10)1. 11)1. 12)1. 13)2. 14)4. 15)3. 16)3. 17)4.

18)4. 19)3. 20)1. 21)4. 22)3. 23)4. 24)3. 25)2. 26)2. 27)3. 28)1. 29)3. 30)4. 31)1. 32)3. 33)2.

34)1. 35)3. 36)3. 37)2. 38)4. 39)4. 40)3. 41)4. 42)4. 43)3. 44)3. 45)4. 46)1. 47)2. 48)2. 49)1. 50)3.

UNIT 12 : GENERAL PRINCIPLES AND PROCESS OF ISOLATION OF METALS

1. Which ore can be best concentrated by froth floatation process?
A) Malachite B) Cassiterite C) Galena D) Magnetite
Answer: C

2. Bessemer converter is used in the manufacture of_____________
(a) Pig iron (b) Steel (c) Wrought iron (d) Cast iron
Answer: B

3. Purest form of iron is_________
A) Cast iron B) Hard Steel C) Stainless steel D) Wrought iron
Answer: D

4. Ore of aluminium is_____________
A) bauxite B) hematite C) dolomite D) None of these
Answer: A

5. For which of the following ores froth floatation method is used for concentration?
A) Haematite B) Zinc blende C) Magnetite D) Camallite
Answer: B

6. Which of the following metals is not extracted by leaching?
A) Aluminium B) Mercury C) Silver D) Gold
Answer: B

7. The method of zone refining of metals is based upon the principle of___________
A)greater solubility of the impurity in molten state than in solid
B)greater mobility of pure metal than impurity
C) higher melting point of impurity than that of pure metal.
D)greater noble character of solid metal than that of the impurity
Answer: A

8. Cassiterite is the ore of which metal?
A) Mn B) Sb C) Sn D) Ni
Answer: C

9. During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are_______
A) Pb and Zn B) Sn and Ag C) Fe and Ni
D) Ag and Au **Answer: D**

10. Extraction of zinc from zinc blende is achieved by__________
A) electrolytic reduction
B) roasting followed by reduction with carbon
C) roasting followed by reduction with another metal
D) roasting followed by self-reduction **Answer: B**

11. An alloy which does not contain copper is_________
A) Bronze B) Magnalium C) Brass D) Bell metal
Answer: B

12. Cinnabar is the ore of____________
A) Zn B) Cd C) Hg D) Ag
Answer: C

13. High purity copper metal is obtained by_________
A) Carbon reduction B) Hydrogen reduction
C) Electrolytic reduction D) Thermite reduction **Answer: C**
14. Pyrolusite is a/an__________
A) Oxide ore B) Sulphide ore C) Carbide ore
D) not an ore. **Answer: A**

15. Which of the following metals is most abundant in the earth's crust?
A) Mg B) Na C) Al D) Fe **Answer: C**

16. Which of the following benefication process is used for the mineral Al2O3.2H2O?
A) Froth Floatation B) Leaching C) Liquation D) Magnetic separation
Answer: B

17. The Mond's process of refining is used for which of the following metals?
A) Gold B) Copper C) Iron D) Nickel **Answer: D**

18. The correct statement is__________ A) cassiterite is an ore of tin
B) pyrolusite is the ore of iron C) dolomite is the ore of zinc
D) galena is the ore of mercury **Answer : A**

19. Which of the following are the correct matching of metals with the most commonly employed ores for their extraction?
A) Fe: Chalcocite: Al: Bauxite B) Fe: Siderite; Al: Clay
C)Fe: Haematite; Al: corundum D) Fe: Haematite; Al: Bauxite **Answer : D**

20. Which one of the furnaces among the following can produce the highest temperature?
A) muffle furnace B) blast furnace C) reverberatory furnace
D) electric furnace **Answer : D**

UNIT 13 : CARBOXYLIC ACIDS

01. Formic acid is obtained when

a) calcium acetate is heated with conc. H_2SO_4.

b) calcium formate is heated with calcium acetate

c) glycerol is heated with oxalic acid

acetaldehyde is oxidized with $K_2Cr_2O_7$and H_2SO_4.

02. Ethyl alcohol on oxidation with $K_2Cr_2O_7$ gives

a) acetic acid b) acetaldehyde c) formaldehyde

d) formic acid

03. Acetic acid is manufactured by the fermentation of

a) ethanol b) methanol c) ethanal d) methanal.

04. A is a higher phenol and B is an aromatic carboxylic acid. Separation of a mixture of A and B can be carried out easily by having a solution

a) NaOH b) Na_2CO_3 c) Lime d) $NaHCO_3$

05. The conversion of CH_3OH into CH_3COOH can be brought about by the following reagents

a) $K_2Cr_2O_7/H^+$ b) CO + Rh c) $KMnO_4$ d) H_3PO_4

06. Acid present in tomatoes is

a) lactic acid b) oxalic acid c) citric acid d) tartaric acid.

07. What is Z in the following sequence of reactions?

$$Phenol \xrightarrow{Zn\ dust} X \xrightarrow[anhyd.AlCl_3]{CH_3Cl} Y \xrightarrow{Alkaline} Z$$

a) toluene b) Benzene c) Benzoic acid d) Benzaldehyde.

08. Cyanohydrin of which of the following forms lactic acid?

a) HCHO b) CH_3COCH_3 c) CH_3CHO d) CH_3CH_2CHO

09. The acid showing salt like character in aqueous solutions is

a) acetic acid b) bezoic acid c) formic acid

d) $\alpha-$ aminoacetic acid.

10. Hydrolysis of trichloromethane with aqueous KOH gives

a) potassium formate b) acetylene c) chloral

d) methanol.

11. The product of the reaction,

$2CH_3COOH \xrightarrow{P_2O_5} .....is$

a) CO and H_2O b) formic acid c) ethanoic anhydride

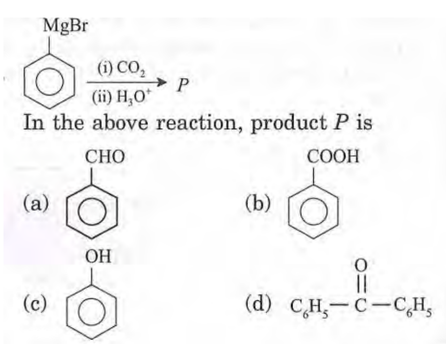
d) ethyl ethanoate.

12. The $RCH_2CH_2COOH \xrightarrow[Br_2]{\text{Red P}} R-CH_2-\underset{\underset{Br}{|}}{CH}-COOH$ reaction is called

a) Reimer Tiemann reaction b) Hell-volhard Zelinsky reaction

c) Cannizzaro reaction d) Sandmeyer reaction.

13.



14. The reaction
$$CH_3CH=CH_2 \xrightarrow[H^+]{CO + H_2O} CH_3-\underset{\displaystyle COOH}{\underset{|}{CH}}-CH_3$$ is known as

a) Wurtz reaction b) Koch reaction c) Clemmensen's reduction

d) Kolbe's reaction.

15. Which of the following cannot reduce Fehling's solution?

a) HCOOH b) H_3CCOOH c) HCHO d) H_3CCHO

16. The IUPAC name of the compound
$$HOOC-CH_2-\underset{\displaystyle COOH}{\underset{|}{CH}}-CH_2-CH_2-COOH$$ is

a) 2-(Carboxymethyl) pentane-1.5-dioic acid

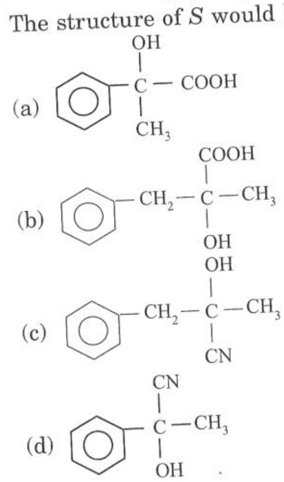
b) 3-Carboxyhexane-1, 6-dioic acid

c) Butane-1, 2, 4-tricarboxylic acid d) 4-Carboxyhexane-1, 6-dioic acid

17. In a set of reactions acetic acid yielded a product S.

$$_3COOH \xrightarrow{SOCl_2} P \xrightarrow[\text{Anhy. } AlCl_3]{\text{Benzene}} Q \xrightarrow{HCN} R \xrightarrow{H.OH} S$$

The structure of S would be



18. Glacial acetic acid is

a) pure acetic acid at 100^0C b) acetic acid mixed with methanol

c) pure acetic acid at 0^0C. d) pure acetic acid around 16.6^0C.

19. Acetic acid is obtained when

a) methyl alcohol is oxidized with potassium permanganate

b) calcium acetate is distilled in the presence of calcium formate

c) acetaldehyde is oxidized with potassium dichromate and sulphuric acid

d) glycerol is heated with sulphuric acid.

20. Benzoic acid gives benzene on being heated with X and phenol gives benzene on being heated with Y. Therefore X and Y are respectively.

a) sodalime and copper

b) zinc dust and sodium hydroxide

c) zinc dust and sodalime

d) sodalime and zinc dust.

21. What is formed when oxalic acid is dehydrated by conc. H_2SO_4?

a) $C+CO_2$ b) CO c) CO_2 d) $CO + CO_2$

22. Which salt can be produced by the reaction of carbon monoxide and caustic soda (NaOH)?

a) CH_3COOH b) $C_2H_2O_4$ c) $HCOONa$ d) $HCHO$

23. Electrolysis of aqueous solution of CH_3COOK gives

a) CH_4 b) C_2H_4 c) C_2H_6 d) C_2H_2

24. $HCOOH$ reacts with conc. H_2SO_4 to produce

a) CO b) CO_2 c) NO d) NO_2

25. Acetic acid reacts with PCl_5 to form

a) $CH_2ClCOOH$ b) $CHCl_2COOH$

c) CH_3COCl d) CH_3COOCl

1	2	3	4	5	6	7	8	9	10
c	a	a	d	b	b	c	c	d	a
11	12	13	14	15	16	17	18	19	20
c	b	b	b	b	c	a	d	c	d
21	22	23	24	25					
d	c	c	a	c					

UNIT 14 P BLOCK ELEMENTS

1. Find the amphoteric oxide

(a) CaO_2 (b) CO_2 (c) SnO_2 (d) SiO_2

Answer: (c)

2. Graphite has a structural similarity with

(a) B_2H_6 (b) B_4C (c) B (d) BN

Answer: (d)

3. Which is the correct order of decreasing acidity of lewis acids?

(a) $BBr_3 > BCl_3 > BF_3$ (b) $BF_3 > BCl_3 > BBr_3$

(c) $BCl_3 > BF_3 > BBr_3$ (d) $BBr_3 > BF_3 > BCl_3$

Answer: (a)

4. In the presence of KF, AlF_3 is soluble in HF. Find the complex formed

(a) $K_3[AlF_6]$ (b) AlH_3 (c) $K[AlF_3H]$ (d) $K_3[AlF_3H_3]$ **Answer: (a)**

5. S-S bond is present in which of the ion pairs

(a) $S_2O_7^{2-}$, $S_2O_3^{2-}$ (b) $S_4O_6^{2-}$, $S_2O_7^{2-}$ (c) $S_2O_7^{2-}$, $S_2O_8^{2-}$

(d) $S_4O_6^{2-}$, $S_2O_3^{2-}$ **Answer: (d)**

6. Which is the correct order of decreasing bond dissociation enthalpy?

(a) $F_2 > Cl_2 > Br_2 > I_2$ (b) $I_2 > Br_2 > Cl_2 > F_2$

(c) $Cl_2 > Br_2 > F_2 > I_2$ (d) $Br_2 > I_2 > F_2 > Cl_2$ **Answer: (c)**

7. Oxygen is not released on heating which of the compounds?

(a) $(NH_4)_2Cr_2O_7$ (b) $K_2Cr_2O_7$

(c) $Zn(ClO_3)_2$ (d) $KClO_3$ **Answer: (a)**

8. Which of the species has a permanent dipole moment?

(a) SF_4 (b) SiF_4 (c) BF_3 (d) XeF_4 **Answer: (a)**

9. Which of the statement is incorrect for XeO_4 ?

(a) four $p\pi$-$d\pi$ bonds are present (b) four $sp^3 - p\ \sigma$ bonds are present

(c) It has a tetrahedral shape (d) It has a square planar shape

Answer: (d)

10. P_4O_{10} has ______ bridging O atoms

(a) 4 (b) 5 (c) 6 (d) 2

Answer: (c)

UNIT 15 : D AND F BLOCK ELEMENTS

01. Which ion is detected by Nessler's reagent?

a) NH_4^+ b) MnO_4^- c) PO_4^{3-} d) CrO_4^{2-}

02. In order to prepare one litre one normal solution of $KMnO_4$, how many grams of $KMnO_4$ are required, if the solution is to be used in acid medium for oxidation?

a) 158g b) 31.60g c) 62.0 g d) 790 g

03. The trace metal present in insulin is

a) Fe b) Co c) Zn d) Mn

04. Bordeaux used as fungicide is a mixture of

a) $CuSO_4$+ $Ca(OH)_2$ b) $CaSO_4$ + $Cu(OH)_2$

c) $CuCO_3$ + $Cu(OH)_2$ d) CuO + CaO

05. Which of the following is ionic in nature?

a) CuF_2 b) $CuCl_2$ c) $CuBr_2$ d) None of these.

06. The number of unpaired electrons in Fe^{3+} (Z=26) are

a) 5 b) 6 c) 3 d) 4

07. Brass is an alloy of

a) Al and Zn b) Cu and Al c) Ni and Zn d) Cu and Zn

08. In Nessler's reagent, the ion present is

a) HgI^{2-} b) HgI_4^{2-} c) Hg^+ d) Hg^{2+}

09. Cuprous ion is colourless while cupric ion is coloured because

a) both have half filled p and d-orbitals

b) cuprous ion has incomplete d-obital and cupric ion has a complete d-orbital

c) both have unpaired electrons in the d-orbitals

d) cuprous ion has complete d-orbital and cupric ion has an incomplete d-orbital.

10. Cuprous ore among the following is

a) chalcopyrites b) azurite c) cuprite d) malachite.

11. In which metal complex central atom is zero valent?

a) $[Pt(NH_3)_2Cl_2]$ b) $[Cu(NH_3)_4]SO_4$ c) $K_3[Fe(CN)_6]$ d) $[Ni(CO)_4]$

12. Pick out the wrong g reaction from

a) $2Na_2CrO_4 + H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

b) $2MnO_4 + 4KOH + O_2 \rightarrow 4KMnO_4 + 2H_2O$

c) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

d) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

13. An atom with atomic number 21 belongs to the category of

a) s-block elements b) p-block elements c) d-block elements d) f-block elements.

14. The number of unpaired electrons in ferrous ion (Z=26) is

a) 3 b) 2 c) 4 d) 5

15. The highest magnetic moment is shown by the transition metal ion with outer electronic configuration

a) $3d^2$ b) $3d^5$ c) $3d^7$ d) $3d^9$

16. Number of moles of $K_2Cr_2O_7$ reduced by one mole of Sn^{2+} ion is

a) 1/3 b) 3 c) 1/6 d) 5

17. Which of the following oxides of Cr is amphoteric?

a) CrO_2 b) Cr_2O_3 c) CrO_5 d) CrO_3

18. The 3d- series starts from

a) Z=21-30 b) Z= 22-30 c) Z=20-30 d) Z=31-40

19. The first element is the 3d-transition series is

a) Sc b) Ti c) V d) Ca

20. Which of the following is not the characteristic of zinc?

a) It is a volatile metal.

b) It dissolves in alkali forming sodium zincate.

c) It is brittle at very high temperatures.

d) Zinc dust is used as a reducing agent.

21. Formation of interstitial compound makes the transition metal

a) more soft b) more ductile c) more metallic

d) more hard.

22. The oxidation number of Fe in Fe_3O_4 is

a) +2 b) +3 c) 8/3 d) 2/3

23. In Cu(Z=29)

a) 13 electrons have spin in one direction and 16 electrons in other direction.

b) 14 electrons have spin in one direction and 15 electrons in other direction.

c) all the electrons have spin in one direction.

d) none of these.

24. Transition metals are often paramagnetic owing to

a) high m.p. and b.p. b) the presence of vacant orbitals

c) the presence of unpaired electrons d) malleability and ductility.

25. $(NH_4)_2SO_4$. $FeSO_4$. $6H_2O$ is

a) mohr's salt b) alum c) blue vitriol d) simple salt.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
a	**b**	**c**	**a**	**a**	**a**	**d**	**b**	**d**	**c**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
d	**b**	**c**	**c**	**b**	**a**	**a**	**a**	**a**	**c**
21	**22**	**23**	**24**	**25**					
d	**c**	**b**	**c**	**a**					

~*~

UNIT 16 : CO-ORDINATION COMPOUNDS

1) The bond between centraf metal ion and ligand in complex compound.
a) coordinate covaler b) covalent c) metallic d) ionic
Answer : a

2) Which of the following points are correct for primary valeney ?
a) It corresponds to Oxidatiom state b) They are non directional
c) It is ionisable d) All of these **Answer : a**

3) The namber of secondary valency in CoCl3 3NH3 is________
a) zero b) one c) six d) three **Answer : c**

4) The number ot mole of AgCl formed when complex CoCl3 4NH3 reacts with AgNO3 is__________
a) three b) zero c) one d) two **Answer : c**

5) Which of the following has higher molar conductance?
a) CoCl3 6NH3 b) CoCl3 5NH3 c) CoCl3 4NH3 d) CoCl 3NH
Answer : a

6) The number of ions formed by the complex K4[Fe(CN)6] is___________
a) three b) fourth c) five **Answer : c**

7) The total charge on the complex CoCl3.5NH3 is____________
a) 2 b) 0 c) 4 d) 6 **Answer : c**

8) Which of the following is not bidentate ligand ?
a) Gly b) C2o4-2 c) O2- d) en **Answer : c**

9) In EDTA, total number of chelating rings are_____________
a) 5 b) 3 c) 4 d) 6 **Answer : a**

10) In triethylene tetrammine the number of donar atoms are________
a) 1 b) 2 c) 3 d) 4 **Answer : d**

11) The coordination number of the metals depends on its following factor are____________
a)charge on its metal ion b) charge on its ligand
c) forces of repulsion between its ligand d) all of these **Answer : d**

12) The correct name [CrCl2 (H2O)4] NO3 is_________
a) dichlorotetraaqueouschromium (III) nitrate
b) tetraaquodichlorochromate (II) nitrate
c) dIchlorotetraaqueouschromium (IV) nitrate
d) tetraaquadichlorochromium (III) nitrate **Answer : d**

13) The correct name for the complex K3 [Fe(C2O4)3] is________
a) potassium ferric Oxalate
b) potassium iron (III) trioxalate
c) potassiuin trioxalato iron (III) d)potassium trioxalatoferrate (III).
Answer : d

14) The correct name tor the complex [Pt(NH3)2 Cl4] is_________
a) platinum diammine tetrachloride b platinum tetrachiorodiammine
c) tetrachlorodiammine platinate (IV) d) diamminetetrachloro platinum (IV)
Answer : d

15) The correct name tor the complex ion Co(en)2 Cl (ONO)+ is
a) cobalt diethylene diamine chloronitrate
b) chlorodiethyldiaminenitrito cobalt (III)
c) chloronitritodiethyldiamine cobaltate (III)
d) chlorobis (ethylenediamine) nitrito cobalt (III) **Answer : d**

16) The correct name for the complex [Cr(NH3)6] [Co(C2O4)3] is_________
a) hexaamminechromium (III) trioxalatocobalt (III)
b) hexaamminechromate (III) trioxalatocobaltate (II)
c) hexaamminechromium (III) trioxalatocobaltate (III)
d) hexaamminechromate (111) trioxalatocobalt (III). **Answer : c**

17) The correct IUPAC name of Mn3 (CO)12 is________
a) dodecacarbonylmanganate (0) c) dodecacarbonyl trimanganese (0)
b) dodecacarbonylmanganic (II) d) manganicdodecacarbonyl (0)
Answer : c

18) The effective atomic number of Cr (atomic no.24) in [Cr (NH3)6] Cl3 is________
a) 35 b) 27 c) 33 d) 36
Answer : c

19) In the metal carbonyls of the general formula M (CO)x where M metal; x=4, the metal is bonded to ?
a) carbon and oxygen b) carbon c) Oxygen d) C-O triple bond
Answer : d

20) The effective atomic number of central Cu (At. No. 29) metal in [Cu (NH,),] SO, is __________
a) 29 b) 30 c) 35 d) 36 **Answer : c**

21) EAN of cobalt is 36 in [Co(NH3)2 02 (en)Cl]. Tnus, O2
a) dioxide b) superoxide ion c) oxide d) peroxide ion
Answer : d

22) which of the folowing statements is in Werners theory
a) primary valency Is the same thing b) secondary valency is the same thing
number as oxidation as Co-ordination
c) secondary valencies are satisfied by-ve ions

d) secondary valencies are directional where as valencies are non directional
Answer : c

23) The number of ions produced from one molecule [PtNH3)5, Cl]Cl3, in the aqueous solution will be______
a) 3 b) 4 c) 5 d) 6 **Answer : b**

24) The complex CoCl3. 5NH3 in aqueous solution in ions to give a total number of ions equal to_______
a) 0 b) 2 c) 4 d) 3 **Answer : d**

25) A solution of potassium ferrocyanide would contain____ions
a) 2 b) 4 c) 3 d) 5 **Answer : d**

26) The complex CoCl3 3NH3 ionizes to give______
a) 1 Cl ions b) 2 C ions c) 3 Cl ions d) No Cl ions **Answer : d**

27) The co-ordination nunmber of a metal in co-ordinat compounds is_____
a) same as primary valency b) sum ot primary and secondary valencies
c) same as secondary valency d) none of the above **Answer : c**

28) According to the postulates of Werner for coordination compounds
a) primary valency is ionisable b) secondary valency is ionizable
c) primary and secondary valencies are non ionizable
d) only primary valency is non-ionizable **Answer : a**

29) Dimethyl glyoxime is used for estimation of ____________
a) nickel b) cobalt c) zinc d) manganese **Answer : a**

30) Cyanide method is used for the extraction of ____________
a) gold b) nickel c) copper d) calcium **Answer : a**

UNIT 17 : ENVIRONMENTAL CHEMISTRY

01. Which of the following statements is false?

a) The lower the concentration of D.O., the more polluted is the water sample.

b) The tolerable limit of lead in drinking water is 50 ppm.

c) Water is considered pure if it has BOD less than 5 ppm.

d) In COD determination, the pollutants resistant to microbial oxidation are not oxidized by oxidizing agents like $K_2Cr_2O_7$.

02. Eutrophication causes reduction in

a) nutrients b) dissolved salts c) dissolved oxygen

d) all the above.

03. Ozone hole is maximum over

a) Europe b) Antarctica c) India d) Africa.

04. The region which greatly affected by air pollution is

a) troposphere b) stratosphere c) mesosphere d) thermosphere.

05. Which of the following statement is false?

a) Photochemical smog causes irritation in eyes.

b) London smog is a mixture of smoke and fog.

c) Photochemical smog results in the formation of PAN.

d) London smog is oxidizing in nature.

06. Which of the following is not regarded as a pollutant?

a) NO_2 b) CO_2 c) SO_2 d) CO.

07. The brown, hazy fumes of photochemical smog are due to

a) nitrogen dioxide b) PAN formation c) aldehydes d) SO_2.

08. a) The main reason for river water pollution is industrial and domestic sewage discharge.

b) Surface water contains a log of organic matter, mineral nutrients and radioactive materials.

c) Oil spill in sea water causes heavy damage to fishery.

d) Oil slick in sea water increases D.O. value.

09. BOD is connected with

a) organic matter b) microbes c) microbes and organic matter d) none of the above

10. Carbon monoxide is harmful to human beings as it

a) is carcinogenic b) is antagonistic to CO_2

c) has higher affinity for haemoglobin as compared to oxygen

d) is destructive to CO_2.

11. Which of the following is responsible for depletion of the ozone layer in the upper strata of the atmosphere?

a) Fullerenes b) Freons c) Polyhalogens d) Ferrocene.

12. Match the lists I and II and pick the correct matching from the codes given below:

	List I		List II
A)	Peroxy acetyl nitrate	1.	Waste incineration
B)	Polycyclie aromatic	2.	Global warming hydrocarbons
C)	Dioxins	3.	Photochemical smog
D)	Indigo	4.	Carcinogens
E)	IR active molecules	5.	Vat dye

	A	B	C	D	E
a)	3	4	1	5	2

b)	1	2	3	4	5
c)	3	5	1	2	4
d)	5	3	1	2	4

13. In Antarctica, ozone depletion is due to the formation of following compound?

a) Acrolein b) Peroxy acetyl nitrate c) SO_2 and SO_3 d) Chlorine nitrate.

14.Ozone in stratosphere is depleted by

a) CF2Cl2 b) C7F16 c) C6H6Cl6 d) C6F6

15.Pick up the correct statement.

a) CO which is major pollutant resulting from the combustion of fuels in automobiles plays a major role in photochemical smog.
b) Classical smog has an oxidizing character while the photochemical smog is reducing in character.
c) Photochemical smog occurs in day time whereas the classical smog occurs in early morning hours.
d) During formation of smog the level of ozone in the atmosphere goes down.

16.Result of ozone hole is

a) Greenhouse effect b) global warming
c) Acid rain d) UV rays reach the earth.

17.Photochemical smog is caused by

a) CO b) CO2 c) O3 d) NO2

18. Acid rains are produced by

a) excess NO2 and SO2 from burning fossil fuels
b) excess production of NH3by industry and coal gas
c) Excess release of carbon monoxide by incomplete combustion.
d) excess formation of CO2by combustion and animal respiration.

19. DDT is

a) Greenhouse gas b) degradable pollutant
c) nondegradable pollutant d) none of the above

20. In creasing skin cancer and high mutation rate are due to

a) acid rain b) ozone depletion c) CO pollution d) CO2pollution.

21.As it passes into food chain, the concentration of DDT

a) remains same b) decreases c) increases d) unpredictable.

22. Which of the following is a biodegradable
a) Plastic b) Sewage c) Asbestos d) Mercury.

23.Atmosphere of big/metropolitan cities is polluted most by
a) automobile exhausts b) pesticide residue c) household waste
d) radioactive fall out

24. The point of temperature inversion between troposphere and ionosphere is called
a) stratopause b) mesopause c) tropopause d) ionopause.

25. Photochemical smog is formed in
a) summer during day time b) summer during morning time
c) winter during morning time d) winter during day time.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
d	**c**	**b**	**a**	**d**	**b**	**a**	**d**	**c**	**c**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
b	**a**	**d**	**a**	**c**	**d**	**d**	**a**	**c**	**b**
21	**22**	**23**	**24**	**25**					
c	**b**	**a**	**c**	**a**					

UNIT 18 :
PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS

01. $ClCH_2COOH$ is heated with fuming HNO_3 in the presence of $AgNO_3$ in Carius tube. After filtration and washing the precipitate, the substance obtained is

a) $AgNO_3$ b) $AgCl$ c) Ag_2SO_4 d) $ClCH_2COOAg$.

02. In Lassaigne's test for N, S and halogens, the organic compound is

a) fused with sodium b) dissolved with sodamide

c) extracted with sodamide d) fused with calcium.

03. The function of boiling the sodium extract with conc. HNO_3 before testing for halogens is

a) to make solution clear b) to destroy CN^- and S^{2-} ions which will otherwise give precipitate c) to make the solution acidic d) to convert $Fe^{2+}$to Fe^{3+}

04. Positive Beilstein test shows that

a) halogens are surely present b) halogens are absent

c) halogens may be present d) none of these.

05. Sodium extract prepared by using thiourea contains which ion in the solution, mainly responsible for a characteristic test?

a) NaCN b) Na_2S c) NaCNS d) Na_2SO_4

06. In Lassaigne's test sodium metal is used because

a) it is very reactive b) its melting point is low

c) its compounds are soluble in water d) all the above.

07. The sodium extract on acidification with acetic acid and then adding lead acetate solution gives a black precipitate. The organic compound contains

a) nitrogen b) halogen c) sulphur d) phosphorous.

08. During Lassaigne's test, N and S present in an organic compound changes into

a) NaCN and Na_2S b) NaSCN c) Na_2SO_4 and NaCN d) Na_2S and NaCNO.

09. If an adding $FeCl_3$ solution to acidified Lassaigne solution, a blood red colouration is produced, it indicates the presence of

a) S b) N c) N and S d) S and Cl.

10. Sodium nitroprusside when added to an alkaline solution of sulphide ions produces a

a) red colouration b) blue colouration c) purple colouration d) brown colouration.

11. In a Lassaigne's test for sulphur in the organic compound with sodium nitroprusside solution the purple colour formed is due to

a) $Na_4[Fe(CN)_5NOS]$ b) $Na_3[Fe(CN)_5S]$ c) $Na_2[Fe(CN)_5NOS]$ d) $Na_3[Fe(CN)_6]$.

12. In Lassaigne's test for nitrogen, the blue colour is due to the formation of

a) potassium ferrocyanide b) sodium cyanide

c) sodium ferrocyanide d) ferriferrocyanide.

13. Which of the following compounds does not show Lassaigne's test for nitrogen?

a) Urea b) Hydrazine c) Phenylhydrazine d) Azobenzene.

14. An organic substance from its aqueous solution can be separated by

a) solvent extraction b) steam distillation

c) distillation d) fractional distillation

15. Which reagent is useful in separating benzoic acid from phenol?

a) Dilute HCl b) dilute H_2SO_4 c) 5% NaOH d) 5% $NaHCO_3$

16. Separation of petroleum into its components is mostly done by
a) chromatography b) sublimation
c) distillation under reduced pressure d) fractional distillation.

17. Simple distillation can be used to separate
a) a mixture of benzene (boiling point 80^0C) and toluene (boiling point 110^0C)
b) a mixture of ether (boiling point 30^0C) and toluene (boiling point 110^0C)
c) a mixture of ethanol (boiling point 78^0C) and water (boiling point 100^0C)
d) none of these.

18. Turpentine oil can be purified by
a) vacuum distillation b) fractional distillation c) steam distillation
d) simple distillation

19. Raw juice in sugar factories is generally concentrated by
a) vacuum distillation b) steam distillation c) sublimation
d) crystallization.

20. A bottle containing two immiscible liquids is
a) Fractionating column b) Separating funnel
c) Fractional distillation d) Steam distillation.

21. In steam distillation of toluene, the pressure of toluene in vapour is
a) equal to pressure of barometer b) less than pressure of barometer
c) equal to vapour pressure of toluene in simple distillation
d) more than vapour pressure of toluene in simple distillation.

22. Some organic compounds are purified by distillation at low pressure because the compounds are

a) low boiling liquids b) high boiling liquids
c) highly volatile d) dissociated before reaching their boiling points.

23. Chromatographic techniques of purification can be used for
a) coloured compounds b) liquids c) solids d) all of these

24. In steam distillation, the vapour pressure of the volatile organic compounds is
a) equal to atmospheric pressure b) less than atmospheric pressure
c)more than atmospheric pressure d) none of these.

25. Which method cannot be used for purification of liquids?
a) Chromatographic b) Steam distillation c) Sublimation
d) Distillation.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
b	**a**	**b**	**c**	**c**	**d**	**c**	**a**	**c**	**c**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	**d**	**b**	**a**	**d**	**d**	**b**	**c**	**a**	**b**
21	**22**	**23**	**24**	**25**					
b	**d**	**d**	**b**	**c**					

UNIT 19 : SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

Q1. Which carbon isotope is used in obtaining relative atomic masses?

1. Carbon-12 2. Carbon-13 3. Carbon-14
4. None of the above

Answer: (a), The carbon-12 isotope is used to obtain relative atomic masses.

Q2. What is the relation between the molar mass and the vapour density of a gas?

1. Molar mass = Vapour density / 2
2. Molar mass = 2 × Vapour density
3. Molar mass = Vapour density
4. No relation

Answer: (b), Molar mass = 2 × Vapour density.

Q3. How many significant figures are there in 7070×10^7?

1. Two
2. Four
3. Seven
4. Can't be determined

Answer: There are four significant figures in 7070×10^7.

Q4. What do you mean by the term significant figure?

Answer: Significant figures refers to the digits that carry a meaning towards the resolution of the measurement.

For example, 3600 has two significant figures. In contrast, 36.00 has four significant figures.

Q5. What is gay lussac's law of combining volumes?

Answer: The gay lussac's law of combining volumes states that the relative volumes of gases are in the ratio of small whole numbers at constant temperature and pressure.

Q6. What is the volume of 6.022×10^{23} molecules of hydrogen at NTP?

1. 22.4 litres
2. 11.2 litres
3. 1 litre
4. 2 litres

Answer: (a), 6.022×10^{23} molecules of hydrogen contain 22.4 litres of hydrogen.

Q7. What is the molarity of a solution containing 5.85 g of NaCl(s) in a 500 mL solution?

Answer: Given

Mass of solute = 5.85 g

Volume of solution 500 ml

Molar mass of NaCl = 23 + 35.5 = 58.5

No. of moles of solute = Mass of solute / Molar mass of solute

No. of moles of solute = 5.85 / 58.5

No. of moles of solute = 0.1

Molarity = No. of the mole of solute / Volume of solution

Molarity = 0.1 / 0.5 = 0.2 mol / L

Q8. What is the mass of one atom of C-12 (in grams)?

Answer: Mass of 1 mole of C-12 atoms = 12 g

1 mole of C-12 atoms contains 6.022×10^{23} atoms.

Thus, the mass of one atom of C-12 will be = $12 / (6.022 \times 10^{23})$.

Mass of one atom of C-12 = $1.99 \text{ X } 10^{-23}$ g

Q9. What is the law of multiple proportions?

Answer: Law of multiple proportions was given by English chemist John Dalton. He states that when two elements combine to form one or more compounds. Then the weight of one element that combines with the fixed weight of other elements is in the small whole-number ratio.

Q10. What are the postulates of dalton's atomic theory?

Answer: The postulates of dalton's atomic theory are mentioned below.

- He states that the atom is indivisible, i.e. we can not further subdivide it.
- He states that all atoms of the same element are identical.
- He states that different elements have different types of atoms.
- Compounds are formed when atoms of different elements join in a simple whole-number ratio.

Q11. What are the demerits of dalton's atomic theory?

Answer: The demerits of dalton's atomic theory are mentioned below.

- He states that an atom is indivisible, but we can further sub-divide the atom into electron protons and neutrons.
- He states that atoms of different elements combine in a simple whole-number ratio, but this concept failed to explain sugar molecule combination ($C_{12}H_{22}O_{11}$).
- He failed to explain the existence of isotopes, isobars and allotropes.

Q12. Match the following.

Column I	Column II
1 mol of any gas	3 mol
88 g of CO_2	1 mol
5.6 litres of O_2 at STP	0.25 mol
6.022 x 10^{23} molecules of H_2O	2 mol
96 g of O	6.022 X 10^{23} molecules

Answer:

Column I	Column II
1 mol of any gas	6.022 X 10^{23} molecules
88 g of CO_2	2 mol
5.6 litres of O_2 at STP	0.25 mol
6.022 x 10^{23} molecules of H_2O	1 mol
96 g of O	3 mol

Q13. What are the differences between molarity and molality?

Answer:

S. No.	Molarity	Normality
1.	Molarity is the number of moles of compound present in 1 litre of solution.	Molality is the number of moles of solute present in 1 kilogram of a solvent.
2.	Its unit is mol / L.	Its unit is mol / kg.
3.	It is dependent on the temperature, volume and solubility of the solute.	It depends on the mass and is independent of temperature and volume.

Q14. What are the differences between molarity and normality?

Answer:

S. No.	**Molarity**	**Normality**
1.	**Molarity is the number of moles of compound present in 1 litre of solution.**	**Normality is the gram equivalent of solute present in 1 litre of solution.**
2.	**Its unit is mol / L.**	**Its unit is eq / L or meq / L.**
3.	**It does not depend on the type of reaction the solute undergoes.**	**It depends on the kind of reaction the solute undergoes.**
4.	**It is dependent on the temperature, volume and solubility of the solute.**	**It is dependent on reactive species present in the solution.**

Q15. Match the following physical quantities with their corresponding units.

Column I	**Column II**
Luminous intensity	**mol / L**
Mole	**kg**
Pressure	**Unitless**
Mole fraction	**Pascal**
Mass	**mol**
Molarity	**Candela**

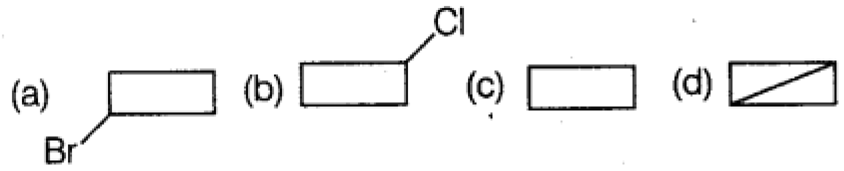
Answer:

Column I	Column II
Luminous intensity	Candela
Mole	mol
Pressure	Pascal
Mole fraction	Unitless
Mass	kg
Molarity	mol / L

UNIT 20 : HYDROCARBONS

Question 1:
By Wurtz reaction, a mixture of methyl iodide and ethyl iodide give
(a) butane
(b) ethane
(c) propane
(d) a mixture of the above three

Question 2:
What would be the product formed when 1-bromo-3-chlorocyclobutane reacts with two equivalents of metallic sodium in ether?



Question 3:
Formation of alkane by the action of zinc on alkyl halide is calle
(a) Wurtz reaction
(b) Kolbe's reaction
(c) Ulmann's reaction
(d) Frankland reaction

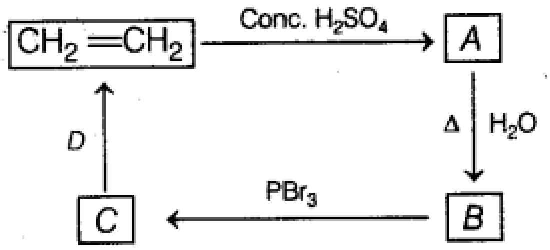
Question 4:
Which isomer of hexane has only two different sets of structurally equivalent hydrogen atoms?
(a) 2,2-dimethylbutane
(b) 2-methylpentane
(c) 3-methylpentane
(d) 2,3-dimethylbutane

Question 5:
The increasing order of reduction of alkyl halides with zinc and dilute HCl is
(a)R— C<R — I<R —Br
(b)R—Cl<R—Br<R — I
(c)R — I<R — Br<R—Cl
(d)R—Br<R — I<R—Cl

Question 6:
Ozonolysis of an organic compounds gives formaldehyde as one of the products. This confirms the presence of
(a) two ethylenic double bonds
(b) a vinyl group
(c) an iso-propyl group
(d) an acetylenic triple bond

Question 7:

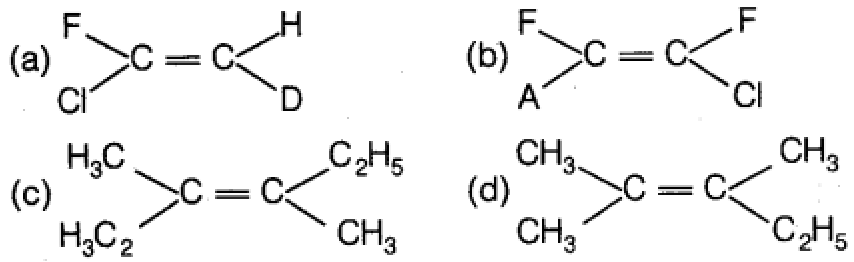
Identify *B* and *D* in the following sequence of reactions



(a) Methanol and bromoethane
(b) Ethyl hydrogen sulphate and alcoholic KOH
(c) Ethyl hydrogen sulphate and aqueous KOH
(d) Ethanol and alcoholic KOH

Question 8:

Which of the following will not show geometrical isomerism? **[NCERT Exemplar]**



Question 9:

A gas which reacts with aqueous KMn04 solution but does not give precipitates with ammoniacal Cu2Cl2 solution i

(a) ethylene
(b) methane
(c) acetylene
(d) ethane

Question 10:

Addition of HI on double bond of propene yields isopropyl iodide as major product. It is because the addition proceeds through

(a) more stable carbocation
(b) more stable carboanion
(c) homolysis
(d) more stable free radical

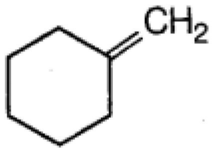
Question 11:

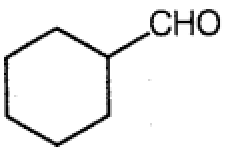
Which does not follow Markownikoff's rule?

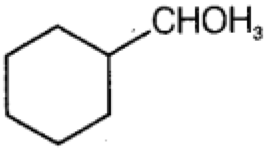
(a) $CH_3-CH=CH_2$ (b) $CF_3CH=CH_2$

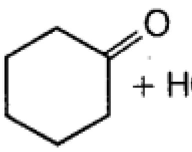
(c) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH_2$ (d) $CH_3-CH_2-CH=CH_2$

Question 12:

 on ozonolysis gives

(a) 

(b) 

(c)  + HCHO

(d) None of these

Question 13:
Arrange the following hydrogen halides in the order of their decreasing reactivity with propene

(a) HCl > HBr > HI
(b) HBr > HI > HCl
(c) HI > HBr > HCl
(d) HCl > HI > HBr

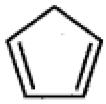
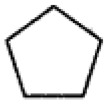
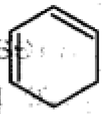
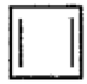
Question 14:
Acid catalysed hydration of alkenes except ethene leads to the formation of
(a) primary alcohol
(b) secondary or tertiary alcohol
(c) mixture of primary and secondary alcohols
(d) mixture of secondary and tertiary alcohols

Question 15:
The reaction of propene with HOCl proceeds *via* the addition of
(a) H^+ in the first step
(b) Cl^+ and OH^- in a single step
(c) OH^- in the first step
(d) Cl^+ in the first step

Question 16:
The best method to prepare cyclohexene from cyclohexanol is by using
(a) HBr
(b) cone. H3P04
(c) cone. HCI + ZnCI2
(d) cone. HCI

Question 17:

Ozonolysis products of an olefin are $\begin{array}{c} CHO \\ | \\ CHO \end{array}$ and $\begin{array}{c} CH_2CHO \\ | \\ CH_2CHO \end{array}$ olefin is

(a)  (b)  (c)  (d) 

Question 18:

Predict the product *C* obtained in the following reaction of butyne-1.

$$CH_3CH_2—C \equiv CH + HCl \longrightarrow B \xrightarrow{HI} C$$

(a) $CH_3—\underset{\underset{Cl}{|}}{CH}—CH_2—CH_2I$

(b) $CH_3—CH_2—CH_2—\underset{\underset{Cl}{|}}{CHI}$

(c) $CH_3—CH_2—\overset{\overset{I}{|}}{CH}—CH_2Cl$

(d) $CH_3CH_2—\overset{\overset{I}{|}}{\underset{\underset{Cl}{|}}{C}}—CH_3$

Question 19:
The enthalpy of combustion of H2, cyclohexene and cyclohexane are-241 ,-3800 and -3920 kJ per mol respectively. Heat of hydrogenation of cyclohexene is
(a) – 121 kJ per mol
(b) + 121 kJ per mol
(c) + 242 kJ per mol
(d) – 242 kJ per mol

Question 20:

2-hexyne gives *trans*-2-hexene on treatment with

(a) Pt / H_2
(b) Li / NH_3
(c) $Pd / BaSO_4$
(d) $LiAlH_4$

Question 21:

Products of the following reaction are

$$CH_3 \equiv C \cdot CH_2CH_3 \xrightarrow[\text{(ii) Hydrolysis}]{\text{(i) } O_3}$$

(a) $CH_3CHO + CH_3CH_2CHO$
(b) $CH_3COOH + CH_3COCH_3$
(c) $CH_3COOH + HOOC \cdot CH_2CH_3$
(d) $CH_3COOH + CO_2$

Question 22:

$$CaC_2 + H_2O \longrightarrow A \xrightarrow{H_2SO_4/HgSO_4} B$$

Identify *A* and *B* in the given reaction

(a) C_2H_2 and CH_3CHO (b) CH_4 and $HCOOH$
(c) C_2H_4 and CH_3COOH (d) C_2H_2 and CH_3COOH

Question 23:

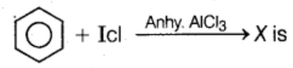
The compound '*C*' in the following reaction is

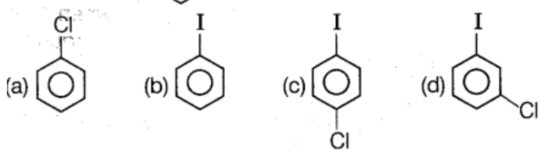
$$C_7H_8 \xrightarrow{3\,Cl_2/\Delta} A \xrightarrow{Br_2/Fe} B \xrightarrow{Zn/HCl} C$$

(a) *o*-bromotoluene
(b) *m*-bromotoluene
(c) *p*-bromotoluene
(d) 3-bromo-2, 4, 6-trichlorotoluene

Question 24:

. The compound *X* in the reaction,





Question 25:

Isopropyl benzene on air oxidation in the presence of dilute acid give

(a) C6H5COOH (c) C6H5CHO
(b) C6H5COCH3 (d) C6H5OH

Asnwers:

1 .d	2 .d	3.d	4.d	5.b	6.b	7.d	8.d	9.a	10.a
11.b	12.c	13.c	14.b	15. d	16.b	17.c	18.d	19.a	20.b
21.c	22.a	23.c	24.b	25.d					

UNIT 21 : ORGANIC COMPOUNDS CONTAINING HALOGENS

01. For a given alkyl group, the densities, boiling point, melting point are in the order

a) RI<RBr < RCl   b) RI < RCl< RBr

c) RBr< RI<RCl   d) RCl < RBr < RI.

02. An alkyl halide may be converted into an alcohol by

a) addition   b) substitution   c) dehydrohalogenation

d) elimination

03. In the reaction,

$$CH_3 \equiv C^- Na^+ + (CH_3)_2\, CHCl \longrightarrow ?$$

The product formed is

a) 4-methyl -2-pentyne   b) propyne   c) propyne and propene

d) none of these.

04. Most readily hydrolysed halide is

a) C_6H_5Cl b) $(C_6H_5)_2CHCl$ c) $C_6H_5CH_2Cl$ d) $(C_6H_5)_3CCl$.

05. Isobutyl chloride and butyl chloride are

a) position isomers b) chain isomers   c) functional isomers   d) metamers.

06. $CH_3CHCH_2CH_3 \xrightarrow[475K]{H_2SO_4}$ $\longrightarrow CH_3 – CH = CH – CH_3$

$\longrightarrow CH_2 = CHCH_2CH_3$

a) $cH_3 – CH = CH – CH_3$ predominates   b) $CH_2 = CH – CH_2 – CH_3$ predominates

c) both are formed in equal amounts   d) The product ratio is dependent on the halogen X .

07. Chlorine is most reactive towards NaOH in

a)CH_3Cl b) $CH_2 = CHCl$ c) C_6H_5Cl d) $C_6H_5CH_2Cl$

08. Alkyl halides on treatment with a suspension of Ag_2O moist in ether gives

a) alkanol b) alkanal c) alkanes d) alkoxy alkane.

09. Iso-butyll magnesium bromide with dry ether and absolute alcohol gives

a) $CH_3 - CH - CH_2OH$ and $CH_3 - CH_2MgBr$ b) $CH_3 - CH - CH_2 - CH_3$ and Mg(OH)Br

| |
CH_3 CH_3

c) $CH_3 - CH_2 - CH_3$, $CH_2 = CH_2$ and Mg(OH) Br d) $CH_3 - CH - CH_3$ and CH_3 cH_2OMgBr CH_3

10. Formation of alkane by the action of Zn on alkyl halide is called

a) Wurtz reaction b) Kolbe's reaction

c) Cannizzaro's reaction d) Frankland reaction.

11. $C_2H_5Br \xrightarrow{KCN} (A) \xrightarrow{Hydrolysis} (B)$

The compound (B) in above reaction is

a) ethylene chloride b) acetic acid c) propionic acid d) ethyl cyanide.

12. The product obtained on treatment of ethyl chloride with potassium cyanide is reduced by sodium and alcohol to give a) propyl amine b) ethyl amine c) dithyl amine d) acetic acid.

13. Which group is displaced by a halogen group?

a) Hydroxyl (OH) group b) Aldehyde (-CHO) group

c) Carboxylic group (-COOH) d) Keto ($>$CO) group

14. Which reagent is useful in increasing the carbon chain of an alkyl halide?

a) HCN b) KCN c) NH_4CN d) AgCN.

15. Identify (Z) in the following reaction series,

$$C_2H_5I \xrightarrow[KOH]{Alcoholic} (X) \xrightarrow{Br_2} (Y) \xrightarrow{KCN} (Z)$$

a) $CH_3 - CH_2 - CN$

b) $\begin{array}{ccc} CH_2 & - & CH_2 \\ | & & | \\ CN & & CN \end{array}$

c) $\begin{array}{ccc} CH_2 & - & CH_2 \\ | & & | \\ Br & & CN \end{array}$

d) $\begin{array}{ccc} CH & = & CH \\ | & & | \\ Br & & CN \end{array}$

16. The products of reaction of alcoholic silver nitrite with ethyl bromide are

a) ethane b) ethene c) ethyl alcohol d) nitroethane.

17. The reaction, $RCl + NaI \xrightarrow{Acetone} R\text{-}I + NaCl$ is known as

a) Wurtz's reaction b) Fitting reaction c) Frankland's reaction d) Finkelstein's reaction.

18. 2-Bromopentane is heated with potassium ethoxide in ethanol. The major product is

a) trans-Pent-2- ene b) 2-Ethoxy pentane c) Pent-1-ene

d) cis-Pent-2-ene.

19. A mixture of sodium acetate and soda lime is heated and the product treated with excess of chlorine in presence of bright sunlight. The product is

a) CH_3COOH b) $CH_2ClCOOH$ c) CCl_4 d) CH_3Cl

20. $CH_2 = CHCl$ reacts with HCl to form

a) $CH_2Cl - CH_2Cl$ b) $CH_3\text{-}CHCl_2$ c) $CH_2 = CHCl.\ HCl$

d) none of these

21. The reactivities of methyl chloride (A), propyl chloride (B) and chlorobenzene (C) are in the order a) A > B > C b) C > B > A c) A > C > B

d) B > A > C

22. A mixture of 1-chloropropane and 2-chloropropane when treated with alcoholic KOH, it gives

a) 1-Propene b) 2-Propene c) Iso-propylene d) A mixture of 1-propene and 2-propene.

23. Treatment of ammonia with excess of ethyl chloride will yield

a) diethyl amine b) ethane c) tetraethylammonium chloride

d) methyl amine.

24. The IUPAC name of the compound,

CH_3 > C- Br
CH_3 | is
$CH_2 – CH_2$ Br

a) 1, 3 Dibromo-3-methylbuttane b) 3-Methyl-1, 2-dibromobuane

c) 3-Methyl-1, 3-dibromopropane d) None of these.

25. The correct order of melting and boiling points of the primary (P), secondary (S), and tertiary (T) alkyl halides is a) P > S > T b) T > S > P c) S>T> P d) T>P>S

~*~

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
d	**b**	**a**	**d**	**b**	**a**	**d**	**d**	**d**	**d**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	**a**	**a**	**b**	**b**	**d**	**d**	**a**	**c**	**b**
21	**22**	**23**	**24**	**25**					
a	**a**	**c**	**a**	**a**					

Unit 22 : Organic Compounds Containing Oxygen

1) In phenol the term phenol is used for________
a) phenolic smell b) benzene c) phenopthalene
d) antisepic **Answer- : b**

2) Which of the following has lowest pka value?
a) phenol b) ethanol c) m-nitrophenol
d) para nitrophenol **Answer- : d**

3) The role of sulphuric acid in nitrating mixture is_________
a) dehydrating agent b) catalyst
c) to provide NO2 ion from nitric acid
d) act as base **Answer -: c**

4) In which of the following reaction 2-hydroxy benzaldehyde is prepared from phenol
a) Kolbe's reaction b) Reimer and Tiemann's reaction
c) diazotization reaction d) Raschig reaction **Answer- : b**

5) In the colour test of phenol with neutral FeCl3 the purple colour is developed due to the formation of_______
a) chlorobenzene b) ferrous phenoxide ion
c) feric phenoxide ion d) feric hydroxide ion **Answer- : c**

6) The derivative of phenol which is used as a selective weedkiller is_________
a) phenol formaldehyde polymer b) picric acid
c) 2,4-dichlorophenoxy acetic acid **Answer- : d**

7) The general formula Cn H2n+2O represent for_______
a) aliphatic ethers
b) aromatic hydroxy compounds
c) aldehydes and ketones
d) aromatic ethers
Answer- : d

8) In ethers the bond length of C-O bond is_______
a) 136 pm
b) 139 pm
c) 141 pm
d) 121pm
Answer- : c

9) Which of the following isomerism is a special type ot position isomerism?
a) metamerism b) tautomerism C) conformational isomerism
d) optical isomerism **Answer- : a**

10) The bond length of C-O bond in methyl alcohol is _______
a) 96 pm b) 142 pm C) 120 pm d) 154 pm **Answer- : b**

11) Which of the following reagent 1s not used to convert alkyl halide into alcohol
a) caustic soda solution (aqueous) b) aqueous caustic potash
c) moist Ag,O d) dry silver oxide **Answer- : d**

12) On treatment with conc. sulphuric acid followed hydrolysis propylene and ethylene respectively gives-______
a)-propanol and ethanol b) 2-butanol and ethanol
c) ethanal and 2-propanol d) 2-propanol and ethanol **Answer- : d**

13) Which of the following is not a suitable reagent for the conversion of aldehydes and ketones into primary secondary alcohols respectively
a) Na-Hg/HO b) Zn/HCI (alcoholic) c) conc. H2SO4
d) H/Raney Ni **Answer- : c**

14) Hydration of alkenes except ethene produces-________
a) 2° alcohols b) 1° and 3° alcohols c) 3° alcohols
d) 2° and 3° alcohols **Answer- : d**

15)Unknown compound X on hydration by conc. H2S04 gives' Y. the compound Y on Oxidation gives acetone The compound X is,
a) CH3CH=CH2 b) CH3CHOHCH3 c) CH3CH2OH d) CH2=CH2
Answer- : a

16) Formaldehyde when treated with Grignard 's reagent and the adduct after acid hydrolysis gives_______
a) secondary alcohol b) dihydric alcohol c) primary alcohol
d) tertiary alcohol **Answer- : c**

17) When acetone is treated with methyl magnesium iodide in etheral medium and Mg-complex is hydrolysed in acid medium gives_______
a) iso-propyl alcohol b)tert-butyl alcohol c) sec-butyl alcohol
d n-butyl alcohol **Answer- : b**

18) which of the following is not a characteristic Of alcohol ?
a) Lower members are insoluble in water but solubility regularly increases with molecular weight b) They are lighter than water
c) lower members have a pleasant smell and burning taste, higher members are odourless and tasteless d) Their B.P. rise fairly uniformly with rising molecular weight
Answer- : b

19) Alcohols forms hydrogen bonding____
a) only among themselves b) only with water
c) in chloroform d) both 'a' and 'b' **Answer- : d**

20) As the number of -OH groups in alcohol increases_____
a) boiling point decreases b) viscosity decreases
c) density decreases d) boiling point increases **Answer- : d**

21) In which of the following compounds, hydrogen bonding is maximum
a) $C2H5Cl$ b) $C2H5NH2$ c) $C2H5OH$ d) $C2H5-O-C2H5$
Answer- : c

22) Which of the following compound has highest boiling point?
a) 1-butanol b) iso-butyl alcohol c) 2-butanol d) tert-butyl alcohol
Answer- : d

23) Phenol reacts with bromine in CS2 at low temperature to give,______
a) m-bromophenol b) p-bromophenol c) 0-and p-bromophenols
d) 2,4,0-tribromopheno **Answer- : c**

24) Phenol is treated with bromine water and shaken well.The white precipitate formed during process is_______
a) m-bromophenol b) 2,4-dibromophenol c) 2,4,6-tribromophenol
d) a mixture of o- and p- bromophenols **Answer- : c**

25) In the nitration of phenol with a mixture of conc. HNO3 and conc. H2SO4 the active species involved is______
a) nitrite ion b) nitronium ion (NO2+,) c) nitrate ion d) none
Answer- : b

26) Molar ratio of phenol and bromine in aqueous solution of bromination of phenol is_____
a) I:3 b) 2:3 c) 3:1 d) 3:2 **Answer- : a**

27) In the reaction of phenol with CHCl3 and aqueous NaOH at 70°C (343 K), the electrophile attacking the ring
a) CHCl3 b) CHCl2, c) COCl2 d) :CCl2 **Answer- : d**

28) The reaction of phenol with conc. HNO3 and conc H2SO4 gives_______
a) o phenol sulphonic acid b) P phenol sulphonic acid
c) 2,4,6-trinitro phenol d) 2,4,6-trinitrobenzene **Answer- : c**

29) Phenol and benzoic acid can be distinguished by_______
a) aq. NaHCO3 b) aq. NaNO3, c) aq. NaOH d) conc. H2SO4
Answer- : a

30) In the preparation of ethers by Williamson Synthesis the most convenient pairs are______
a) a primary alkylhalide and the alkoxy off tetiary alcohol
b) a secondary alkylhalide and the alkoxy of tertiary alcohol
c) a tertiary alkylhalide and the alkoxy of tertiary alcohol
d) a primary alkylhalide and the alkoxy of primary alcohol **Answer- : a**

UNIT : 23 ORGANIC COMPOUNDS CONTAINING NITROGEN

01. Tautomerism will be exhibited by

a) $(CH_3)_3CNO$ b) $(CH_3)_2NH$ c) R_3CNO_2

d) RCH_2NO_2

02. Tertiary nitro compounds do not tautomerise because

a) there is no double bond b) there is no α - hydrogen

c) oxygen is more electronegative than hydrogen d) all of the above.

03. Attacking species in nitration of benzene in presence of fuming HNO_3 is

a) SO_3 b) SO_3^+ c) NO_3^- d) NO_3^+

04. Which reaction sequence would be best to prepare 3-chloronaniline from benzene?

a) Chlorination, nitration, reduction b) Nitration, chlorination, reduction

c) Nitration, reduction, chlorination d) nitration, reduction, acetylation, chlorination, hydrolysis.

05. The compound that is most reactive towards electrophilic nitration is

a) Toluene b) Benzene c) Benzoic acid d) Nitrobenzene.

06. What is the end product in the following sequence of operations?

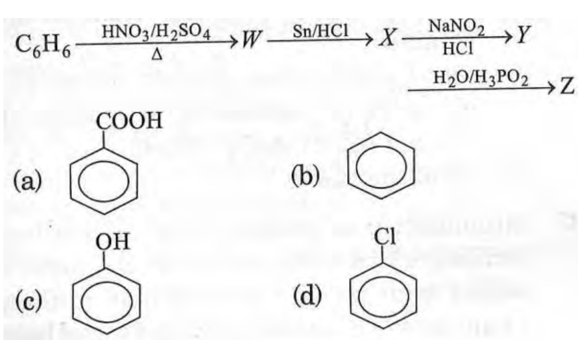
$$C_2H_5NH_2 \xrightarrow{HNO_2} A \xrightarrow{PCl_5} B \xrightarrow{NH_3} C$$

a) Ethyl cyanide b) Methylamine c) Ethylamine d) Acetamide

07. On reduction, secondary amine is given by

a) nitrobenzene b) methyl cyanide c) nitroethane d) methyl isocyanide.

08. 'Z' in the following sequence of reactions is



09. Chloropicrin is obtained by the reaction of

a) steam on carbon tetrachloride b) nitric acid on chlorobenzene

c) chlorine on picric acid d) nitric acid on chloroform.

10. Primary an secondary amines are distinguished by

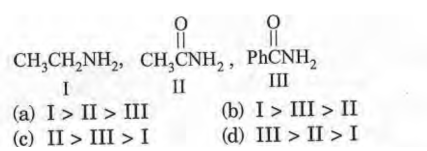
a) Br_2/KOH b) HClO c) HNO_2 d) NH_3

11. Indicate which nitrogen compound amongst the following would undergo Hofmann bromamide reaction (i.e., reaction with $Br_2$and strong KOH) to furnish the primary amine ($R\text{-}NH_2$)?

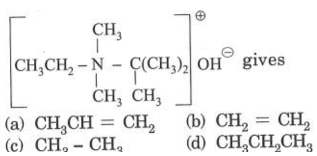
a) $RCONHCH_3$ b) $RCOONH_4$ c) $RCONH_2$

d) R - CO –NHOH

12. Basic nature of the following is in order:



13. Thermal decomposition of

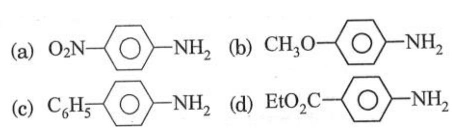


14. A primary amine can be distinguished from secondary and tertiary amines by

a) carbylamine reaction b) reaction with methyl iodide

c) reaction with acetyl chloride d) none of the above.

15. Which of the following is least alkaline?



16. Maximum pK_b value is of

17. $C_2H_3Cl \xrightarrow{NaCN} X \xrightarrow{Ni/H_2} Y \xrightarrow{Acetic\ anhydride} Z$

Z in the above reaction sequence is

a) $CH_3CH_2CH_2NHCOCH_3$ b) $CH_3CH_2CH_2NH_2$

c) $CH_3CH_2CH_2CONHCH_3$ d) $CH_3CH_2CONHCOCH_3$

18. Which is most basic?

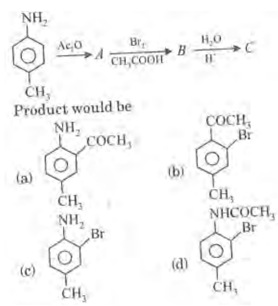
a) $C_6H_5NH_2$ b) $(C_6H_5)_2NH$ c) CH_3NH_2

d) $(CH_3)_2NH$

19. The compound that will react most readily with NaOH to form methanol is

a) $(CH_3)_4N^+I^-$ b) CH_3OCH_3 c) $(CH_3)_3S^+I^-$ d) $(CH_3)_3CCl$

20.



21. Among the following the weakest base is

a) $C_6H_5CH_2NH_2$ b) $C_6H_5CH_2NHCH_3$ c) $O_2NCH_2NH_2$ d) CH_3NHCHO

22. Which of the following on reduction with hydrogen and Raney nickel gives bezylamine?

a) Benzonitrile b) Acetonitrile c) Propionitrile d) Butyronitrile.

23. Ethylamine can be obtained from methyl iodide by reaction with alcoholic KCN followed by

a) hydrolysis b) reduction c) oxidation d) reaction with ammonia

24. Which of the following amides will not undergo Hofmann bromamide reaction?

a) CH_3CONH_2 b) $CH_3CH_2CONH_2$ c) $C_6H_5CONH_2$ d) $CH_3CONHCH_3$

25. Which of the following reagents can be used to convert primary amides into primary amines containing the same number of carbon atoms?

a) Br_2 +NaOH b) $LiAlH_4$ c) Sn + HCl d) Ni/H_2

~*~

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
d	**b**	**d**	**b**	**a**	**c**	**d**	**b**	**d**	**c**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
c	**a**	**b**	**a**	**a**	**d**	**a**	**d**	**a**	**c**
21	**22**	**23**	**24**	**25**					
d	**a**	**b**	**d**	**b**					

UNIT : 24 POLYMERS

01. Which of the following is a polyamide?

a) Nylon b) Orlon c) Teflon d) Terylene.

02. An example of natural biopolymer is

a) Teflon b) Nylon -6, 6 c) Rubber

d) DNA

03. Which of the following is used to make non-stick cookware?

a) PVC b) Polystyrene c) Polyethylene (terephthalate)

d) Polytetrafluoroethylene

.

04. Ziegler –Natta catalyst is

a) $K[PtCl_3(C_2H_4)]$ b) $[(Ph)_3Pl_3RhCl$ c) $Al(C_2H_5)_3$ $TiCl_4$ d) $Fe(C_6H_5)_2$

05. Soft drinks and baby feeding bottles are generally made up of

a) polyester b) polyurethane c) polystyrene

d) polyamide.

06. Polyvinyl alcohol can be prepared by

a) polymerization of vinyl alcohol

b) alkaline hydrolysis of polyvinyl acetate

c) polymerization of nectylene

d) reaction of acetylene with H_2SO_4in presence of $HgSO_4$

07. Monomer of $\left[-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2- \right]_n$ is

a) 2-Methylpropene b) styrene c) propylene d) ethene.

08. Cellulose acetate is a

a) natural rubber b) semi-synthetic polymer

c) synthetic polymer d) plasticizer.

09. Whhich of the following has ester linkage?

a) Nylon b) Bakelie c) Terylene d) PVC.

10. Which of the following is a biodegradable polymer?

a) Cellulose b) Polythene c) Polyvinyl chloride

d) Nylon-6.

11. The substance used to harden the rubber for tyre manufacture is

a) wax b) 1, 3-Butadiene c) CaC_2 d) carbon black.

12. The number average molecular mass and mass average molecular mass of a polymer are respectively 30,000 and 40,000. The polydispersity index of the polymer is

a) <1 b) >1 c) 1 d) 0

13. PMMA is the polymer of

a) methyl ethacrylate b) methacrylate c) methylacrylate

d) Ethylacrylate.

14. The turbidity of a polymer solutin measures

a) light absorbed by solution

b) light transmitted by the solution

c) light scattered by the solution d) none of the above.

15. The raw material to form nylon is

a) adipic acid b) butadiene c) isoprene d) ethylene.

16. Which one of the following pairs is not correctly matched?

a) Terylene-condensation polymer of terephthalic acid and ethylene glycol

b) Teflon-thermally stable cross-linkeed polymer of phenol and formaldehyde

c) Perspex homopolymer of methylmethacrylate

d) Synthetic rubber –a copolymer of butadiene ad styrene.

17. Glyptal polymer is obtained from glycerol on reacting with

a) malonic acid b) phhthalic acid c) maleic acid

d) acetic acid.

18. Co-polymer is

a) Nylon-6 b) Nylon-6,6 c) PMMA

d) Polyethylene.

19. The process involving heating of rubber with sulphur is called

a) galvanization b) vuleanization c) bessemerisation

d) sulphonation.

20. Which one is a polymeric compound?

a) SO_2 b) CO_2 c) CH_4 d) PVC.

21. Which of the following is used in paints?

a) Terylene b) Nylon c) Glyptal

d) Chloroprene.

22. Which of the following is used in tyre cords?

a) Terylene b) Bakelite c) Rubber

d) Nylon.

23. Which of the following is a chain growth polymer?

a) Starch b) Nucleic acid c) Polystyrene

d) Protein.

24. Give the monomers of nylon-6, 6.

a) Butadiene and acrylonitrile b) Ethylene glycol and terephthalic acid

c) hexamethylenediamine and adipic acid d) Melamine and formaldehyde.

25. Peptide bond is a key feature in

a) polysaccharide b) Proteins c) nucleotide d) vitamins.

~*~

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
a	**d**	**d**	**c**	**c**	**b**	**a**	**b**	**c**	**a**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
d	**b**	**a**	**c**	**a**	**b**	**b**	**b**	**b**	**d**
21	**22**	**23**	**24**	**25**					
c	**d**	**c**	**c**	**b**					

UNIT 25 : BIOMOLECULES

01. Which of the following compounds is found in abundance in nature?

a) Fructose b) Glucose c) Starch d) Cellulose

02. On hydrolysis of starch, we finally get

a) glucose b) fructose c) both d) sucrose.

03. Hydrolysis of sucrose gives

a) two molecules of glucose b) two molecules of fructose

c) one molecule each of glucose and fructose d) one molecule each of glucose and mannose.

04. Glucose when treated with CH_3OH in presence of dry HCl gas gives $\alpha - and\ \beta -$ methylglucosides because it contains

a) an aldehydic group b) a-CH_2OH group

c) a ring structure d) five –OH groups.

05. Which of the following monosaccharides is a pentose?

a) Glucose b) Fructose c) Arabinose d) Galactose.

06. Table suga is a

a) disaccharide of D-glucose and D-fructose

b) monosaccharide

c) disaccharide containing two glucose units.

d) D-Glucose.

07. Which of the following does not reduce Benedict's solution?

a) Glucose b) Fructose c) Sucrose d) Aldehyde.

08. The change in the optical rotation (with time) of freshly prepared solution of sugar is known as

a) specific rotation b) inversion c) rotatory motion d) mutarotation.

09. When amylases catalyse the hydrolysis of starch, the final product obtained is chiefly

a) cellobiose b) glucose c) maltose d) sucrose

10. Glucose molecule reacts with X number of molecules of phenylhydrazine to yield osazone. The value of X is

a) three   b) two   c) one   d) four

11. Molisch test is answered by

a) all carbohydrates   b) sucrose   c) fructose   d) glucose.

12. Assuming sweetness of the cane sugar to be 10, the sweetness of glucose is

a) 15   b) 1.5   c) 1.5   d) 7.5

13. Which of the following reagents cannot distinguish between glucose and fructose?

a) Tollen's reagent   b) Fehling's solution

c) Benedict's solution   d) All of these.

14. In polysaccharides, the linkage connecting monosaccharides is called

a) glyeoside linkage   b) nucleoside linkage

c) glycogen linkage   d) peptide linkage.

15. The rapid interconversion of $\alpha-D$ - glucose and $\beta-D$ - glucose in solution is known as

a) racemization   b) asymmetric induction

c) functional isomerism   d) mutarotation.

16. Which of the following is the sweetest sugar?

a) Sucrose   b) glucose   c) Fructose   d) Maltose.

17. What happens when dil. H_2SO_4 is treated with sugar?

a) Oxidation   b) Reduction   c) Dehydration   d) Hydrolysis.

18. Which is the correct statement?

a) Starch is a polymer of $\alpha-$ glucose

b) Amylose is a component of cellulose

c) Proteins are compounds of only one type of amino acid.

d) In cyclic structure of fructose, there are four carbons and one oxygen atom.

19. Cellulose is a polymer of

a) glucose   b) fructose   c) ribose   d) sucrose.

20. An organic compound with the formula $C_6H_{12}O_6$ forms a yellow crystalline solid with phenylhydrazine and gives a mixture of sorbitol and mannitol when reduced with sodium. Which among the following could be the compound?

a) Fructose b) Glucose c) Mannose d) Sucrose.

21. The disaccharide present in milk is

a) sucrose b) maltose c) lactose d) cellobiose.

22. The reagent which forms crystalline osazone derivative when treated with glucose is

a) Fehling solution b) phenylhydrazine c) Benedict solution d) hydroxylamine.

23. The term invert sugar refers to an equimolar mixture of

a) D-glucose and D-galactose b) D-glucose and D-fructose

c) D-glucose and D-mannose d) D-glucose and D-ribose

24. $\alpha - D$ - glucose and $\beta - D$ - glucose differ from each other due to the difference in one carbon with respect to its.

a) size of hemiacetal ring b) number of –OH groups

c) configuration d) all of these.

25. Anomers have different

a) properties b) melting points c) specific rotation d) all of these.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
d	**a**	**c**	**c**	**c**	**a**	**c**	**d**	**b**	**a**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
a	**d**	**d**	**a**	**d**	**c**	**d**	**a**	**a**	**a**
21	**22**	**23**	**24**	**25**					
c	**b**	**b**	**c**	**c**					

UNIT 26 : CHEMISTRY IN EVERYDAY LIFE

01. An antipyretic is

a) Quinine b) Paracetamol c) Luminal d) Piperazine.

02. One of the most widely used drug in medicine iodex is

a) Methyl salicylate b) Ethyl salicylate c) Acetyl salicylic acid

d) *o*- Hydroxybenzoic acid.

03. Medicine which is an antibiotic is

a) Ampicillin b) Aspirin c) Calmpose d) Chloroquine.

04. Aspirin is an acetylation product of

a) p-dihydroxy benzene b) *o*- hydroxyl benzoic acid

c) *o*-dihydroxy benzene d) m-hydroxy benzoic acid.

05. The drug given during hypertension is

a) Streptomycin b) Chloroxylenol c) Equanil d) Aspirin.

06. Streptomycin, a well known antibiotic, is a derivative of

a) Peptides b) Carbohydrates c) Terpenes d) Alkaloids,

07. Which of the following is used as an antiseptic?

a) Phenol b) Benzldehyde c) Benzalamine d) Malic anhydride.

08. Drug which helps to reduce anxiety and brings about calmness is

a) Tranquilizer b) Diuretic c) Analogesic d) Antihistamine.

09. The use of chemicals for treatment of diseases is called as

a) Homeotherapy b) Isothermotherapy c) Chemotherapy d) Physiotherapy.

10. Barbituric acid and its derivatives are well known as

a) Tranquilizers b) Antiseptics c) Analgesics

d) Antipyretics.

11. 2, 4-Dichlorophenoxyacetic acid is used a s

a) Fungicide b) Insecticide c) Herbicide d) Moth repellant.

12. Aresenic drugs are mainly used in the treatment of

a) Jaundice b) Typhoid c) Syphilis d) Cholera.

13. Phenol is used as

a) An antiseptic b) A disinfectant c) Both (a) and (b) d) A styptic.

14. Amoxichillin is semi-synthetic modification of

a) Penicillin b) Streptomycin c) Tetracycline d) Chloramphenicol.

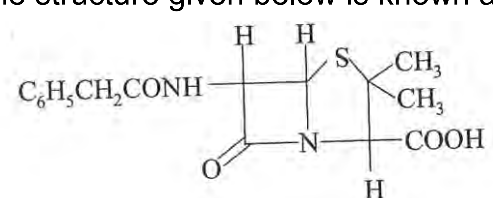
15. Which of these is a hypnotic?

a) Metaldehyde b) Acetaldehyde c) Paraldehyde d) None of these.

16. Tranquilizers are substances used for the treatment of

a) Cancer b) AIDS c) Mental diseases d) Physical disorders.

17. The structure given below is known as



a) Penicillin F b) Penicillin G c) Penicillin K d) Ampicillin.

18. An example of psychedelic agent is

a) DNA b) LSD c) DDT d) TNT.

19. The indicator used in the titration of a strong acid and a strong base is

a) Phenophthalein b) Methyl orange c) Alizarin yellow d) Red litmus.

20. Match List I with List II and select the correct answer using the codes given below the lists:

List I	List II
I) Iodoform	A) Anaesthetic
II) Methyl salicylate	B) Antiseptic
III) Diethyl ether	C) Insecticide
IV) Hexachlorocyclohexane	D) Detergent
	E) Pain balm

Codes:

a) I –B, II-E, III-C, IV-D b) I-D, II-B, III-A, Iv-C

c) I-B, II-E, III-A, IV-C d) I-C, II-A, III-D, IV-B

21. One of the oxidants used with liquid propellants is

a) Ammonium perchlorate b) Nitrocellulose

c) Sulphuric acid d) Nitrogen tetroxide.

22. Which is not true for a detergent molecule?

a) It has a non-polar organic part and a polar group.

b) it is not easily biodegraded

c) it is sodium salt of a fatty acid

d) it is a surface active reagent.

23. Which one of the following is not a surfactant?

(a) $CH_3-(CH_2)_{15}-\overset{\overset{\displaystyle CH_3}{+|}}{\underset{\underset{\displaystyle CH_3}{|}}{N}}-CH_3Br^-$

(b) $CH_3-(CH_2)_{14}-CH_2NH_2$

(c) $CH_3-(CH_2)_{16}CH_2OSO_2^-Na^+$

(d) $OHC-(CH_2)_{14}-CH_2-COO^-Na^+$.

24. The drug used as an antidepressant is

a) Luminal b) Tofranil c) Mescaline d) Sulphadiazine.

25. Alum is used by dyers of cloth

a) For fire proofing fabrics b) As first aid for cuts c) For softening hard water

d) As mordant.

~*~

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	**A**	**A**	**B**	**C**	**B**	**A**	**A**	**C**	**A**
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
C	**C**	**C**	**A**	**C**	**C**	**B**	**B**	**A**	**C**
21	**22**	**23**	**24**	**25**					
D	**C**	**B**	**B**	**D**					

MATHEMATICS

Brief Profile of the Author:

Prof. Seetharam S Udupi brings over 30 years of experience as a Mathematics Lecturer in multiple P.U. colleges. Throughout his career, he actively participated in refresher courses, workshops, and orientation camps organized by the Department of P.U. Education in Bengaluru, Karnataka, as well as workshops on Education by RIE Mysore.

Serving as a Resource Person, Seetharam contributed to refresher and orientation courses for both teachers and students under the Department of P.U. Education in Bengaluru, Karnataka. Additionally, he co-authored various publications and played a key role as a question paper setter for diverse Competitive examinations.

His expertise extended to being a member of the question paper pattern committee for P.U. Mathematics and serving as a trainer in Mathematics for competitive examinations organized by different charities. Seetharam S Udupi's rich experience reflects his commitment to advancing education and contributing to the academic community.

Prof. Seetharam S Udupi

Professor of Mathematics

Mathematics Syllabus Exams Topics of 1st and 2nd PUC

A. FIRST P. U. TOPICS

1. SETS

1. The number of elements in the set $A = \{x : x \in N,\ x < 10,\ 2^x - 1 \text{ is an odd integer}\}$ is

(a) 9 (b) 10 (c) 11 (d) 8

2. Which of the following statements (A) and (B) is FALSE?

(A) $7747 \in \{x : x$ is a multiple of $37\}$

(B) $47 \in \{x : x$ has exactly two positive divisors$\}$

(a) both (A) and (B) (b) neither (A) nor (B) (c) only (B) (d) only (A)

3. Let $X = \{1, 2, 3, 4, 5, 6\}$. Which of the following is empty?

(a) $A = \{x : x \in X,\ 2x \notin X\}$ (b) $B = \{x : x \in X,\ 2x + 7 < 8\}$

(c) $C = \{x : x \in X,\ x^2 \notin X\}$ (d) $D = \{x : x \in X,\ x + 5 > 8\}$

4. Consider the following statements (i) and (ii) with regard to the sets, A, B and C.

(i) If $x \in A$ and $A \in B$ then $x \in B$. (ii) If $A \subset B$ and $B \in C$ then $A \in C$.

Then (a) only (i) is false (b) only (ii) is false

(c) both (i) and (ii) are true (d) both (i) and (ii) are false

5. The total number of subsets of a finite set A is 56 more than the number of subsets of another finite set B. The number of elements in A is

(a) 5 (b) 6 (c) 7 (d) 8

6. If $C = \{x : x \in R,\ 2x + 11 = 15\}$ and $D = \{x : x^2 = x,\ x \in R\}$ then

(a) $n(C) - n(D) = 1$ (b) $n(C \cup D) = 4$

(c) $n(C \cap D) = 1$ (d) $n(C - D) = 1$

7. Let S be the set of points inside a square, T the set of points inside a triangle and C the set of points inside a circle. If the triangle and the circle intersect each other and are contained in a square then

(a) $S \cap T \cap C = \phi$ (b) $S \cup T \cup C = C$ (c) $S \cup T \cup C = S$ (d) $S \subset (T \cup C)$

8. If A and B are two sets defined as

$A = \{(x, y) : y = \frac{1}{x},\ x \neq 0,\ x \in R\}$ and $B = \{(x, y) : y = -x,\ x \in R\}$ then

(a) $B - A = \phi$ (b) $A - B = \phi$ (c) $A \cup B = \phi$ (d) $A \cap B = \phi$

9. If $A = \{1, 3, 5, 7, 9, 11, 13, 15, 17\}$ and $B = \{2, 4, 6, 8, 10, 12, 14, 16, 18\}$ and if N, the set of natural numbers is the universal set then $A' \cup \{(A \cup B) \cap B'\}$ is

(a) N (b) ϕ (c) $A \cap B$ (d) $A \cup B$

10. If X and Y are any two non-empty sets then $(X - Y)' =$

(a) $X' - Y'$ (b) $X' \cap Y$ (c) $X' \cup Y$ (d) $X - Y'$

11. In a town of 640 persons, 250 persons read Hindi news paper, 200 read English news paper and 100 read both the newspapers. The number of persons who read neither is

(a) 320 (b) 210 (c) 290 (d) 350

12. In a University, out of 850 students, 680 like music and 215 like dance. The least number of students who like music and dance is

(a) 15 (b) 45 (c) 20 (d) 35

Correct options

1.(a) 2.(d) 3.(b) 4.(d) 5.(b) 6.(d) 7.(c) 8.(d) 9.(a) 10.(c) 11.(c) 12.(b)

Unit test

1. Which of the following is an element of the set $\{x \in N : 2x$ is the sum of all the positive factors of $x\}$?

(a) 12 (b) 6 (c) 21 (d) 18

2. Consider the following sets: $A = \{x : x \in R$ and x satisfy $x^2 - 8x + 12 = 0\}$, $B = \{2, 4, 6\}$, $C = \{2, 4, 6, \ldots\}$ and $D = \{6\}$. Which of the following ie FALSE?

(a) $B \not\subset A$ (b) $C \not\subset B$ (c) $D \not\subset C$ (d) $A \not\subset D$

3. Consider the following statements (i) and (ii) with regard to the sets, A, B and C:

(i) If $x \in A$ and $A \not\subset B$ then $x \in B$. (ii) If $A \subset B$ and $x \notin B$ then $x \notin A$.Then

(a) (i) is true and (ii) is false (b) (i) is false and (ii) is true

(c) both (i) and (ii) are true (d) both (i) and (ii) are false

4. If A and B have 3 and 6 elements respectively, then which of the following is FALSE?

(a) The minimum number of elements in $A \cup B$ is 6

(b) The maximum number of elements in $A \cup B$ is 9

(c) The minimum number of elements in $A \cap B$ is 0

(d) The maximum number of elements in $A \cap B$ is 6

5. If $G = \{x : x^4 - 3x^2 - 10 = 0, x \in R\}$ and $H = \{1, 2\}$ then

(a) $G \cap H$ is infinite (b) $G \subset H$ (c) $G - H$ is finite (d) $H - G$ is empty

6. If for any two sets A and B, $P(A) \cap P(B) = 2^k P(A \cap B)$ then $k =$

(a) $n(A) - n(B)$ (b) $n(A) + n(B)$ (c) 1 (d) 0

7. Let A, B and C are three subsets of a set X such that $C = (A \cap B') \cup (A' \cap B)$ where A' and B' are complements of A and B respectively in X. Then C is equal to

(a) $(A \cup B') - (A \cap B')$ (b) $(A' \cup B) - (A' \cap B)$

(c) $(A \cup B) - (A \cap B)$ (d) $(A' \cup B') - (A' \cap B')$

8. Out of 100 students 15 passed in English, 12 in Mathematics, 8 in Physics, 6 in English and mathematics, 7 in Mathematics and Physics and 4 in Physics and English. Also 4 passed in all the three subjects. Which of the following is FALSE?

(a) The number of students who passed in more than one subject is 9.

(b) The number of students passed in English, mathematics but not in Physics is 14.

(c) The number of students passed in Mathematics or Physics is 13.

(d) The number of students passed in Mathematics only is 2.

Correct options

1.(b) 2.(c) 3.(b) 4.(d) 5.(c) 6.(d) 7.(c) 8.(d)

Filler

In a survey of 60 people, it was found that 25 people read newspaper H, 26 read newspaper T, 26 read newspaper I, 9 read both H and I, 11 read both H and T, 8 read both T and I, 3 read all the three newspapers. The number of people who read exactly one newspaper is

(a) 22 (b) 52 (c) 70 (d) 30

Ans(d): Let H, T and I be the set of all people who read the news papers H, T and I respectively. Given $n(H) = 25$, $n(T) = 26$, $n(I) = 26$, $n(H \cap I) = 9$, $n(H \cap T) = 11$, $n(T \cap I) = 8$ and $n(H \cap T \cap I) = 3$.

$$n(H\ only) = n(H) - \{n(H \cap I) + n(H \cap T) - n(H \cap T \cap I)\}$$
$$= 25 - \{9 + 11 - 3\} = 8.$$
$$n(T\ only) = n(T) - \{n(T \cap H) + n(T \cap I) - n(H \cap T \cap I)\}$$
$$= 26 - \{11 + 8 - 3\} = 10.$$
$$n(I\ only) = n(I) - \{n(I \cap H) + n(I \cap T) - n(H \cap T \cap I)\}$$
$$= 26 - \{9 + 8 - 3\} = 12.$$

Required $= n(H\ only) + n(T\ only) + n(I\ only) = 8 + 10 + 12 = 30.$

2. RELATIONS AND FUNCTIONS

1. If $A = \{2, 3\}$, $B = \{3, 4\}$ and $C = \{4, 5\}$ and if $(x, y) \in (A \times B) \cup (A \times C)$ then the sum of the minimum value of x and maximum value of y is

(a) 7 (b) 6 (c) 4 (d) 8

2. If $(x - 2,\ y + 5) = \left(-2,\ \frac{1}{3}\right)$ then $\left|\frac{x + y}{x - y}\right| =$

(a) 2 (b) 1 (c) 3 (d) 5

3. If $A = \{4n + 2 : n$ is a natural number $\leq 3\}$ and $B = \{3n : n$ is a natural number $\leq 2\}$ then the number of relations that can be defined on $A \cap B$ is

(a) 8 (b) 1 (c) 4 (d) 2

4. If A is the domain and B is the range of the relation,

$f = \{(x, y) : y = x + \frac{6}{x}$, where $x,\ y \in N$ and $x < 6\}$, then $A \cup B =$

(a) $\{1, 2, 3, 5, 7\}$ (b) $\{1, 4, 6\}$ (c) $\{1, 3, 5, 7\}$ (d) $\{2, 4, 5\}$

5. If $A = \{2, 4, 6, 9\}$ and $B = \{2, 4, 18, 54\}$ and if $g = \{(x, y) : x \in A,\ y \in B, x$ divides y and $x < y\}$ then the difference between the greatest and least value of y is

(a) 52 (b) 50 (c) 20 (d) 18

6. Which of the following is NOT a real valued function?

(a) $f_1 = \{(|x|,\ x) : x \in R\}$ (b) $f_2 = \left\{\left(|x|,\ \frac{1}{x}\right) : x \in N\right\}$

(c) $f_3 = \{(|x|, -x) : x \in W\}$ (d) $f_4 = \{(|x|,\ x^2) : x \in R^+\}$

7. The number of functions that can be defined from a set into another set is 64. Then maximum possible number of elements in the codomain is

(a) 8 (b) 3 (c) 64 (d) 6

8. The real valued relations f and g are defined by

$f(x) = \begin{cases} x^2, & 0 \leq x \leq 3 \\ 3x, & 3 \leq x \leq 10 \end{cases}$ and $g(x) = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 3x, & 2 \leq x \leq 10 \end{cases}$. Then

(a) both f and g are functions (b) only f is a function

(c) only g is a function (d) both f and g are not functions

9. If $f(x) = x$ and $g(x) = |x|$, $\forall\, x \in R$, then the function $h(x)$, satisfying $(h - f)^2 + (h - g)^2 = 0$ is

(a) $x + |x|$ (b) $-x - |x|$ (c) $x,\ x \geq 0$ (d) $2x,\ x \geq 0$

10. If $f\left(x-\frac{1}{x}\right)=x^3-\frac{1}{x^3}$ then $f(2)=$

(a) 11 (b) 13 (c) 12 (d) 14

11. If the domain of $f(x)=\frac{1}{\sqrt{[x]^2-[x]-6}}$, where $[.]$ denotes the greatest integer function is $R-[a,b)$ then $b-a=$

(a) 4 (b) 5 (c) 3 (d) 6

12. The range of $f(x)=\frac{3}{2-x^3}$ is

(a) $R-\{\sqrt[3]{2}\}$ (b) $R-\{1\}$ (c) R (d) $R-\{0\}$

13. If $f(x)=x^3+\frac{1}{x^3},\ x\neq 0$ is a real valued function then the range of the function $f(x)-f\left(-\frac{1}{x}\right)$ is

(a) $[-4,\ 4]$ (b) $(-\infty,-4]\cup[4,\infty)$ (c) $[0,\infty]$ (d) $(-\infty,\ \infty)$

14. If $f=\{(0,1),(2,0),(3,-4),(4,2),(5,1)\}$ and $g=\{(1,0),(2,2),(3,-1),(4,4),(5,3)\}$ then the sum of the elements belonging to the domain of fg is

(a) 13 (b) 15 (c) 14 (d) 16

15. The number of integers NOT belonging to the domain of $f(x)=\sqrt{4-x}+\frac{1}{\sqrt{x^2-1}}$ is

(a) 2 (b) 3 (c) 1 (d) 0

Correct options

1.(a) 2.(b) 3.(d) 4.(a) 5.(b) 6.(a) 7.(c) 8.(b) 9.(c) 10.(d) 11.(d) 12.(d) 13.(b) 14.(c) 15(b)

Unit test

1. If $A=\{2,4,6,9\}$ and $B=\{4,6,18,27,54\}$ then the number of ordered pairs belonging to $R=\{(x,\ y):\ x$ is a factor of $y\}$ is

(a) 10 (b) 12 (c) 13 (d) 11

2. Let $A=\{x:x\in W,\ x<3\}$, $B=\{x:x\in N,\ 2\leq x<4\}$ and $C=\{3,4\}$ then the number of elements in $(A\cup B)\times C$ is

(a) 4 (b) 6 (c) 12 (d) 8

3. If $A = \{x, y, z\}$ and $B = \{1, 2, 3, 4\}$ then the total number of relations from $A \times B$ to $B \times A$ is

(a) 2^{24} (b) 2^{12} (c) 2^{288} (d) 2^{144}

4. Consider the relation $f = \{(x,\ y) :\ y = 2x^2 + 7,\ x \in A\},\ A = \{0,\ \pm 1,\ \pm 2,\ \pm 3\}$. The number of elements in the range of the relation is

(a) 13 (b) 3 (c) 7 (d) 4

5. Choose the correct option.

(a) $f_1 = \{(a, d),\ (b, d),\ (c, b),\ (c, a)\}$ is a function defined on $X = \{a, b, c, d\}$.

(b) $f_2 = \{(a, d),\ (d, c),\ (c, c),\ (b, b)\}$ is not a function defined on $X = \{a, b, c, d\}$.

(c) $f_3 = \{(p, 1), (q, 2), (r, 3), (s, 4)\}$ is a function from $A = \{p,\ q,\ r,\ s\}$ to $B = \{1, 2, 3\}$.

(d) $f_4 = \{(p, 1), (q, 1), (r, 2), (s, 3)\}$ is a function from $A = \{p,\ q,\ r,\ s\}$ to $B = \{1,\ 2,\ 3\}$.

6. Let f be the subset of $Z \times Z$ defined by $f = \{(ab,\ a + b) :\ a,\ b \in Z\}$. Then

(a) f is a function (b) f is not a function

(c) f is a subset of $N \times N$ (d) f is not a relation

7. The function $f(x) = |x - 1| + |x + 1|,\ -2 \le x \le 2$, is given by

(a) $f(x) = \begin{cases} -2x, & -2 < x \le -1 \\ 2, & -1 \le x \le 1 \\ -2x, & 1 \le x \le 2 \end{cases}$ (b) $f(x) = \begin{cases} -2x, & -2 \le x \le -1 \\ 2, & -1 \le x \le 1 \\ 2x, & 1 \le x \le 2 \end{cases}$

(c) $f(x) = \begin{cases} 2x, & -2 < x \le -1 \\ 1, & -1 \le x \le 1 \\ x, & 1 \le x \le 2 \end{cases}$ (d) $f(x) = \begin{cases} 2x, & -2 < x \le -1 \\ 1, & -1 \le x \le 1 \\ -x, & 1 \le x \le 2 \end{cases}$

8. The number of functions that can be defined from $A \times A$ into a set B, where $A = \{1, 2, 3\}$ and $B = \{1, 3, 5\}$ is

(a) 3^9 (b) 27^3 (c) 81^3 (d) 243

9. If $f(x) + 2.f(1 - x) = x^2 + 5,\ \forall\, x \in R$ then the range of $f(x)$ is

(a) $[-1,\ \infty)$ (b) $[3, \infty)$ (c) $[1, \infty)$ (d) $(0, 3)$

10. For which of the following functions both domain and range are infinite sets? {Here $|.|$ indicates the absolute value and $[.]$ indicates the greatest integer function}

(a) $f(x) = \frac{4 - x}{x - 4}$ (b) $g(x) = 2 - |x - 5|$ (c) $h(x) = \frac{x}{|x|}$ (d) $k(x) = [x - [x]]$

Correct options

1.(d) 2.(d) 3.(d) 4.(d) 5.(d) 6.(b) 7.(b) 8.(a) 9.(c) 10.(b)

3. TRIGONOMETRIC FUNCTIONS

1. A circular ring of radius 3 cm is cut and bent so as to lie along the circumference of a hoop of radius 4cm. The angle subtended by the arc at the center of the hoop, is

(a) $5\pi/6$ (b) $3\pi/4$ (c) $3\pi/2$ (d) $\pi/6$

2. A wheel of radius 2 m makes 20 revolutions per minute. The area traced by it in 30 sec is

(a) 25π (b) 20π (c) 75π (d) 40π

3. If $sin\, x + cos\, x = a$ then $|sin\, x - cos\, x| =$

(a) $\sqrt{4 - a^2}$ (b) $2\sqrt{1 - a^2}$ (c) $\sqrt{2 - a^2}$ (d) $2\sqrt{2 - a^2}$

4. If $(sin\, x + cosec\, x)^2 + (cos\, x + sec\, x)^2 = k + tan^2x + cot^2x$ then the value of k is

(a) 8 (b) 7 (c) 4 (d) 3

5. If $x \neq (2n+1)\frac{\pi}{2}$, $n \in Z$ and $sec\, x + sec^2x = 1$ then $tan^2x - tan^4x =$

(a) 0 (b) -1 (c) 1 (d) 2

6. Which of the following is FALSE?

(a) If $tan\, \theta = 3$ and θ lies in the third quadrant then $sin\, \theta = -\frac{3}{\sqrt{10}}$

(b) If $cot\, \theta = 2$ and θ lies in the first quadrant then $cos\, \theta = \frac{2}{\sqrt{5}}$

(c) If $sec\, \theta = 4$ and θ lies in the fourth quadrant then $tan\, \theta = -\sqrt{15}$

(d) If $cosec\, \theta = 5$ and θ lies in the second quadrant then $cot\, \theta = -\sqrt{20}$

7. Which one below is CORRECT?

(a) $sin\, 1° < sin\, 1^c$ (b) $tan\, 1° > tan\, 1^c$ (c) $cos\, 1° < cos\, 1^c$ (d) $sin\, 1° = sin\, 1^c$

8. If $\frac{\pi}{2} < \theta < \pi$ then $\sqrt{\frac{1 - sin\, \theta}{1 + sin\, \theta}} + \sqrt{\frac{1 + sin\, \theta}{1 - sin\, \theta}} =$

(a) $2.sec\, \theta$ (b) $-2.sec\, \theta$ (c) $-2.cosec\, \theta$ (d) $2.cosec\, \theta$

9. If $cos\, \alpha + cos\, \beta + cos\, \gamma = 0$ where $0 < \alpha, \beta, \gamma \leq \frac{\pi}{2}$ then the value of $sin\, \alpha + sin\, \beta + sin\, \gamma =$

(a) 0 (b) $3\sqrt{2}$ (c) 3 (d) $1/2\sqrt{2}$

10. If $A = cos^2\theta + sin^4\theta$ for all real values of θ then

(a) $\frac{5}{4} \leq A \leq 1$ (b) $\frac{3}{8} \leq A \leq 1$ (c) $\frac{3}{4} \leq A \leq 1$ (d) $\frac{1}{2} \leq A \leq 1$

11. If $p = sin\,989°.cos\,991°$ then

(a) p is positive (b) p is negative (c) $p = 0$ (d) p is not defined

12. Let $a = tan\,\frac{\pi}{6}$, $b = tan\,\frac{3\pi}{4}$, $c = tan\,\frac{5\pi}{4}$ and $d = tan\,\frac{2\pi}{3}$ then

(a) $c < b < a < d$ (b) $d < b < a < c$ (c) $b < d < a < c$ (d) $d < b < c < a$

13. The value of $\frac{1}{sin\,10°} - \frac{\sqrt{3}}{cos\,10°}$ is

(a) 0 (b) 1 (c) 2 (d) 4

14. In triangle ABC, sine of two acute angles respectively are $\frac{5}{13}$ and $\frac{99}{101}$. The cosine of the third angle is

(a) $-255/1313$ (b) $-175/1313$ (c) $255/1313$ (d) $175/1313$

15. The simplest form of $cot\,35°.cot\,65° + cot\,65°.cot\,80° + cot\,80°.cot\,35°$ is

(a) 1 (b) 2 (c) 0 (d) 3

16. Consider the following statements.

(i) If $tan\,x = -\frac{4}{3}$ and x lies in the II quadrant then $sin\left(\frac{x}{2}\right) = \frac{2}{\sqrt{5}}$.

(ii) If $cos\,x = -\frac{1}{3}$ and x lies in the III quadrant then $tan\left(\frac{x}{2}\right) = -\sqrt{2}$. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

17. If $cosec\,\theta - cot\,\theta = x$ then $sec\,\theta =$

(a) $\frac{1-x^2}{1+x^2}$ (b) $\frac{2x}{1+x^2}$ (c) $\frac{1+x^2}{1-x^2}$ (d) $\frac{2x}{1-x^2}$

18. The smallest integral value of n satisfying $n\{sin^2(67.5°) - sin^2(22.5°)\} > 1$, is

(a) 3 (b) 4 (c) 2 (d) 1

19. If $cos\,A = m.cos\,B$ and $cot\,\frac{A+B}{2} = n.tan\,\frac{B-A}{2}$ then $n =$

(a) $\frac{m+2}{m-2}$ (b) $\frac{m+1}{m-1}$ (c) $\frac{m+1}{1-m}$ (d) $\frac{m+2}{2-m}$

20. $2.cos\,\frac{\pi}{13}.cos\,\frac{9\pi}{13} + cos\,\frac{3\pi}{13} + cos\,\frac{5\pi}{13} =$

(a) 2 (b) 0 (c) $\sqrt{3}$ (d) 3

21. If $sin\,x - sin\,y = 1/2$, $cos\,x - cos\,y = 1/3$ then $cos\,(x+y) =$

(a) $1/3$ (b) $1/4$ (c) $5/13$ (d) $-5/13$

22. The vertical poles, AB of length $2m$ and CD of length $20m$ are erected with base B and D respectively. It is given that the distance between the poles is more than $20m$ and $tan\ \angle ACB = \frac{2}{77}$. The distance between the poles is

(a) $36m$ (b) $24m$ (c) $72m$ (d) $75m$

23. Three vertical towers of heights $12m$, $18m$ and $27m$ stand at the three vertices of an equilateral triangular park. The towers subtend angles P, Q and R respectively at the circumcenter of the park. Then $tan^2 Q =$

(a) $tan\ P.tan\ R$ (b) $tan^2 P.tan^2 R$ (c) $tan\ P + tan\ R$ (d) $tan^2 P + tan^2 R$

24. The general solution of $cot\ \theta + tan\ \theta = 2.cosec\ \theta$ is $\theta = 2n\pi + t$ (here $n \in Z$). The sum of two possible values of t very near to zero is

(a) $2\pi/3$ (b) $\pi/4$ (c) 0 (d) $\pi/2$

25. The number of solutions for x satisfying $sin\ 3a = 4.sin\ a.sin\ (x + a).sin\ (x - a)$, $0 < a < \pi$ and lying between 0 and 2π, is

(a) 0 (b) 2 (c) 3 (d) 4

26. If the sides of a triangle are in the ratio $2 : \sqrt{6} : 1 + \sqrt{3}$ then the smallest angle of the triangle is

(a) $75°$ (b) $60°$ (c) $45°$ (d) $30°$

27. In ΔABC if $a : b = cos\ A : cos\ B$ and $a : c = cos\ A : cos\ C$ then ΔABC is

(a) equilateral (b) right angled (c) isosceles (d) scalene

Correct options

1.(c) 2.(d) 3.(c) 4.(b) 5.(b) 6.(d) 7.(a) 8.(b) 9.(c) 10.(c) 11.(b) 12.(b) 13.(d) 14.(c) 15(a) 16.(c) 17.(c) 18.(c) 19.(b) 20.(b) 21.(c) 22.(c) 23.(a) 24.(c) 25.(d) 26.(c) 27.(a)

Unit test

1. A regular polygon of 15 sides is enclosed by a unit circle. The length of the arc cut by each side is

(a) $2\pi/15$ (b) $\pi/15$ (c) $3\pi/5$ (d) $\pi/5$

2. If $tan\ x + sec\ x = 4$ then the value of $sin\ x$ is

(a) $8/17$ (b) $8/15$ (c) $15/17$ (d) $23/32$

3. The range of the function $f(x) = 1 + 3.cos\ 2x$ is

(a) $[-1, 5]$ (b) $[0, 5]$ (c) $[-2, 4]$ (d) $[3, 5]$

4. If $sin\,\theta = x + \frac{a}{x}$, $\forall\, x \in R - \{0\}$ and $a > 0$, then a true statement in the following is

(a) $a \geq 4$ (b) $a \geq \frac{1}{2}$ (c) $a \leq \frac{1}{4}$ (d) $a \leq \frac{1}{2}$

5. $sin^2\left(\frac{\pi}{18}\right) + sin^2\left(\frac{\pi}{9}\right) + sin^2\left(\frac{7\pi}{18}\right) + sin^2\left(\frac{4\pi}{9}\right) =$

(a) 2 (b) 1 (c) $2\sqrt{2}$ (d) $1/2$

6. The value of $tan\,(-1575°)$ is equal to

(a) 1 (b) -1 (c) $\sqrt{3}$ (d) $-\sqrt{3}$

7. If $tan\,9° = x$ then $\frac{tan\,54° - tan\,189°}{tan\,36° - tan\,351°} =$

(a) $\frac{1+x}{1-x}$ (b) 1 (c) $\frac{1+x^2}{1-x^2}$ (d) 0

8. If $tan\,\alpha$ and $tan\,\beta$ are the roots of $x^2 + bx + c = 0,\ b \neq 0$ then $sin\,(\alpha+\beta).sec\,\alpha.sec\,\beta =$

(a) b (b) $2b$ (c) $-2b$ (d) $-b$

9. If for a given value of $cos\,A$, only one value for $cos\,\frac{A}{2}$ is possible then A must be

(a) an even multiple of $180°$ (b) an even multiple of $90°$

(c) an odd multiple of $90°$ (d) an odd multiple of $180°$

10. The maximum value of $p = sin^4x - cos^4x$ is attained at

(a) $\pi/4$ (b) $\pi/2$ (c) π (d) 2π

11. The value of the expression, $\frac{1 - 4.sin\,10°.sin\,70°}{2.sin\,10°}$ is

(a) 2 (b) $1/2$ (c) 1 (d) 4

12. The number of triangles ABC that can be formed satisfying $sin\,A + sin\,B = sin\,C$, is

(a) 1 (b) 2 (c) 0 (d) infinite

13. A tower is observed from two stations A and B where B is east of A at a distance of $200m$. The tower is due north of A, which is at a distance of $200m$ from the base of the tower and west of B. The angles of elevation of the top of the tower from A and B are complementary. The height of the tower is

(a) $200.\sqrt[4]{2}m$ (b) $100.\sqrt[4]{2}m$ (c) $20.\sqrt[4]{2}m$ (d) $10.\sqrt[4]{2}m$

14. If the angles $A,\ B$ and C of the triangle ABC are in A.P. then $\frac{a+c}{b} =$

(a) $2.sin\left(\frac{A-C}{2}\right)$ (b) $2.cos\left(\frac{A-C}{2}\right)$ (c) $cos\left(\frac{A-C}{2}\right)$ (d) $sin\left(\frac{A-C}{2}\right)$

15. In ΔABC, if $\frac{a}{b+c} + \frac{b}{c+a} = 1$ then $C =$

(a) $30°$ (b) $45°$ (c) $60°$ (d) $90°$

16. In ΔABC, if $cot\ A$, $cot\ B$, $cot\ C$ are in A.P. then $a^2 + c^2 =$

(a) $3b^2$ (b) b^2 (c) $2b^2$ (d) $4b^2$

17. The number of values of θ lying between 0 and 2π satisfying the equation

$2. sin\ 2\theta - 2. cos\ \theta - 2\sqrt{3}. sin\ \theta + \sqrt{2} = 0$ is

(a) 1 (b) 2 (c) 3 (d) 4

18. The general solution of the equation $tan^2 x = cos\ 2x - 1$ is a set of all integral multiple of (a) $\pi/2$ (b) $\pi/3$ (c) π (d) $\pi/4$

Correct options

1.(a) 2.(c) 3.(c) 4.(c) 5.(a) 6.(a) 7.(b) 8.(d) 9.(d) 10.(c) 11.(c) 12.(c) 13.(a) 14.(b) 15.(c) 16.(c) 17.(c) 18.(c)

Filler

Let $sin\ (A+B) = 1$ and $sin\ (A-B) = 1/2$, where $A,\ B \in \left[0,\ \frac{\pi}{2}\right]$. Consider the following statements. (i) $A = \frac{\pi}{3}$. (ii) $tan\ (A+2B). tan\ (2A+B) = 1$.

(iii) $sin^2 A - sin^2 B = \frac{1}{2}$. Then the number TRUE statements in the above is

(a) 1 (b) 2 (c) 3 (d) 0

Ans(c): Here $A,\ B \in \left[0,\ \frac{\pi}{2}\right]$.

$\therefore\ sin\ (A+B) = 1 \Rightarrow A + B = \frac{\pi}{2}$ and $sin\ (A-B) = \frac{1}{2} \Rightarrow A - B = \frac{\pi}{6}$.

By solving $A + B = \frac{\pi}{2}$ and $A - B = \frac{\pi}{6}$, we get, $A = \frac{\pi}{3}$ and $B = \frac{\pi}{6}$.

$\therefore tan\ (A+2B) = tan\ \frac{2\pi}{3} = tan\ \left(\pi - \frac{\pi}{3}\right) = -\sqrt{3},$

$tan\ (2A+B) = tan\ \frac{5\pi}{6} = tan\ \left(\pi - \frac{\pi}{6}\right) = -\frac{1}{\sqrt{3}}.$

$\therefore\ tan\ (A+2B). tan\ (2A+B) = -\sqrt{3}. \left(\frac{-1}{\sqrt{3}}\right) = 1.$

$sin^2 A - sin^2 B = \left(\frac{\sqrt{3}}{2}\right)^2 - \left(\frac{1}{2}\right)^2 = \frac{3}{4} - \frac{1}{4} = \frac{1}{2}.$

4. PRINCIPLE OF MATHEMATICAL INDUCTION

1. Each term of the sequence $\{7^n - 2^n : n \in N\}$ is divisible by

(a) 5 (b) 35 (c) 15 (d) 25

2. It is given that $1^3 + 2^3 + 3^3 + \cdots + n^3 = 325\{1 + 2 + 3 + \cdots + n\}$. The value of n is

(a) 31 (b) 25 (c) 26 (d) 30

3. For any $n \in N$, each term of the sequence $(n^3 - 7n + 3)$ is divisible by

(a) 3 but not by 9 (b) 6 but not by 9 (c) 2 but not by 4 (d) 5 but not by 6

4. For any $n \in N$, each term of the sequence $\{n(n^2 + 5)\}$ is divisible by

(a) 4! but not by 5! (b) 3! but not by 4! (c) 3! and 4! (d) 4! and 5!

5. The greatest negative integral value of k for which the terms of the sequence $\{49^n + 16^n + k\}, n \in N$ are divisible by 64 is

(a) -3 (b) -1 (c) -2 (d) -4

6. The statement $2n < n!$, $n \in N$ is true only when

(a) $n \geq 4$ (b) $n \geq 2$ (c) $n = 5$ (d) $n = 6$

Correct options

1.(a) 2.(b) 3.(a) 4.(b) 5.(b) 6.(a)

Unit test

1. For any $n \in N$, each term of the sequence $(n^3 - n)$ is divisible by

(a) 2, 3, 6 (b) 4, 6 (c) 2, 8 (d) 3, 9

2. The least positive integral value of k for which the terms of the sequence $10^n + 3 \times 4^{n+2} + k$ are divisible by 9, is

(a) 3 (b) 2 (c) 5 (d) 4

3. $(2n + 1) < 2^n$ is true

(a) $\forall\, n \in N,\ n \geq 3$ (b) $\forall\, n \in N,\ n \geq 2$ (c) $\forall\, n \in N,\ n \geq 1$ (d) only when $n = 3$

4. For any $n \geq 2$, $n \in N$, the value of $\left(1 - \frac{1}{2^2}\right)\left(1 - \frac{1}{3^2}\right)\left(1 - \frac{1}{4^2}\right) \ldots \left(1 - \frac{1}{n^2}\right)$

(a) $= \frac{n+1}{2n}$ (b) $\leq \frac{n+1}{2n}$ (c) $\geq \frac{n+1}{2n}$ (d) > 1

Correct options

1.(a) 2.(c) 3.(a) 4.(a)

5. COMPLEX NUMBERS AND QUADRATIC EQUATIONS

1. If one root of $x^2 + px + q = 0$ is square of the other then

(a) $p^3 - 3pq + q - q^2 = 0$ (b) $p^3 - 3pq - q + q^2 = 0$

(c) $p^3 + 3pq + q + q^2 = 0$ (d) $p^3 - 3pq + q + q^2 = 0$

2. If $x^2 - 3x + 2 = 0$ then $x^{100} - (2^{100} - 1)x + (2^{100} - 2) =$

(a) 0 (b) 100 (c) 99 (d) 1

3. If the equations $ax^2 + bx + c = 0$ and $bx^2 + cx + a = 0$ have both the roots in common then the product of the roots is

(a) 1 (b) 2 (c) -1 (d) 0

4. One of the roots of the equation $(b - c)x^2 + (c - a)x + (a - b) = 0$ is

(a) $\frac{c-a}{b-c}$ (b) $\frac{a-b}{b-c}$ (c) $\frac{b-c}{a-b}$ (d) $\frac{c-a}{a-b}$

5. If $i = \sqrt{-1}$ then $\sum_{n=1}^{13} (i^{2n} + i^{2n+1}) =$

(a) $-1 - i$ (b) $1 + i$ (c) i (d) $-i$

6. $\frac{(\cos\theta + i\sin\theta)^8}{(\sin\theta - i\cos\theta)^8} =$

(a) -1 (b) i (c) 1 (d) $-i$

7. A non-zero real value of x for which $\frac{(1+ix)(1+2ix)}{1-ix}$ {where $i = \sqrt{-1}$} is purely real is

(a) 9 (b) 5 (c) $\sqrt{2}$ (d) 1

8. The sum of the modulus and principal argument of the complex number $\frac{1+2i}{1-(1-i)^2}$ is

(a) 1 (b) -1 (c) $\pi - 1$ (d) 0

9. The argument of $(1-i)^{100}$ {where $i = \sqrt{-1}$} is

(a) 0 (b) $-\pi/2$ (c) $\pi/2$ (d) π

10. The value of $\left|\frac{1 + (1/\sqrt{2}) + i(1/\sqrt{2})}{1 + (1/\sqrt{2}) - i(1/\sqrt{2})}\right|$ {where $i = \sqrt{-1}$} is

(a) 2 (b) 1 (c) 0.5 (d) 0.25

11. If the point $z_1 = 1 + i$ where $i = \sqrt{-1}$ is the reflection of a point $z_2 = h + ik$ in the line $i\bar{z} - iz = 5$ then the point z_2 is

(a) $1 + 6i$ (b) $1 + 4i$ (c) $1 + 2i$ (d) $1 + 8i$

12. If $z = x + iy$ {where $i = \sqrt{-1}$} satisfies the locus $Re\left(\frac{z-1}{z+1}\right) = 0$ then a point on the locus is

(a) $z = \frac{\sqrt{3}}{2} - i\frac{1}{2}$ (b) $z = 1 - i$ (c) $z = 2 + i$ (d) $z = 2i$

Correct options

1.(d) 2.(a) 3.(a) 4.(b) 5.(a) 6.(c) 7.(c) 8.(a) 9.(d) 10.(b) 11.(b) 12.(a)

Unit test

1. If the difference between the roots of the equation $x^2 + kx + 1 = 0$ is strictly less than $\sqrt{5}$, where $|k| \geq 2$ then $k \in$

(a) $(-3, 3)$ (b) $(-3, -2] \cup [2, 3)$ (c) $(-\infty, -2] \cup [2, \infty)$ (d) $(-1, 1)$

2. If $x^6 + x^3 + 1 = 0$ then $x^9 + \frac{1}{x^9} =$

(a) -2 (b) 2 (c) -1 (d) 1

3. If α, β, γ and δ are the roots of $x^4 + 12x^2 + 35 = 0$ then $\sum \frac{\alpha}{\beta\gamma\delta} =$

(a) $7/12$ (b) $-7/12$ (c) $24/35$ (d) $-24/35$

4. A square root of $3 + 4i$ is $x + iy$. Then $x : y$ is

(a) $2 : 1$ (b) $3 : 1$ (c) $1 : 2$ (d) $1 : 3$

5. If z_1 and z_2 are two complex numbers satisfying $z + \bar{z} = 2|z - 1|$ and $arg(z_1 - z_2) = \frac{\pi}{4}$ then $Im\,(z_1 + z_2) =$

(a) 1 (b) 0 (c) 2 (d) -1

6. If $z_1 = \sqrt{3} + i\sqrt{3}$ and $z_2 = \sqrt{3} + i$ then the quadrant in which $\frac{z_1}{z_2}$ lies, is

(a) III quadrant (b) II quadrant (c) I quadrant (d) IV quadrant

7. The set of points represented by $\left|\frac{i+z}{i-z}\right| = 1,\ z = x + iy$ is

(a) the imaginary axis (b) the real axis (c) the origin (d) the line $y = x$

8. The least positive integer n such that $\left(\frac{1-i}{i}\right)^n$ is a positive integer, is

(a) 8 (b) 6 (c) 4 (d) 2

Correct options

1.(b) 2.(b) 3.(d) 4.(a) 5.(c) 6.(c) 7.(b) 8.(a)

6. LINEAR INEQUALITIES

1. If S is the solution set of $4x - 3 \geq \frac{10x-1}{3}$ then the number of the distinct real roots of the equation $x^4 - 16x^3 + x - 16 = 0$, NOT belonging to S is

(a) 2 (b) 1 (c) 4 (d) 3

2. The water acidity in a pool is considered to be normal when the average pH reading of 3 daily measurements is between 8.2 and 8.5. If the first two pH readings are 8.48 and 8.35, the range of third reading that will result in the acidity level being normal, is

(a) $8.2 \leq x \leq 8.5$ (b) $7.01 \leq x \leq 8.13$

(c) $8 \leq x \leq 9$ (d) $7.77 \leq x \leq 8.67$

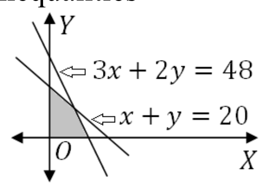
3. The set of values of x, NOT satisfying $-5 \leq \frac{2-3x}{4} \leq 9$ is{Here R is the set of all real numbers}

(a) $R - \left\{\frac{-34}{3}, \frac{22}{3}\right\}$ (b) $R - \left(\frac{-34}{3}, \frac{22}{3}\right)$ (c) $R - \left[\frac{-34}{3}, \frac{22}{3}\right]$ (d) R

4. The shaded region in the adjacent diagram is represented by the set of inequalities

(a) $x + y \leq 20,\ 3x + 2y \geq 48$ (b) $x + y \geq 20,\ 3x + 2y \leq 48$

(c) $x + y \leq 20,\ 3x + 2y \leq 48$ (d) $x + y \geq 20,\ 3x + 2y \geq 48$



5. In drilling world's deepest hole, it was found that the temperature T in degree Celsius, $x\ km$ below the earth's surface was given by $T = 30 + 25(x - 3),\ 3 \leq x \leq 15$. At what depth will the temperature lie between $155°C$ and $205°C$?

(a) $8\ km$ to $10\ km$ (b) $9\ km$ to $11\ km$ (c) $4\ km$ to $5\ km$ (d) $3\ km$ to $15\ km$

6. Consider the following 4 statements.

(i) The graph of $x > -2$ is the half plane not containing the origin.

(ii) The solution set of $x - y \leq 0$ includes the points lying on $y = x$.

(iii) The solution set of $x - y \leq 0$ includes the points lying below the line $y = x$.

(iv) The graph of $x < 3$ is the half plane lying to the right of the line $x = 3$.

The number of TRUE statements in the above is

(a) 1 (b) 2 (c) 3 (d) 4

7. The set of all integral values of x satisfying both $4x + 3 \geq 2x + 17$ and $3x - 5 < -2$ is

(a) $\{1, 2\}$ (b) $\{\ \}$ (c) $\{1,2,3 \ldots\}$ (d) W

8. The complete set of values of x satisfied by $\frac{x-2}{x+5} > 2$ is the interval

(a) $(-12, -5)$ (b) $(-1, -4)$ (c) $(5, 12)$ (d) $(-5, \infty)$

9. The number of common integral values of x satisfying $|x+3| \geq 10$ and $|x+2| \leq 9$ is

(a) 1 (b) 2 (c) 3 (d) 7

10. The set of values of x for which $|x+3| > |2x-1|$ is

(a) $(-\infty, -4) \cup \left(\frac{2}{3}, \infty\right)$ (b) $\left(-\infty, -\frac{2}{3}\right) \cup (4, \infty)$ (c) $\left(-4, \frac{2}{3}\right)$ (d) $\left(-\frac{2}{3}, 4\right)$

11. Let $A = \{x : x^2 + 6x - 7 < 0\}$ and $B = \{x : x^2 + 9x + 14 > 0\}$. Consider the following statements. (i) $A \cap B = (-2, 1)$. (ii) $A - B = (-7, -2)$. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

12. The number of integral solutions of the inequality $\frac{x-1}{x} \geq 2$ is

(a) 2 (b) 1 (c) 4 (d) 3

Correct options

1.(b) 2.(d) 3.(c) 4.(c) 5.(a) 6.(a) 7.(b) 8.(a) 9.(a) 10.(d) 11.(a) 12.(b)

Unit test

1. If S is the solution set of $4x - 3 \geq \frac{10x-1}{3}$ then the sum of the real roots of the equation $x^4 - 16x^3 + x - 16 = 0$, not belonging to S is

(a) 17 (b) -1 (c) 15 (d) 0

2. If $2(x-1) < x+5,\ 3(x+2) > 2 - x$ then sum of the greatest and least possible integral values of x is equal to

(a) 4 (b) 6 (c) 7 (d) 8

3. A function $f(x)$ is defined for any x, for the values of x satisfying $\frac{5x+8}{4-x} \leq 2$ then number of integral points not belonging to the domain of $f(x)$ is

(a) 4 (b) 3 (c) 5 (d) infinite

4. The amount of water added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content is x. Then

(a) $0 < x < 300$ (b) $562.5 < x < 900$

(c) $102.5 < x < 200$ (d) $5 < x < 16$

5. The number of integral values of x satisfying both $|x-1| \leq 5$ and $|x| \geq 2$ is

(a) 8 (b) 9 (c) 7 (d) ∞

6. The set of all values of x satisfying $\frac{|x+3|+x}{x+2} > 1$ is $(a, b) \cup (c, \infty)$. The value of $a + b + c =$

(a) -7 (b) -8 (c) -9 (d) -6

7. The number of ordered pairs of positive integers (x, y) such that $x + y \leq 4$, is

(a) 4 (b) 5 (c) 6 (d) 8

8. The marks obtained by a student in first and second terminal examination are 52 and 45 respectively. The minimum marks the student should get in the third examination to have an average of atleast 60 marks is

(a) 73 (b) 83 (c) 67 (d) 57

Correct options

1.(b) 2.(b) 3.(a) 4.(b) 5.(a) 6.(b) 7.(c) 8.(b)

Filler

Which of the following is NOT a subset of the solution set of $|x^2 + 3x| + x^2 - 2 \geq 0$?

(a) $(-\infty, -3)$ (b) $\left[-3, -\frac{2}{3}\right]$ (c) $[1/2, \infty)$ (d) $(-1, 3)$

Ans(d): If $x^2 + 3x \geq 0$ then $|x^2 + 3x| + x^2 - 2 \geq 0$

$\Rightarrow x^2 + 3x + x^2 - 2 \geq 0 \Rightarrow 2x^2 + 3x - 2 \geq 0$

$\Rightarrow (2x - 1)(x + 2) \geq 0 \Rightarrow x \leq -2$ or $x \geq \frac{1}{2}$ ... (1)

But $x^2 + 3x \geq 0 \Rightarrow x(x + 3) \geq 0 \Rightarrow x \geq 0$ or $x \leq -3$ ... (2)

Combining (1) and (2) we get, $x \leq -3$ or $x \geq \frac{1}{2}$ ... (3)

If $x^2 + 3x \leq 0$ then $|x^2 + 3x| + x^2 - 2 \geq 0$

$\Rightarrow -x^2 - 3x + x^2 - 2 \geq 0 \Rightarrow -3x - 2 \geq 0 \Rightarrow x \leq -\frac{2}{3}$ ... (4)

But $x^2 + 3x \leq 0 \Rightarrow x(x + 3) \leq 0 \Rightarrow -3 \leq x \leq 0$ ...(5)

Combining (3) and (4) we get, $-3 \leq x \leq -\frac{2}{3}$ ... (6)

Thus combining above (3) and (6) we get, $(-\infty, -3) \cup \left[-3, -\frac{2}{3}\right] \cup [1/2, \infty)$.

From the options we see that (d) is not a subset of the solution set.

7. PERMUTATIONS AND COMBINATIONS

1. The number of numbers between 99 and 1000 having 7 in its units place is

(a) 100 (b) 90 (c) 81 (d) 99

2. The number of ways in which some or all the n objects can be taken at a time is

(a) $2n$ (b) 2^n (c) $2^n - 1$ (d) $2n - 1$

3. The smallest natural number n such that $n!$ is divisible by 990, is

(a) 9 (b) 11 (c) 33 (d) 9

4. The number of ways in which 6 persons can be arranged in a row so that 2 particular persons are never together, is

(a) 72 (b) 600 (c) 60 (d) 480

5. Three married couples are to be seated in a row having six consecutive seats in a cinema hall. Consider the statements (i) and (ii) :

(i) The number of ways of arrangements if spouses are to be seated next to each other is 48

(ii) The number of ways of arrangements if all the ladies sit next to each other is 144

(a) only (i) is true (b) only (ii) is true

(c) neither (i) nor (ii) is true (d) both (i) and (ii) are true

6. The 4 distinct English books, 5 distinct Kannada books and n distinct Hindi books are arranged in a shelf so that the books of the same language are together. If the number of arrangements is 103680 the value of n is

(a) 1 (b) 2 (c) 3 (d) 4

7. The number of permutations of the letters of the word 'BASEBALL' taken all at a time is x. Out of these permutations if y is the number of permutations beginning with B and ending with L then $x - y =$

(a) 298 (b) 4680 (c) 3720 (d) 336

8. If all the letters of the word SMELL are arranged as in the dictionary order, the rank of the word SMELL is

(a) 56 (b) 58 (c) 59 (d) 57

9. The expression, ${}^{47}C_3 + 3.{}^{47}C_4 + 3.{}^{47}C_5 + {}^{47}C_6$ is

(a) ${}^{49}C_6$ (b) ${}^{51}C_5$ (c) ${}^{50}C_6$ (d) ${}^{50}C_5$

10. Suppose that we want to form a group of 6 persons from a group of 8 persons. If the person A is included in the group then another person B must be included. The number of ways of forming the group of 6 is

(a) 18 (b) 36 (c) 30 (d) 22

11. A group consists of 4 girls and 7 boys. The number of ways can a team of 5 be selected

(a) if no girl is included, is 20 (b) if only one boy is included, is 2

(c) if 3 girls included, is 84 (d) if only one girl is excluded, is 64

12. The number of ways in which 6, '+' signs and 4, '−' signs can be arranged in a line such that no two '−' signs are together, is

(a) 35 (b) 72 (c) 81 (d) 84

13. The number of different words that can be formed by jumbling the letters of the word PUTTAPUTTI in which two P are not adjacent, is

(a) $\frac{8!}{2!.4!}.{}^9C_2$ (b) $\frac{8!}{2!.4!}.{}^9C_3$ (c) $\frac{8!}{3!.5!}.{}^9C_2$ (d) $\frac{8!}{3!.54!}.{}^9C_3$

14. The sum of all the unit digits of the numbers formed by the digits $3, 4, 5, 6$ taken all at a time is

(a) 108 (b) 144 (c) 200 (d) 68

Correct options

1.(b) 2.(c) 3.(b) 4.(d) 5.(d) 6.(c) 7.(b) 8.(b) 9.(c) 10.(d) 11.(c) 12.(a) 13.(a) 14.(a)

Unit test

1. There are four candidates for one post in a company. The selection committee contains five members. Each selection committee member should vote for one candidate only. The number of ways in which the votes can be given, is

(a) 1048 (b) 1072 (c) 1024 (d) 625

2. A sequence of numbers $a_1, a_2, a_3, \dots, a_n$ is defined by $a_1 = 2$, $a_k = \frac{a_{k-1}}{k}$, $\forall\, k \in N$, $k \geq 2$. Then which of the following is FALSE?

(a) $\frac{1}{a_k} + \frac{1}{a_{k+1}} = \frac{k!(k+2)}{2}$ (b) $a_k : a_{k+1} = (k+1) : 1$

(c) $a_k + a_{k+1} = \frac{2(k+2)}{(k+1)!}$ (d) $\sqrt{a_k a_{k+1}} = \frac{2}{(k+1)!}$.

3. The possible number of numbers greater than 41000 that can be formed by using the digits, is $1, 2, 3, 4, 5$ only once, is

(a) 41 (b) 48 (c) 50 (d) 55

4. The number of ways in which the letters of the word GLOOMY be arranged so that the two O's are not together, is

(a) 360 (b) 240 (c) 600 (d) 480

5. If ${}^{36}C_{n+2} = {}^{36}C_{2n-2}$ then ${}^{n}C_{10} =$

(a) 28 (b) 66 (c) 42 (d) 54

6. If 20 lines are drawn in a plane such that no two of them are parallel and no three are concurrent then the number of points of intersection of the lines is

(a) 96 (b) 190 (c) 380 (d) 40

7. There are 10 persons named, $P_1,\ P_2,\ P_3, \dots, P_{10}$. Out of 10 persons, 5 persons are to be arranged in a line such that in each arrangement P_1 must occur where as P_4 and P_5 do not occur. The number of possible such arrangements is

(a) ${}^{7}C_4 . 4!$ (b) ${}^{7}C_3 . 3!$ (c) ${}^{7}C_4 . 5!$ (d) ${}^{7}C_3 . 2!$

8. There are three parallel lines in a plane. A total of m points are marked on the first line, n points on the second line and p points are marked on the third line. The maximum number of triangles that can be formed from these points is

(a) ${}^{m+n+k}C_3 - {}^{m}C_3 - {}^{n}C_3 - {}^{k}C_3$ (b) ${}^{m+n+k}C_3 + {}^{m}C_3 + {}^{n}C_3 + {}^{k}C_3$

(c) ${}^{m+n+k}C_3 - {}^{m}C_3 . {}^{n}C_3 . {}^{k}C_3$ (d) ${}^{m+n+k}C_3 - {}^{m}C_3 - {}^{n}C_3 - {}^{k}C_3 - 3$

9. In how many ways can the letters of the word "GARDEN" be arranged so that in each word the vowels appear in alphabetical order?

(a) 120 (b) 240 (c) 360 (d) 480

10. The number of permutations of n different things taken r at a time such that two specific things are together is

(a) $(r-1)! . {}^{n-2}C_{r-1}$ (b) $(r-2)! . 2! . {}^{n-2}C_{r-2}$

(c) $(r-1)! . 2! . {}^{n-2}C_{r-2}$ (d) $r! . 2! . {}^{n-2}C_{r-2}$

Correct options

1.(c) 2.(d) 3.(b) 4.(b) 5.(b) 6.(b) 7.(c) 8.(a) 9.(c) 10.(c)

8. BINOMIAL THEOREM

1. If $(1-ax)^n = 1-15x+90x^2-270x^3+\cdots$ then $a+n=$

(a) 3 (b) 2 (c) 8 (d) 7

2. In the expansion of $(x+a)^n$ if the sum of the odd terms is denoted by O and the sum of the even terms is denoted by E then $O^2-E^2=$

(a) $(x^2+a^2)^n$ (b) $(x+a)^{2n}-(x-a)^{2n}$

(c) $(x^2-a^2)^n$ (d) $(x+a)^{2n}+(x-a)^{2n}$

3. The remainder obtained when 25^{15} is divided by 13 is

(a) 0 (b) 12 (c) 1 (d) 9

4. The value of n if the coefficients of x^7 and x^8 in the expansion of $\left(2+\frac{x}{3}\right)^n$ are equal, is

(a) 55 (b) 54 (c) 15 (d) 14

5. In the binomial expansion of $\left(\frac{1}{2}x^2-\frac{1}{x}\right)^{11}$, the 5^{th} term from the right end is

(a) $-{}^{11}C_5.\frac{x}{8}$ (b) $-{}^{11}C_4.\frac{x}{16}$ (c) ${}^{11}C_4.\frac{x}{12}$ (d) ${}^{11}C_5.\frac{x}{8}$

6. The term independent of x in the expansion of $\left(3x-\frac{2}{x^2}\right)^{15}$ is NOT divisible by

(a) 15 (b) 13 (c) 14 (d) 21

7. If the middle term in the expansion of $\left(\frac{n}{2}+2\right)^8$ is 1120 then $n=$

(a) 2 (b) 4 (c) 3 (d) 1

8. The coefficient of x in the expansion of

$$(1+x)^3+(1+x)^4+(1+x)^5+\cdots+(1+x)^{90} \text{ is } =$$

(a) 4093 (b) 4092 (c) 404 (d) 406

9. The coefficient of x^{50} in the expansion of $(1+2x+x^2)^{50}$ is

(a) $\frac{100!}{50!}$ (b) $\frac{100!}{49!.51!}$ (c) $\frac{100!}{(50!)^2}$ (d) $\frac{100!}{49!}$

10. The ratio of the coefficients of two successive terms in the expansion of $(1+x)^{24}$ is 4. The ranks of the terms are

(a) $20,\ 21$ (b) $19,\ 20$ (c) $18,\ 19$ (d) $21,\ 22$

11. Sum of the first 107 coefficients of the terms in the expansion of $(1+x)^{213}$, when arranged in ascending powers of x, is

(a) 2^{212} (b) 2^{214} (c) 2^{107} (d) 2^{206}

12. Consider the binomial expansion of $(1 + x)^{2n + 1}$. The mean of the coefficients of the two middle terms is

(a) ${}^{2n + 2}C_{n + 1}$ (b) $\frac{1}{2}.{}^{2n + 2}C_{n}$ (c) $\frac{1}{2}.{}^{2n + 2}C_{n + 1}$ (d) ${}^{2n + 2}C_{n}$

Correct options

1.(c) 2.(c) 3.(b) 4.(a) 5.(b) 6.(a) 7.(a) 8.(b) 9.(c) 10.(a) 11.(a) 12.(c)

Unit test

1. The first three terms in the expansion of $(a + b)^n$ are 729, 7290 and 30375 respectively. Which of the following is TRUE?

(a) $n = 5$ (b) $a = 4$ (c) $b = 3$ (d) $a + b + n = 14$

2. The term independent of x in the expansion of $\left(\frac{3x^2}{2} - \frac{k}{3x}\right)^{15}$ is ${}^{15}C_5$ then $k =$

(a) 0 (b) $\pm 2\sqrt{6}$ (c) $\pm\sqrt{6}$ (d) $\pm\frac{1}{2\sqrt{6}}$

3. The two middle terms in the expansion of $\left(\frac{p}{x} + \frac{x}{p}\right)^9$ are equal when

(a) $x = 2p$ (b) $p = 2x$ (c) $p^2 = 2x^2$ (d) $p^2 = x^2$

4. If in the expansion of $(1 + a)^n$ the coefficients of $a^{r - 1}$, a^r and $a^{r + 1}$ are in arithmetic progression, then $(n - 2r)^2 =$

(a) $n - 2$ (b) $n + 2$ (c) $2n - 2$ (d) $2n + 2$

5. The coefficient of $\frac{1}{x}$ in the expansion of $(1 + x)^n\left(1 + \frac{1}{x}\right)^n$ is

(a) $\frac{(2n)!}{n!.n!}$ (b) $\frac{(2n)!}{(n-1)!.n!}$ (c) $\frac{(2n)!}{(n-2)!.(n+2)!}$ (d) $\frac{(2n)!}{(n-1)!.(n+1)!}$

6. The sum of all the binomial coefficients in the binomial expansion of $(a + b)^n$ is 2048. The greatest binomial coefficient is

(a) 1048 (b) 462 (c) 1800 (d) 924

7. If $C_0, C_1, C_2, \ldots, C_{30}$ are the binomial coefficients of order 30, then

$$1.\frac{C_1}{C_0} + 3.\frac{C_3}{C_2} + 5.\frac{C_5}{C_4} + \cdots + 29.\frac{C_{29}}{C_{28}} =$$

(a) 240 (b) 105 (c) 120 (d) 210

Correct options

1.(d) 2.(c) 3.(d) 4.(b) 5.(d) 6.(b) 7.(a)

9. SEQUENCES AND SERIES

1. If the reciprocals of the numbers $0.272727 \ldots$, x, $0.727272 \ldots$ are in A.P. then $x =$

(a) $48/121$ (b) $24/121$ (c) $48/11$ (d) $24/11$

2. A carpenter was hired to build 192 window frames. The first day he made five frames and each day there after he made two more frames than he made the day before. The number of days he took to finish the job is

(a) 15 (b) 10 (c) 11 (d) 12

3. An A.P. contains $2n + 1$ terms. The ratio of the sum of all odd terms to the sum of all even terms in the simplest form is $a : b$ where a and b are relatively prime. Then $a + b =$

(a) n (b) $n + 1$ (c) $2n$ (d) $2n + 1$

4. If a, b, c are in G.P. then $\frac{a-b}{b-c} =$

(a) c/b (b) a/c (c) b/a (d) b/c

5. A sequence of numbers $a_1, a_2, a_3, \ldots, a_n$ is defined by $a_1 = 2$, $a_n = 5a_{n-1}$, $\forall\, n \in N$, $n \geq 2$. Then which of the following is FALSE?

(a) fourth term of the sequence is 250 (b) $a_n = 2 \times 5^{n-1}$

(c) $a_1, a_2, a_3, \ldots$ is a G.P. with the common ratio 5 (d) $a_{n-1} = 5 \times 2^n$

6. The lengths of three unequal edges of a rectangular solid block are in G.P. The volume of the block is $216\ cm^3$ and the total surface area is $252\ cm^2$. The length of the longest edge, is

(a) 6 (b) 12 (c) 32 (d) 16

7. If a, b, c are three unequal numbers in A.P. and if $a, b - a, c - a$ are in G.P. Then $a : b : c$ is

(a) $3 : 2 : 5$ (b) $1 : 3 : 5$ (c) $2 : 3 : 4$ (d) $1 : 2 : 1$

8. If $x, 2y, 3z$ are in A.P. and x, y, z are in G.P. then the sum of all possible values of the common ratio of the given G.P is

(a) $2/3$ (b) $4/3$ (c) $1/3$ (d) 1

9. In a G.P. of positive terms if each term is A.M. between the next two terms and if 10^{th} term is x then the 20^{th} term is

(a) x (b) $10x$ (c) $20x$ (d) $100x$

10. If a, b, c are positive numbers then $(a + b)(b + c)(c + a)$ is

(a) $> 8abc$ (b) $< 2abc$ (c) $= 4abc$ (d) $= abc$

11. The sum of the series $1 + 3x + 5x^2 + 7x^3 + \cdots,\ \ 0 < x < 1$, up to infinity is

(a) $\frac{1}{1-x}$ (b) $\frac{1+x}{(1-x)^2}$ (c) $\frac{2-x}{(1-x)^2}$ (d) $\frac{1}{(1-x)^2}$

12. Let $S_n = \sum_{k=1}^{n} t_k$ where $t_k = 1 + 3 + 5 + \cdots$ to k terms. Then $S_{100} =$

(a) 5050×201 (b) 1010×67 (c) 5050×67 (d) 1010×201

13. The 30^{th} term of the series $1 + 5 + 12 + 22 + 35 + \cdots$ is

(a) 1440 (b) 2670 (c) 1335 (d) 2880

14. If the sum to n terms of $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \ldots$ is $\frac{3}{19}$ then value of n is

(a) 4 (b) 2 (c) 8 (d) 12

Correct options

1.(a) 2.(d) 3.(d) 4.(d) 5.(d) 6.(b) 7.(b) 8.(b) 9.(a) 10.(a) 11.(b) 12.(c) 13.(c) 14.(d)

Unit test

1. If the sum to m terms of an A.P. is equal to the sum of either the next n terms or next p terms then $\frac{m+n}{m-n} : \frac{m+p}{m-p} =$

(a) $p : n$ (b) $n : p$ (c) $(mp+1) : (mn+1)$ (d) $p^2 : n^2$

2. In a G.P. of even number of terms the sum of all terms is 5 times the sum of the oddth terms. The common ratio of the G.P. is

(a) -2 (b) 4 (c) 2 (d) -4

3. A manufacturer reckons that the value of a machine, which costs him ₹15625, will depreciate each year by 20%. The estimated value at the end of 5 years, is

(a) ₹4290 (b) ₹5120 (c) ₹6240 (d) ₹3760

4. The coefficient of x^4 in the expansion of $(1 + 2x + 3x^2 + 4x^3 + \cdots)^{1/2}$ is

(a) $1/4$ (b) $1/16$ (c) 1 (d) $1/128$

5. If $a\left(\frac{1}{b} + \frac{1}{c}\right),\ b\left(\frac{1}{c} + \frac{1}{a}\right)$ and $c\left(\frac{1}{a} + \frac{1}{b}\right)$ are in A.P. then $a,\ b,\ c$ are in

(a) A.P. (b) G.P. (c) H.P. (d) A.G.P.

6. The minimum value of $4^x + 4^{1-x}$ is

(a) 24 (b) 4 (c) 2 (d) 1

7. The sum to n terms of $1^2 + 3^2 + 5^2 + \cdots$ is 1330. The value of n is

(a) 18 (b) 20 (c) 9 (d) 10

8. The n^{th} term of the series $1 + 3 + 7 + 13 + 21 + \cdots$ is 10101. Then $n =$

(a) 99 (b) 100 (c) 101 (d) 102

9. The sum to n terms of $\frac{3}{1.2}.\frac{1}{2} + \frac{4}{2.3}.\frac{1}{2^2} + \frac{5}{3.4}.\frac{1}{2^3} + \cdots =$

(a) $1 - \frac{1}{n.2^n}$ (b) $1 - \frac{1}{(n+1).2^n}$ (c) $1 + \frac{1}{(n+1).2^n}$ (d) $1 + \frac{1}{n.2^n}$

10. If a, b, c, d are four distinct positive quantities in A.P. then

(a) $bc^2 > ad^2$ (b) $bc < ad$ (c) $bc > ad$ (d) $bc^2 < ad^2$

Correct options

1.(a) 2.(b) 3.(b) 4.(c) 5.(a) 6.(b) 7.(d) 8.(c) 9.(b) 10.(c)

Filler

The sum of three numbers in G.P. is 56. If we subtract 1, 7, 21 from these numbers in that order, we obtain an A.P. The second number is

(a) 32 (b) 8 (c) 16 (d) 64

Ans(c): Let a, ar, ar^2 be the three given numbers. Given $a + ar + ar^2 = 56$.
Also by the given condition, $a - 1$, $ar - 7$ and $ar^2 - 21$ are in A.P.
Thus $(a-1) + (ar^2 - 21) = 2(ar - 7) \Rightarrow ar^2 - 2ar + a = 8$.
Thus $\frac{a + ar + ar^2}{ar^2 - 2ar + a} = \frac{56}{8} \Rightarrow \frac{a(1 + r + r^2)}{a(r^2 - 2r + 1)} = 7 \Rightarrow 1 + r + r^2 = 7(r^2 - 2r + 1)$

$\Rightarrow 6r^2 - 15r + 6 = 0 \Rightarrow 2r^2 - 5r + 2 = 0 \Rightarrow (2r - 1)(r - 2) = 0$

$\Rightarrow r = 2, \frac{1}{2}$.

By taking $r = 2$ in $a + ar + ar^2 = 56$ we get, $a + 2a + 4a = 56$. $\therefore 7a = 56$. $\therefore a = 8$.

By taking $r = \frac{1}{2}$ in $a + ar + ar^2 = 56$ we get, $a + \frac{a}{2} + \frac{a}{4} = 56$. $\therefore \frac{7a}{4} = 56$. $\therefore a = 32$.

When $r = 2$, $a = 8$, the required numbers (a, ar, ar^2) are 8, 16, 32

when $r = \frac{1}{2}$, $a = 32$, the required numbers (a, ar, ar^2) are 32, 16, 8.

10. STRAIGHT LINES

1. Consider the parallelogram formed by the four points $A(1,2)$, $B(4,y)$, $C(x,6)$ and $D(3,5)$ taken in order. The area of the parallelogram (in sq. units) is

(a) $5/2$ (b) 5 (c) $7/2$ (d) 7

2. The ends of the base of an isosceles triangle are at $(2a,0)$ and $(0,\ a)$. One side is parallel to y-axis. The third vertex is

(a) $(a,\ 5a/2)$ (b) $(2a,\ 3a/2)$ (c) $(a,\ 3a/2)$ (d) $(2a,\ 5a/2)$

3. Consider the line AB joining $A(3,\ -4)$ and $B(-2,\ 6)$ and the line CD joining the points $C(-3,6)$ and $D(9,\ -18)$. Then

(a) AB is perpendicular to CD (b) AB is parallel to CD and are not coincident

(c) AB coincides with CD (d) AB and CD are inclined at $45°$

4. A ray of light coming from the point $(1,\ 2)$ is reflected at a point A on the x-axis and then passes through the point $(5,3)$. Then A is

(a) $(-3,0)$ (b) $(18/5,0)$ (c) $(13/5,0)$ (d) $(-7,0)$

5. The equation of the altitude through A of the triangle formed by the points $A(0,\ 4)$, $B(-3,\ 0)$ and $C(3,\ 0)$ is

(a) $x = 0$ (b) $y = 0$ (c) $x = 3$ (d) $y = 4$

6. The line having length of the perpendicular from the origin as 4 units and having the inclination of the perpendicular to the line from the origin with the positive x-axis as $30°$, passes through

(a) $(2,\sqrt{3})$ (b) $(1,\sqrt{3})$ (c) $(\sqrt{3},5)$ (d) $(\sqrt{3},3)$

7. The portion of the line intercepted between the coordinate axes is divided by the point $(-5,\ 4)$ in the ratio $1:2$. The equation of the line is

(a) $8x + 5y + 20 = 0$ (b) $8x - 5y + 60 = 0$

(c) $2x + y + 6 = 0$ (d) $x + 2y - 3 = 0$

8. The value of k for which the equations $3x - y = 8$ and $9x - ky = 24$ will have infinitely many solutions, is

(a) 3 (b) 1 (c) 4 (d) 9

9. If the point $(a,\ a)$ lies between the lines $|x + y| = 2$ then set of all possible values of a is

(a) $(-1,1)$ (b) $(-2,2)$ (c) $(-1/2,1/2)$ (d) $(-1/\sqrt{2},1/\sqrt{2})$

10. The equation of the line passing through the origin and through a point of trisection of the portion of the line $3x + y = 12$, intercepted between the axes, is

(a) $y = 2x$ (b) $y = 3x$ (c) $y = 6x$ (d) $y = x$

11. The angle θ between the straight lines $(m^2 - mn)y = (mn + n^2)x + n^3$ and $(m^2 + mn)y = (mn - n^2)x + m^3$ where $m > n$, is given by

(a) $sin\ \theta = \frac{4m^2n^2}{m^4 - n^4}$ (b) $tan\ \theta = \frac{4m^2n^2}{m^4 - n^4}$ (c) $tan\ \theta = \frac{4mn}{m^2 - n^2}$ (d) $sin\ \theta = \frac{4mn}{m^2 - n^2}$

12. The line passing through the point of intersection of the lines $x - y + 1 = 0$ and $3x + y - 5 = 0$ and perpendicular to the first line, contains the point

(a) $(3, -2)$ (b) $(1, -4)$ (c) $(7, -3)$ (d) $(5, -2)$

13. The equation of the base of an equilateral triangle is $x + y = 2$ and the third vertex is $(2, -1)$. The length of the side of the triangle is

(a) $\sqrt{2/3}$ (b) $2\sqrt{3}$ (c) $\sqrt{6}$ (d) $\sqrt{6}/2$

14. The distance between the lines $3x + 4y = 9$ and $6x + 8y = 15$ is $\frac{a}{b}$ where a and b are relatively prime. The value of $b - a =$

(a) 4 (b) 7 (c) 13 (d) 9

15. If the length of the perpendicular dropped from (a, b) on a line with intercepts a and b on the axes is unity then

(a) $a^2 - b^2 = 1$ (b) $a - b = 1$ (c) $a + b = 1$ (d) $a^{-2} + b^{-2} = 1$

Correct options

1.(d) 2.(d) 3.(b) 4.(c) 5.(a) 6.(c) 7.(b) 8.(a) 9.(a) 10.(c) 11.(b) 12.(d) 13.(a) 14.(b) 15(d)

Unite test

1. Let $O \equiv (0,0)$, $A \equiv (2,3)$ and $B \equiv (6,9)$ be three points such that O divides AB externally in the ratio $m : n$. The point C which divides AB internally in the ratio $m : n$ is

(a) $(2, 7/2)$ (b) $(3, 9/2)$ (c) $(4, 6)$ (d) $(2, 6)$

2. The incenter of the triangle formed by the points $A(1, \sqrt{3})$, $B(0,0)$ and $C(2,0)$ is

(a) $(1, \sqrt{3})$ (b) $(1, 1/\sqrt{3})$ (c) $(2, \sqrt{3})$ (d) $(2, 1/\sqrt{3})$

3. P_1 and P_2 are two points on the two lines given by $y = \sqrt{3}|x| + 2$ at a distance of 5 units from the point of intersection of the two lines. The foot of the perpendicular drawn from the points P_1 and P_2 to the internal angle bisector of the two lines is

(a) $\left(0,\ 2 + \frac{5}{2}\right)$ (b) $\left(0,\ 2 + \frac{5\sqrt{3}}{2}\right)$ (c) $\left(0,\ 2 - \frac{5\sqrt{3}}{2}\right)$ (d) $\left(0,\ 2 - \frac{5}{2}\right)$

4. If the slope of the line passing through $A(3,\ 2)$ is $\frac{3}{4}$ then the points on the line at a distance of 5 units away from A are

(a) $(7, -2),\ (-1,\ 1)$ (b) $(-7, -2),\ (-2,\ 1)$

(c) $(7,\ 5),\ (1,\ 1)$ (d) $(7,\ 5),\ (-1,\ -1)$

5. The distance of the line $4x + 7y + 5 = 0$ from the point $(1, 2)$ along the line $2x - y = 0$ is

(a) $23\sqrt{5}/4$ (b) $23\sqrt{5}/2$ (c) $23\sqrt{5}/9$ (d) $23\sqrt{5}/18$

6. Equation of the line passing through $(acos^3\theta,\ asin^3\theta)$ and parallel to $x.sec\ \theta + y.cosec\ \theta = a$ is $x.sin\ \theta + y.cos\ \theta = c$ then $c =$

(a) $-\frac{1}{2}a.sin\ 2\theta$ (b) $\frac{1}{2}a.sin\ 2\theta$ (c) $\frac{1}{2}a.cos\ 2\theta$ (d) $-\frac{1}{2}a.cos\ 2\theta$

7. The angle between the lines $y = \left(2 - \sqrt{3}\right)(x + 5)$ and $y = \left(2 + \sqrt{3}\right)(x - 7)$ is

(a) $90°$ (b) $45°$ (c) $30°$ (d) $60°$

8. The equation of the diagonal of the quadrilateral formed by the lines $x = 0,\ y = 0,\ x + y = 1$ and $6x + y = 3$, passing through the origin, is

(a) $2x + 3y = 0$ (b) $2x - 3y = 0$ (c) $3x - 2y = 0$ (d) $3x + 2y = 0$

9. The equation of the line passing through $(1, 0)$ lying at a distance of $\frac{\sqrt{3}}{2}$ from the origin is (a) $\sqrt{3}x - y - \sqrt{3} = 0$ or $\sqrt{3}x + y + \sqrt{3} = 0$

(b) $\sqrt{3}x - y - \sqrt{3} = 0$ or $\sqrt{3}x + y - \sqrt{3} = 0$

(c) $\sqrt{3}x + y - \sqrt{3} = 0$ or $\sqrt{3}x + y + \sqrt{3} = 0$

(d) $\sqrt{3}x - y + \sqrt{3} = 0$ or $\sqrt{3}x + y + \sqrt{3} = 0$

10. The end points of the base of a triangle are $(2, -1)$ and $(3,\ -4)$. The locus of the vertex of the triangle, if the altitude from the vertex is $\sqrt{10}$, is

(a) $3x + y + 5 = 0$ (b) $3x - y - 7 = 0$ (c) $3x + y + 15 = 0$ (d) $3x - y - 15 = 0$

Correct options

1.(b) 2.(b) 3.(b) 4.(d) 5.(d) 6.(b) 7.(d) 8.(c) 9.(b) 10.(a)

11. CONIC SECTIONS

1. A circle passing through $(3, -6)$ touches both the axes. The difference of the x-coordinates of the centers of the possible circles is

(a) 8 (b) 18 (c) 12 (d) 14

2. The locus of the point (x, y) where $x = \frac{2at}{1+t^2}$ and $y = \frac{a(1-t^2)}{1+t^2}$ where t is a parameter and $a > 0$, is a circle centered at (h, k) having radius r. Then $h + k + r =$

(a) $a/2$ (b) $\sqrt{2}a$ (c) $2a$ (d) a

3. The number of common tangents that can be drawn to the circles

$x^2 + y^2 - 4x - 6y - 3 = 0$ and $x^2 + y^2 + 2x + 2y - 1 = 0$ is

(a) 4 (b) 2 (c) 3 (d) 1

4. The equation of the parabola having directrix at $x = 0$ and focus at $(6, 0)$ is

(a) $x^2 - 12y + 5 = 0$ (b) $x^2 - 12y + 36 = 0$

(c) $y^2 - 12x + 36 = 0$ (d) $y^2 - 12x + 5 = 0$

5. Which of the following is FALSE with regard to the parabola $x^2 = -8y$?

(a) focus is $(0, -2)$ (b) directrix is $y = 2$

(c) length of the latus rectum is 16 (d) vertex is $(0, 0)$

6. In the parabola $y^2 = 4ax$, the length of the chord passing through the vertex and inclined to the x-axis at $\pi/4$ is

(a) $4a\sqrt{2}$ (b) $4a$ (c) $2a\sqrt{2}$ (d) $2a$

7. The distance of $A(p, q)$ lying on the parabola $y^2 = 8x$ from its focus is 4. The value of $p + |q| =$

(a) 8 (b) 2 (c) 4 (d) 6

8. If the major axis of an ellipse is double the minor axis and the length of latus rectum is 3, then the distance between the two foci is

(a) $2\sqrt{3}$ (b) $4\sqrt{3}$ (c) $8\sqrt{3}$ (d) $6\sqrt{3}$

9. If the focal distance of an end of the minor axis of an ellipse centered at the origin is k and the distance between the foci is $2h$, then the equation of the ellipse is

(a) $\frac{x^2}{k^2} + \frac{y^2}{k^2 - h^2} = 1$ (b) $\frac{x^2}{k^2} + \frac{y^2}{h^2 - k^2} = 1$ (c) $\frac{x^2}{k^2} + \frac{y^2}{h^2} = 1$ (d) $\frac{x^2}{h^2} + \frac{y^2}{k^2 + h^2} = 1$

10. If the angle between the lines joining the foci of an ellipse to an extremity of the minor axis is 90°, the ratio between the major axis and minor axis is

(a) $2\sqrt{2} : 1$ (b) $\sqrt{2} : 1$ (c) $2\sqrt{2} : 3$ (d) $4\sqrt{2} : 3$

11. Which of the following is FALSE with regard to the hyperbola, $9x^2 - 16y^2 = 144$?

(a) Two vertices are $(\pm 4,\ 0)$ (b) Eccentricity is $= 5/4$

(c) Two foci are $(\pm 5, 0)$ (d) Length of the latus rectum $= 32/3$

12. The locus of the point of intersection of the lines $\sqrt{3}x - y - 4\sqrt{3}k = 0$ and $\sqrt{3}xk + yk - 4\sqrt{3} = 0$, where k is a parameter is

(a) a circle (b) a parabola (c) an ellipse (d) a hyperbola

13. The eccentricity of a hyperbola is $\sqrt{3}$. The eccentricity of the hyperbola conjugate to the given hyperbola is

(a) $\sqrt{5/2}$ (b) $\sqrt{4/3}$ (c) $\sqrt{3/2}$ (d) $\sqrt{5/3}$

14. The foci of the ellipse, $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola, $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide then $b^2 =$

(a) 7 (b) 5 (c) 9 (d) 1

Correct options

1.(c) 2.(d) 3.(b) 4.(c) 5.(c) 6.(a) 7.(d) 8.(d) 9.(a) 10.(b) 11.(d) 12.(d) 13.(c) 14.(a)

Unit test

1. From any point on the circle $x^2 + y^2 = r^2$ tangents are drawn to the circle, $x^2 + y^2 = r^2 sin^2\alpha$. The angle between them, is

(a) 4α (b) $\alpha/2$ (c) α (d) 2α

2. The equation of the chord of the circle $x^2 + y^2 - 2x - 30 = 0$ bisected at $(0,\ 2)$ is

(a) $2x + y + 2 = 0$ (b) $x - 2y + 4 = 0$

(c) $2x - y + 2 = 0$ (d) $x + 2y - 4 = 0$

3. A circle C has center at $(0, 1)$ and it touches $x^2 + y^2 + 4x - 2y - 20 = 0$ internally. The radius of the circle C is

(a) 4 (b) 7 (c) 5 (d) 3

4. The equation of the parabola having $(0, 4)$ and $(0, 2)$ as vertex and focus respectively, is

(a) $x^2 - 6y + 24 = 0$ (b) $x^2 + 8y - 32 = 0$

(c) $x^2 - 2y + 8 = 0$ (d) $x^2 - 4y + 16 = 0$

5. If the vertex of the parabola $y = x^2 - 8x + c$ lies on the x-axis then $c =$

(a) 16 (b) -3 (c) -4 (d) 12

6. The equation, $\frac{x^2}{10 - k} + \frac{y^2}{4 - k} = 1$ represents an ellipse, if

(a) $k < 4$ (b) $k > 4$ (c) $k < 8$ (d) $k > 8$

7. If the eccentricity of an ellipse is $\frac{5}{8}$ and the distance between the foci is 10, then the length of the latus rectum $=$

(a) $13/2$ (b) $39/4$ (c) $39/2$ (d) 13

8. The equation of the normal to the hyperbola, $x^2 - y^2 = -3$ at $(0, \sqrt{3})$ is

(a) $x = \sqrt{3}$ (b) $y = \sqrt{3}$ (c) $x = 0$ (d) $y = 0$

9. The equation of the hyperbola having foci at $(0, \pm\sqrt{10})$ passes through $(2, 3)$. The length of the transverse axis is

(a) $2\sqrt{3}$ (b) $2\sqrt{10}$ (c) $2\sqrt{5}$ (d) $2\sqrt{6}$

10. A circle passes through $(0, 0)$, $(a, 0)$ and $(0, b)$. Then which of the following is FALSE?

(a) center is (a, b) (b) equation of the circle is $x^2 + y^2 - ax - by = 0$

(c) radius of the circle is $\frac{1}{2}\sqrt{a^2 + b^2}$ (d) center is $(a/2, b/2)$

Correct options

1.(d) 2.(b) 3.(d) 4.(b) 5.(a) 6.(a) 7.(b) 8.(c) 9.(c) 10.(a)

Filler

The vertices of a hyperbola centered at the origin are $(0, \pm 7)$ and $e = \frac{4}{3}$. The difference between the focal distances of a point on the hyperbola is

(a) 7 (b) 14 (c) $\sqrt{343}/3$ (d) $2\sqrt{343}/3$

Ans(b): Two vertices lie on the y-axis. $\therefore$ the transverse axis lies along the y-axis.

$\therefore b = 7$. Also eccentricity, $e = \frac{4}{3}$. $\therefore a^2 = b^2(e^2 - 1) = 49\left(\frac{16}{9} - 1\right) = 49 \times \frac{7}{9} = \frac{343}{9}$.

$\therefore$ equation of the hyperbola is $\frac{x^2}{343/9} - \frac{y^2}{49} = -1$. The difference between the focal distances is equal to the length of the transverse axis $= 2b = 14$.

12. THREE DIMENSIONAL GEOMETRY

1. Which of the following is FALSE?

(a) $(2,3,4)$ lies in the first octant (b) $(-1,2,4)$ lies in the second octant

(c) $(-2,-4,7)$ lies in the third octant (d) $(4,2,-5)$ lies in the fourth octant

2. Let $A,\ B,\ C$ be the feet of the perpendiculars drawn from the point $P(-5,3,7)$ on the yz, zx and xy planes. Then the sum of the coordinates of

(a) A and B is 10 (b) A and C is 6 (c) B and C is 8 (d) A, B and C is 10

3. Let $A,\ B,\ C$ be the feet of the perpendiculars drawn from the point $P(3,4,5)$ on the x-, y- and z-axes and O is the origin. Then

(a) $PA = 41$ (b) $PB = 34$ (c) $PC = 25$ (d) $OP = 5\sqrt{2}$

4. The length of the longest piece of a string that can be stretched straight in a rectangular room whose dimensions are $10, 13, 8$ units is

(a) 15 (b) 17 (c) $\sqrt{324}$ (d) $\sqrt{333}$

5. The point equidistant from the points $O(0,0,0)$, $A(l,0,0)$, $B(0,m,0)$ and $C(0,0,n)$ is

(a) $(0,\ 0,\ 0)$ (b) $(2l,\ 2m,\ 2n)$ (c) $(l,\ m,\ n)$ (d) $(l/2,\ m/2, n/2)$

6. The ratio in which the point $A(0,-1,-7)$ divides the line joining the points $B(2,1,-9)$ and $C(6,5,-13)$ is

(a) $1:2$ externally (b) $1:3$ externally (c) $1:2$ internally (d) $1:3$ internally

7. The coordinates of the point which is five-sixth of the way from $A(-2,0,6)$ to $B(10,-6,-12)$ are

(a) $(8,\ 5,\ 9)$ (b) $(8,\ -5,\ -9)$ (c) $(-8,\ -5,\ 9)$ (d) $(8,\ 5,\ -9)$

8. If the midpoints of the sides of a triangle are $(1,\ 2,\ -3)$, $(3,\ 0,\ 1)$ and $(-1,\ 1,\ -4)$ then the centroid of the triangle is

(a) $(1,\ 1,\ -2)$ (b) $(1,\ 1,\ 2)$ (c) $(1,-1,\ 0)$ (d) $(0,\ 1,\ -2)$

Correct options

1.(d) 2.(d) 3.(d) 4.(d) 5.(d) 6.(b) 7.(b) 8.(a)

Unit test

1. Let $A,\ B,\ C$ be the feet of the perpendiculars drawn from the point $P(-5,3,7)$ on the yz, zx and xy planes. Then $PA + PB + PC =$

(a) 15 (b) 5 (c) 81 (d) 9

2. Consider the parallelopiped with vertex at $(3,5,6)$, placed in the first octant with diagonally opposite vertex at the origin, having edges along x-, y- and z-axes. Then which of the following is NOT a vertex of the parallelopiped?

(a) $(0,5,6)$ (b) $(3,0,6)$ (c) $(0,0,3)$ (d) $(0,5,0)$

3. If $P(x,\ y,\ z)$ is a point on the line joining the points $(3,\ 2,-1)$ and $(6,\ 2,-2)$ and if $x = 5$ then $y =$

(a) -3 (b) 2 (c) -4 (d) -5

4. Let $A(3,2,0)$, $B(5,\ 3,\ 2)$ and $C(-9,\ 6,\ -3)$ be three points forming a triangle. The internal bisector AD of angle BAC, meets BC in D. The coordinates of D are

(a) $\left(\frac{38}{16}, \frac{57}{16}, -\frac{17}{16}\right)$ (b) $\left(-\frac{38}{16}, \frac{57}{16}, \frac{17}{16}\right)$ (c) $\left(\frac{38}{16}, -\frac{57}{16}, \frac{17}{16}\right)$ (d) $\left(\frac{38}{16}, \frac{57}{16}, \frac{17}{16}\right)$

5. If the distance between the points $(a,0,1)$ and $(0,1,2)$ is $\sqrt{27}$ then $a =$

(a) $\pm\sqrt{29}$ (b) $\pm\sqrt{24}$ (c) ± 5 (d) $\pm\sqrt{2}$

6. The equation $x^2 + y^2 = 0$ in the three dimensional system represents

(a) the space (b) z-axis (c) xy- plane (d) origin

Correct options

1.() 2.(c) 3.(b) 4.(d) 5.(c) 6.(b)

Filler

The point on the yz plane which is equidistant from the points $A(2,0,3)$, $B(0,3,2)$ and $C(0,0,1)$ is

(a) $(0,2,3)$ (b) $(0,1,3)$ (c) $(0,-1,3)$ (d) $(0,-2,1)$

Ans(b): Let $P(0,y,z)$ is the required point.

Then $PA^2 = PB^2 \Rightarrow 2^2 + y^2 + (z-3)^2 = 0^2 + (y-3)^2 + (z-2)^2$

$\Rightarrow 4 + y^2 + z^2 + 9 - 6z = y^2 + 9 - 6y + z^2 + 4 - 4z$

$\Rightarrow 6y - 2z = 0 \quad \Rightarrow 3y - z = 0 \quad \ldots (1)$

Also $PB^2 = PC^2 \Rightarrow 0^2 + (y-3)^2 + (z-2)^2 = 0^2 + y^2 + (z-1)^2$

$\Rightarrow y^2 + 9 - 6y + z^2 + 4 - 4z = y^2 + z^2 + 1 - 2z$

$\Rightarrow -6y - 2z = -12 \quad \Rightarrow 3y + z = 6 \quad \ldots (2)$

Solving (1) and (2) we get, $y = 1,\ z = 3$. $\therefore$ required point is $P(0,1,3)$.

13. LIMITS AND DERIVATIVES

1. $\lim_{x \to 1} \frac{(\sqrt{x} - 1)(2x - 3)}{2x^2 + x - 3} =$

(a) $-1/10$ (b) $1/10$ (c) $-1/5$ (d) $1/5$

2. $\lim_{h \to 0} \frac{\sqrt{2x + 3h} - \sqrt{2x}}{2h} =$

(a) $3/\sqrt{2x}$ (b) $3/2\sqrt{2x}$ (c) $3/4\sqrt{2x}$ (d) $3/8\sqrt{x}$

3. $\lim_{x \to \pi} \frac{1 - \sin\frac{x}{2}}{\cos\frac{x}{2}\left(\cos\frac{x}{4} - \sin\frac{x}{4}\right)} =$

(a) $2\sqrt{2}$ (b) $\sqrt{2}$ (c) 2 (d) $1/\sqrt{2}$

4. $\lim_{x \to \pi/6} \frac{\cot^2 x - \sqrt{3}\cot x}{\sin\left(\frac{\pi}{6} - x\right)} =$

(a) $2\sqrt{3}$ (b) $4\sqrt{3}$ (c) 4 (d) 2

5. $\lim_{x \to \frac{1}{2}} \left[\frac{8x - 3}{2x - 1} - \frac{4x^2 + 1}{4x^2 - 1}\right] =$

(a) $3/2$ (b) $7/2$ (c) $5/2$ (d) 1

6. For $a > 3$, if $\lim_{x \to a} \left(\frac{(x - 3)^{7/4} - (a - 3)^{7/4}}{x - a}\right) = \frac{7}{4}$ then $a =$

(a) 3 (b) 4 (c) 5 (d) 8

7. $\lim_{x \to 1} (x - 1).\tan\frac{\pi x}{2} =$

(a) $-\pi/2$ (b) $\pi/2$ (c) $-2/\pi$ (d) $2/\pi$

8. If $\lim_{x \to 0} \left(\frac{\sin 2x + a.\sin x}{x^3}\right)$ is finite then $a =$

(a) 1 (b) -1 (c) 2 (d) -2

9. Let $f(x) = \begin{cases} \frac{\sin [x]}{[x]}, & [x] \neq 0 \\ 0, & [x] = 0 \end{cases}$, where $[.]$ indicates the greatest integer function. Which of the following is NOT true?

(a) $\lim_{x \to 0+} f(x) = 0$ (b) $\lim_{x \to 0-} f(x) = \sin 1$

(c) $\lim_{x \to 0} f(x) = 0$ (d) $\lim_{x \to 0} f(x)$ does not exist

10. $\lim_{x \to \pi/3} \frac{\sqrt{1 - \cos 6x}}{\sqrt{2}\left(\frac{\pi}{3} - x\right)}$

(a) $= -3$ (b) $= 3$ (c) $= 2\sqrt{2}$ (d) does not exist

11. $\lim_{n \to \infty} \left(\frac{1 + 2^n}{1 + 3^n}\right) =$

(a) 3 (b) 0 (c) 2 (d) 6

12. $\lim_{n \to \infty} \left[\frac{(1 + n)(1 + 2n)(1 + 3n)...(1 + kn)}{n^k}\right] =$

(a) $k!$ (b) $(k - 1)!$ (c) 0 (d) 1

13. $\lim_{n \to \infty} \left(\frac{1 + 4 + 7 + \cdots to\ n\ terms}{1 + 3 + 5 + \cdots to\ n\ terms}\right) =$

(a) 3/5 (b) 1/2 (c) 9/2 (d) 3/2

14. If $y = (1 + x^{1/4})(1 + x^{1/2})(1 - x^{1/4})$ then $\frac{dy}{dx} =$

(a) 1 (b) -1 (c) 0 (d) $-2x$

15. If $\frac{d}{dx}\left\{\frac{1 + x^2 + x^4}{1 + x + x^2}\right\} = ax + b$ then $a + b =$

(a) -1 (b) 2 (c) 1 (d) -2

16. If $\frac{d}{dx}\left(\frac{x^5 - \cos x}{\sin x}\right) = \frac{5x^4.f(x) - x^5.f'(x) + 1}{\sin^2 x}$ then $f(x) =$

(a) $\sin x$ (b) $-\sin x$ (c) $\cos x$ (d) $-\cos x$

17. If $5.f(x) + 3.f\left(\frac{1}{x}\right) = x + 2$ then $f'(1) =$

(a) $1/2$ (b) -1 (c) 1 (d) 2

18. If $f(x)$ is differentiable then the value of $\lim_{h \to 0} \frac{\{f(x + h)\}^2 - \{f(x)\}^2}{2h} =$

(a) $f(x) - f'(x)$ (b) $f(x) + f'(x)$ (c) $f(x).f'(x)$ (d) $2f(x).f'(x)$

19. $\lim_{h \to 0} \frac{(a + h)^2.\sin(a + h) - a^2.\sin a}{h} =$

(a) $a^2.\cos a + 2a.\sin a$ (b) $a.\cos a + 2\sin a$

(c) $a^2.\sin a + 2a.\cos a$ (d) $a.\cos a + 2.\sin a$

20. If $f(2) = f'(2) = 4$ then $\lim_{x \to 2} \frac{x.f(x) - 8}{x - 2} =$

(a) 1 (b) 12 (c) 8 (d) 6

21. If $\frac{\pi}{4} < x < \frac{5\pi}{4}$ then $\frac{d}{dx}\sqrt{1 - \sin 2x}$ is

(a) $\sin x - \cos x$ (b) $\cos x - \sin x$ (c) $\cos x + \sin x$ (d) $-\cos x - \sin x$

Correct options

1.(a) 2.(c) 3.(d) 4.(b) 5.(b) 6.(b) 7.(c) 8.(d) 9.(d) 10.(d) 11.(b) 12.(a) 13.(d) 14.(b) 15(c) 16.(a) 17.(a) 18.(c) 19.(a) 20.(b) 21.(c)

Unit test

1. $\lim_{x \to 1} \frac{x^7 - 2x^5 + 1}{x^3 - 3x^2 + 2} =$

(a) -1 (b) -4 (c) 5 (d) 1

2. $\lim_{x \to a} \frac{\sqrt{a + 2x} - \sqrt{3x}}{\sqrt{3a + x} - 2\sqrt{x}} =$

(a) $2/3\sqrt{3}$ (b) $1/2\sqrt{3}$ (c) $1/3\sqrt{3}$ (d) $2\sqrt{3}$

3. $\lim_{x \to 0} \frac{\sin(a + b)x + \sin(a - b)x - \sin 2ax}{\cos 2bx - \cos 2ax} =$

(a) $a/2$ (b) $(a + b)/2$ (c) $b/2$ (d) 0

4. $\lim_{n \to \infty} \sum_{r=1}^{n} \left(\frac{r}{1 - n^2}\right) =$

(a) $-1/2$ (b) $1/2$ (c) $3/2$ (d) $-3/2$

5. $\lim_{x \to 1} \frac{x^4 - \sqrt{x}}{\sqrt{x} - 1} =$

(a) 1 (b) 4 (c) 2 (d) 7

6. $\lim_{x \to 0} \frac{x^2.\cos x}{1 - \cos x} =$

(a) $\pi/2$ (b) 2 (c) 1 (d) $1/\pi$

7. $\lim_{x \to 1/3} [2x - 1]$, where [.] denotes greatest integer function,

(a) is 0 (b) is -1 (c) is 1 (d) does not exist

8. $\lim_{y \to 0} \frac{(x + y).\sec(x + y) - x.\sec x}{y} =$

(a) $\sec x(\tan x + \sec x)$ (b) $\sec x(\tan x + 1)$

(c) $\sec x(x.\tan x + 1)$ (d) $\sec x(x.\tan x + \sec x)$

9. $\frac{d}{dx}\left(\frac{1 - \frac{1}{x^2}}{1 + \frac{1}{x^2}}\right) =$

(a) $\frac{-4x}{(x^2 + 1)^2}$ (b) $\frac{4x}{(x^2 + 1)^2}$ (c) $\frac{4x^2}{(x^2 + 1)^2}$ (d) $\frac{-4x^2}{(x^2 + 1)^2}$

10. If $f(x) = \frac{a + b.\sin x}{c + d.\cos x}$ and $f'(x) = \frac{A\cos x + B.\sin x + C}{(c + d.\cos x)^2}$ then $AB =$

(a) $abcd$ (b) cd (c) ab (d) 1

11. If $f(x) = |\cos x - \sin x|$ then $f'\left(\frac{\pi}{3}\right) =$

(a) $-\frac{\sqrt{3} + 1}{2}$ (b) 0 (c) $\frac{\sqrt{3} + 1}{2}$ (d) -1

12. Let $g(x) = x^3 - 4x + 6$. If $f'(x) = g'(x)$ and $f(1) = 2$ then $f(3) =$

(a) 16 (b) 18 (c) 22 (d) 20

13. If $\lim_{x\to 0}\left(\sin nx.\cot\frac{x}{\sqrt{3}}\right) = 2$ then the greatest integer not greater than n is

(a) 2 (b) 0 (c) 1 (d) 4

14. If $f(x) = \begin{cases} \frac{n.\cos x}{\pi - 2x}, & x \neq \frac{\pi}{2} \\ 3, & x = \frac{\pi}{2} \end{cases}$ and $\lim_{x\to\frac{\pi}{2}} f(x) = f\left(\frac{\pi}{2}\right)$ then $n =$

(a) 12 (b) 6 (c) 1 (c) 5

15. $\lim_{x\to\sqrt{2}} \frac{x^4 - 4}{x^2 + 3\sqrt{2}x - 8} =$

(a) $-8/5$ (b) $8/5$ (c) $4/5$ (d) $-4/5$

Correct options

1.(d) 2.(a) 3.(d) 4.(a) 5.(d) 6.(b) 7.(b) 8.(c) 9.(b) 10.(a) 11.(c) 12.(d) 13.(c) 14.(b) 15.(b)

Filler

1. $\lim_{x\to\pi/4} \frac{\tan^2 x - \tan x}{\cos\left(x + \frac{\pi}{4}\right)} =$

(a) -2 (b) -4 (c) 4 (d) 2

Ans(a): $\lim_{x\to\pi/4} \frac{\tan^2 x - \tan x}{\cos\left(x + \frac{\pi}{4}\right)} = \lim_{x\to\pi/4} \frac{\tan x.(\tan x - 1)}{\cos x.\cos\frac{\pi}{4} - \sin x.\sin\frac{\pi}{4}}$

$$= \lim_{x\to\pi/4} \frac{\tan x.\left(\frac{\sin x}{\cos x} - 1\right)}{\cos x.\cos\frac{\pi}{4} - \sin x.\sin\frac{\pi}{4}} = \lim_{x\to\pi/4} \frac{\tan x.\left(\frac{\sin x - \cos x}{\cos x}\right)}{\cos x.\frac{1}{\sqrt{2}} - \sin x.\frac{1}{\sqrt{2}}}$$

$$= \lim_{x\to\pi/4} \frac{\tan x.(\sin x - \cos x)}{\frac{1}{\sqrt{2}}(\cos x - \sin x).\cos x} = \lim_{x\to\pi/4} \frac{-\tan x}{\frac{1}{\sqrt{2}}.\cos x} = \frac{-1}{\frac{1}{\sqrt{2}}.\frac{1}{\sqrt{2}}} = -2.$$

2. $\lim_{x\to\infty} (2^x + 3^x + 4^x)^{1/x} =$

(a) 4 (b) 3 (c) 2 (d) 1

Ans(a): $\lim_{x\to\infty} (2^x + 3^x + 4^x)^{1/x} = \lim_{x\to\infty} (4^x)^{1/x}.\left\{\left(\frac{2}{4}\right)^x + \left(\frac{3}{4}\right)^x + 1\right\}^x$

$$= 4.(0 + 0 + 1) = 4.$$

14. MATHEMATICAL REASONING

1. Which of the following is NOT a mathematically acceptable statement?

(a) A square has all its sides equal (b) A triangle has three sides

(c) $y + 9 = 7$ (d) 0 is a complex number

2. Given below are two statements $p : 25$ is a multiple of 5, $q : 25$ is a multiple of 8.

Statement (i): $p\ or\ q$ is true. Statement (ii) $p\ and\ q$ is true. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

3. The negation of '$x + y = y + x$ and 29 is a prime number' is

(a) $x + y \neq y + x$ and 29 is not a prime number.

(b) It is not true that $x + y = y + x$ or 29 is a prime number.

(c) It is true that $x + y = y + x$ or 29 is a prime number.

(d) $x + y \neq y + x$ or 29 is not a prime number.

4. In which of the following options, one statement is NOT equivalent to the other?

(a) (i) $2b = a + c$ only if a, b, c are in A.P. (ii) If a, b, c are in A.P. then $2b = a + c$.

(b) (i) A sufficient condition for a team to win a match is that it should contain atleast one all-rounder.

(ii) If a team contains atleast one all-rounder then it will win the match.

(c) (i) A necessary condition for a number to be a multiple of 9 is that it is a multiple of 3.

(ii) If a number is a multiple of 9 then it is a multiple of 3.

(d) (i) If x is divisible by 25 then it is divisible by 5.

(ii) A sufficient condition for a number to be divisible by 5 is that it is divisible by 25.

5. If $\wedge$ indicates 'and' and $\vee$ indicates 'or' then a contradiction in the following is

(a) $p \vee \sim p$ (b) $p \wedge \sim p$ (c) $\sim (p \wedge q) \rightarrow (\sim p \vee \sim q)$ (d) $\sim p$

6. In which of the following options one statement is NOT the converse of the other?

(a) (i) A positive integer is prime only if it has no divisors other than 1 and itself.

(ii) If a positive integer has no divisors other than 1 and itself then it is prime.

(b) (i) I go to a beach, whenever it is a sunny day.

(ii) If I go to a beach then it is a sunny day.

(c) (i) If it is hot outside then you feel thirsty.

(ii) If you feel thirsty then it is hot outside.

(d) (i) If a triangle is not isosceles then it is not equilateral.

(ii) If a triangle is equilateral then it is isosceles.

7. The converse of the contra positive of 'If it is raining then I stay at home' is

(a) If I stay at home then it will rain (b) If it is not raining then I do not stay at home

(c) It is raining iff I stay at home (d) If it is raining then I stay at home

8. In which of the following options one statement is NOT negation of the other?

(a) (i) For every positive real number x, the number $x - 1$ is also positive.

(ii) There exists a positive real number x such that the number $x - 1$ is not positive.

(b) (i) All cats scratch. (ii) There exists a cat, which do not scratch.

(c) (i) For every real number x, either $x > 1$ or $x < 1$.

(ii) There exists a real number x such that neither $x > 1$ nor $x < 1$

(d) (i) There exists a number x such that $0 < x < 1$.

(ii) There exists many numbers x such that $0 < x < 1$

9. Which of the following statements is FALSE?

(a) For any integer n, the number $n^3 - n$ is even.

(b) The product of a non-zero rational and an irrational number is irrational.

(c) For any two real numbers x and y if $x^2 = y^2$ then $x = \pm y$.

(d) If n^2 is even then n is either even or odd.

Correct options

1.(c) 2.(a) 3.(d) 4.(a) 5.(b) 6.(d) 7.(b) 8.(d) 9.(d)

Unit test

1. Which of the following is NOT a mathematically acceptable statement?

(a) New Delhi is in India (b) Every rectangle is a square

(b) Every bird has only one leg (d) Close the door

2. If the propositions $p,\ q,\ r$ have the truth values T, F, T respectively then the truth value of $p \wedge (q \vee \sim r)$ is {Here $\wedge$ indicates 'and' and $\vee$ indicates 'or'.}

(a) F because $q \vee \sim r$ is false (b) F because p is true

(c) T because p is true (d) T because $q \vee \sim r$ is true

3. Let $\wedge$ indicate 'and' and $\vee$ indicate 'or'. Let $p : x$ is an odd integer and $q : x + 1$ is an odd integer. The statement NOT equivalent to 'x or $x + 1$ is an odd integer' is

(a) $p \vee q$ (b) $\sim(\sim p \wedge \sim q)$ (c) $\sim(p \to \sim q)$ (d) $\sim p \to q$

4. Which of the following is a tautology? {Here $\vee$ indicates 'or' and $\wedge$ indicates 'and'.}

(a) $(\sim p \vee \sim q) \wedge (p \wedge q)$ (b) $\sim (p \rightarrow \sim q) \vee (p \vee \sim q)$

(c) $(\sim p \wedge q) \rightarrow \left(\sim (p \vee q)\right)$ (d) $(p \vee q) \leftrightarrow (\sim p \rightarrow q)$

5. In which of the following options one statement is NOT converse of the contrapositive of the other?

(a) (i) If $x = y$ and $y = 3$ then $x = 3$.

(ii) If $x \neq y$ or $y \neq 3$ then $x \neq 3$.

(b) (i) If n is a natural number then n is an integer.

(ii) If n is not a natural number then n is not an integer.

(c) (i) If all the three sides are equal then the triangle is equilateral.

(ii) If all the three sides are not equal then the triangle is not equilateral.

(d) (i) If x and y are negative integers then xy is positive.

(ii) If x and y are positive integers then xy is positive.

6. Which of the following statements DOES NOT contain a quantifier?

(a) There exists a triangle which is not a circle (b) For all real numbers x and y, $xy = yx$.

(c) If $x > 3$ then $x^2 > 9$ (d) All natural numbers are integers

Correct options

1.(d) 2.(a) 3.(c) 4.(d) 5.(d) 6.(c)

Filler

The compound proposition $\sim (p \wedge \sim q) \rightarrow (p \rightarrow q)$ is

(a) a contradiction when p is a contradiction (b) a contradiction when p is a tautology

(c) a tautology (d) neither a tautology nor a contradiction

Ans(d): $p \wedge \sim q \equiv \sim (p \rightarrow q)$. $\therefore \sim (p \wedge \sim q) \equiv (p \rightarrow q)$.

$\therefore$ the given statement becomes $(p \rightarrow q) \rightarrow (p \rightarrow q)$. This is equivalent to $p \rightarrow q$.

(a) When p is false it is not necessary that $p \rightarrow q$ is false {because true when q is true}. $\therefore$ (a) need not be true.

(b) When p is true and q is true, $p \rightarrow q$ is true. $\therefore$ (b) need not be true.

(c) From (a) we conclude (c) does not hold.

(d) Depending on the truth values of $p,\ q$ the given statement is either true or false. $\therefore$ the given statement is neither a tautology nor a contradiction.

15. STATISTICS

1. Students of three sections of a class, having $30, 30, 40$ students appeared for a test of 100 marks. The arithmetic means of the marks of the three sections are 72.2, 69.0, 64.1 in that order. The arithmetic mean of the marks of all the students of the three sections, is

(a) 66.6 (b) 67.3 (c) 68.0 (d) 70.6

2. The median of 27 observations of a variable is 18. Three more observations having values $16, 18, 50$ are included. The median of the new set of 30 observations is

(a) 18 (b) 17 (c) 31 (d) 25

3. The mean deviation of the data $2,\ 3,\ 4,\ 6,\ 9,\ 9,\ 9$ from the mean, is

(a) 7 (b) 6 (c) $18/7$ (d) $17/7$

4. The mean deviation about the median of the following data, is

marks	10	11	12	14	15
Number of students	2	3	8	3	4

(a) 1.35 (b) 1.25 (c) 1.2 (d) 1.5

5. The mean deviation about the mean of the $2n+1$ numbers $a,\ a+d,\ a+2d, \dots, a+2nd$ is (a) $\frac{dn(n+1)}{2(2n+1)}$ (b) $\frac{d(n+1)}{2n+1}$ (c) $\frac{dn(n+1)}{2n+1}$ (d) $\frac{2dn(n+1)}{2n+1}$

6. The standard deviation of $a+1,\ a+2,\ a+3,\ a+7,\ a+8,\ a+9$ is

(a) $\sqrt{8}$ (b) $\sqrt{3}$ (c) $\sqrt{89/3}$ (d) $\sqrt{29/3}$

7. If the standard deviation of the data $2x_1,\ 2x_2,\ 2x_3, \dots 2x_n$ is s then the variance of the data $5x_1,\ 5x_2,\ 5x_3, \dots 5x_n$ is

(a) $6.25s^2$ (b) $6.5s^2$ (c) $2.25s^2$ (d) $2.5s^2$

8. The variance of the observations $101, 102, 103, \dots, 200$ is very near to

(a) 924 (b) 833 (c) 764 (d) 657

9. The coefficients of variation of 2 distributions are 50 and 60 and their corresponding means are 30 and 25. The difference of their standard deviations, is

(a) 15 (b) 75 (c) 0 (d) 20

10. The sum of the squares of the deviations of 20 observations taken from their mean $=100$ is 500. The coefficient of variation is

(a) 5 (b) 50 (c) 2.5 (d) 4

11. If the number of units is 20, mean of the 20 units is 32 and sum of the squares of the 20 units is 25600 then the coefficient of variation is

(a) 30% (b) 20% (c) 50% (d) 75%

Correct options

1.(c) 2.(a) 3.(c) 4.(b) 5.(c) 6.(d) 7.(a) 8.(b) 9.(c) 10.(a) 11.(c)

Unit test

1. Consider the following frequency distribution. It is given that the total frequency is 18 and its mean is 2. The differences of the frequencies f and g is

X	0	1	2	3	4
frequency	f	g	4	4	3

(a) 1 (b) 2 (c) 0 (d) 3

2. The mean deviation about the mean of the following data:

units	1	3	5	7	9	11	13	15
frequency	1	2	3	4	4	3	2	1

(a) 8.5 (b) 2.7

(c) 4.25 (d) 3

3. If $\bar{x}$ is the median and m is the mean deviation about the median of the first 11 positive multiples of 3. Then the number of multiples of 3 lying between $\bar{x} - m$ and $\bar{x} + m$ is

(a) 6 (b) 5 (c) 4 (d) 7

4. The sum of 10 observations is 12 and the sum of their squares is 18. The standard deviation is

(a) $\sqrt{0.6}$ (b) $\sqrt{3.6}$ (c) 0.6 (d) 3.6

5. The standard deviation of some temperature data in degree Celsius, c is 5. If the data were converted into degree Fahrenheit, f then the variance of the data in degree Fahrenheit is $\{$given $f = \frac{9}{5}c + 32\}$

(a) 45 (b) 12.5 (c) 81 (d) 18

6. For a set of 100 observations taking assumed mean as 4, the sum of the deviations of the observations from the assumed mean is found to be -10 and sum of the squares of these deviations is found to be 37. The coefficient of variation is

(a) $100/13$ (b) $200/13$ (c) $400/13$ (d) $300/13$

7. The heights of thirty students of class 1 are compared with the heights of thirty students of class 12. It is found that the average height of class 12 students is twice the average height of class 1 students. If both the observations have the same coefficient of variation then the ratio of the two variances, is

(a) $1:4$ (b) $1:2$ (c) $4:3$ (d) $2:3$

Correct options 1.(a) 2.(d) 3.(b) 4.(c) 5.(c) 6.(b) 7.(a)

16. PROBABILITY

1. If A and B are two events such that $P(A \cup B) = \frac{1}{2}$ and $P(\bar{A}) = \frac{2}{3}$. The probability of occurrence of the event B but non occurrence of the event A is

(a) $1/6$ (b) $4/5$ (c) $3/5$ (d) $1/3$

2. If A, B and C are three mutually exclusive and exhaustive events of a random experiment such that $3P(A) = 2P(B) = P(C)$ then $P(A) =$

(a) $2/5$ (b) $3/11$ (c) $1/5$ (d) $2/11$

3. The probability that at least one of two events A and B occurs is a and the probability that exactly one of the two events A and B occurs is b.Then $P(A') + P(B') =$

(a) $1 + 2a + b$ (b) $2 + 2a + b$ (c) $1 - 2a - b$ (d) $2 - 2a + b$

4. A sample space consists of 9 elementary outcomes $e_1, e_2, e_3, \ldots, e_9$ whose probabilities of occurrences are $P(e_1) = P(e_2) = 0.08$, $P(e_3) = P(e_4) = P(e_5) = 0.1$, $P(e_6) = P(e_7) = 0.2$ and $P(e_8) = P(e_9) = 0.07$.

Let $A = \{e_1, e_5, e_8\}$ and $B = \{e_2, e_5, e_8, e_9\}$. Then $P(A \cup B) =$

(a) 0.4 (b) 0.3 (c) 0.5 (d) 0.6

5. Three digit numbers are formed using the digits $0, 2, 4, 6, 8$. Out of these numbers, a number is chosen at random. The probability that the number formed contains all the three same digits, is

(a) $21/25$ (b) $1/25$ (c) $4/25$ (d) $24/25$

6. Suppose that integers from 1 to 1000 are chosen at random. The probability that the number chosen is neither a multiple of 2 nor a multiple of 9 is

(a) $= 0.5$ (b) < 0.5 (c) > 0.5 (d) $= 1$

7. An urn contains 20 white slips of paper numbered from 1 through 20, ten red slips of paper numbered from 1 through 10, forty yellow slips of paper numbered from 1 through 40 and ten blue slips of paper numbered from 1 through 10. If these 80 slips of paper are thoroughly shuffled so that each slip has the same probability of being drawn. The probability of drawing a slip white in colour numbered higher than 12 or yellow coloured slip numbered higher than 26 is

(a) $21/80$ (b) $11/40$ (c) $1/4$ (d) $31/80$

8. The probability that the sum of any two different single digit natural numbers is a prime number, is

(a) $1/6$ (b) $1/3$ (c) $1/4$ (d) $1/2$

9. A die is loaded in such a way that each odd number is twice as likely to occur as each even number. The probability that a number greater than 3 occurs on a single roll of the die is

(a) $2/3$ (b) $1/3$ (c) $4/9$ (d) $5/9$

10. A card is drawn from a pack of 52 playing cards. The probability that the card drawn is a king or a heart or a red card is

(a) $7/13$ (b) $9/13$ (c) $6/13$ (d) $3/13$

11. The letters of the word ENDEANOEL are arranged at random. The probability that all the Es and Ns come together is

(a) $2/126$ (b) $4/126$ (c) $1/126$ (d) $5/126$

12. There are n persons in a row for a road show. The probability that two particular persons sit next to each other is $\frac{1}{2024}$. The value n is

(a) 1012 (b) 8096 (c) 2024 (d) 4048

Correct options

1.(a) 2.(d) 3.(d) 4.(a) 5.(b) 6.(b) 7.(b) 8.(b) 9.(c) 10.(a) 11.(d) 12.(d)

Unit test

1. If $x \in [0, 5]$ then the probability that $x^2 - 3x + 2 \geq 0$ is

(a) $4/5$ (b) $3/5$ (c) $2/5$ (d) $1/5$

2. A person X visited four cities A, B, C and D in a random order. The probability that the person X visited A either first or second, is

(a) $1/4$ (b) $1/3$ (c) $1/9$ (d) $1/2$

3. If 4-digit numbers greater than 5000 are randomly formed from the digits $0, 1, 3, 5$ and 7, then the probability that the number formed is divisible by 5 when the digits are repeated, is

(a) $2/5$ (b) $3/5$ (c) $1/5$ (d) $4/5$

4. Probability that a truck stopped at a road block will have faulty brakes is 0.23 and have badly working tires 0.24. Also the probability is 0.38 that a truck stopped at the roadblock will have either faulty brakes or badly working tires or both. The probability that a truck stopped at this roadblock will have faulty brakes as well as badly working tires is

(a) 0.19 (b) 0.09 (c) 0.3 (d) 0.25

5. In a random arrangement of the letters of the word 'UNIVERSITY', the probability that two I's donot come together, is

(a) $1/10$ (b) $1/5$ (c) $4/5$ (d) $9/10$

6. In a leap year the probability of neither having 53 Sundays nor having 53 Mondays is

(a) $2/7$ (b) $1/7$ (c) $4/7$ (d) $5/7$

7. Seven unbiased coins are tossed 128 times. If all results in distinct outcomes, the number of throws resulting in at least three heads, is

(a) 117 (b) 121 (c) 99 (d) 94

8. Three digits are chosen at random from the digits $1, 2, 3, 4, 5, 6, 7, 8, 9$ without repetition. The probability that the product of the selected three digits is odd, is

(a) $8/21$ (b) $5/42$ (c) $10/42$ (d) $4/21$

9. Three of the six vertices of a regular hexagon are chosen at random. The probability that the triangle with these vertices is equilateral, is

(a) $3/10$ (b) $1/20$ (c) $3/20$ (d) $1/10$

Correct options

1.(a) 2.(d) 3.(a) 4.(b) 5.(c) 6.(c) 7.(c) 8.(b) 9.(c)

Filler

A die has two faces each with number '1', three faces each with number '2' and one face with number '3'. If die is rolled once then which of the following is FALSE?

(a) probability that the face has the number '2' is $1/2$

(b) probability that the face has the number '1 or 3' is $1/2$

(c) probability that the face has the number 'not 3' is $1/2$

(d) probability that the face has the number 'less than 2' is $1/3$

Ans(c): (a) Three faces out of the six are marked with '2'. $\therefore P(2) = \frac{3}{6} = \frac{1}{2}$. $\therefore$ (a) is true.

(b) There are two faces marked with '1' and one face marked with '3'. Also getting '1' is mutually exclusive to getting '3'. $\therefore$ $P(1 \; or \; 3) = P(1) + P(3) = \frac{2}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$.

(c) There is only one face marked with '3'. Hence there are 5 faces marked with a number other than '3'. $\therefore$ $P(not \;\; 3) = \frac{5}{6}$.

(d) There are two faces marked with '1'. Probability that the face has the number 'less than 2' $= \frac{2}{6} = \frac{1}{3}$.

B. SECOND P. U. TOPICS

1. RELATIONS AND FUNCTIONS

1. The relation $R = \{(0,0),(0,1),(0,3),(1,0),(1,1),(2,2),(3,0),(3,3)\}$ on $A = \{1,2,3,0\}$ is

(a) reflexive but not symmetric (b) symmetric but not transitive

(c) transitive but not reflexive (d) transitive but not symmetric

2. Consider the relation $R = \{(1,1),(1,2),(2,1),(3,3)\}$ on $A = \{1,2,3\}$. Which of the following is FALSE?

(a) R becomes transitive when $(2,2)$ is included

(b) R becomes reflexive when $(2,2)$ is included

(c) R is not symmetric (d) R is not equivalence

3. The relation R defined by xRy if and only if $x - y + \sqrt{2}$ is irrational on the set of real numbers is

(a) neither transitive nor symmetric (b) neither symmetric nor reflexive

(c) neither transitive nor reflexive (d) not reflexive, not symmetric, not transitive

4. A natural number m is said to be related to another natural number n iff 'm divides n'. The relation is

(a) symmetric and transitive (b) symmetric and anti-symmetric

(c) reflexive and symmetric (d) reflexive and transitive

5. The relation R defined on power set of a set, X by $A\ R\ B$ iff $A - B = \phi$ is

(a) reflexive and symmetric (b) reflexive and transitive

(c) symmetric and transitive (d) equivalence

6. Suppose that R is a relation in $Z \times Z$, where Z is the set of integers defined by $(a,\ b)\ R\ (c,\ d)$ iff $bc(b+c) = ad(a+d)$ then

(a) reflexive but not symmetric (b) symmetric but not transitive

(c) transitive but not reflexive (d) equivalence

7. If $f(x)$ is a relation defined from $A = \{1,\ 3,\ 5,\ 7\}$ on $B = \{1,\ 2,\ 3,\ 4\}$ by $f(x) = \frac{x+1}{2}$ then

(a) $f(x)$ contains three ordered pairs (b) $f(x)$ is symmetric and reflexive

(c) $f^{-1}(x) = \{(1,1),\ (2,\ 3),\ (3,\ 5),\ (4,\ 7)\}$ (d) domain of $f^{-1}(x) \neq$ range of $f(x)$

8. If $R = \{(a,\ b),\ (b,\ c)\}$ is a relation on $A = \{a,\ b,\ c\}$ then the minimum number of elements that can be added to R to make it equivalence is

(a) 3 (b) 5 (c) 7 (d) 2

9. The number of equivalence relations that can be defined from $A = \{1, 2, 3\}$ to itself is

(a) 5 (b) 3 (c) 4 (d) 1

10. Which of the following can be domain for the function $f(x) = sin\ 2x$ to be one-one?

(a) $[0,\ \pi/4]$ (b) $[0,\ \pi/2]$ (c) $[0,\ 2\pi]$ (d) $[\pi/2\ ,\ 3\pi/2]$

11. If $n(A) = 3$ and $n(B) = 2$ then the possible number of on-to functions from A to B is

(a) 8 (b) 9 (c) 6 (d) 7

12. The function $f : R \to R,\ f(x) = \frac{2x}{x^2 + 1}$ from R to R is

(a) one-one and onto (b) onto but not one-one

(c) neither one-one nor onto (d) one-one but not onto

13. Consider the function $f : R \to R,\ f(x) = \big[x - [x]\big]$, where $[x]$ denotes the greatest integer function. Which of the following is TRUE?

(a) The range of $f(x)$ is Z (b) $f(x)$ is one-one (c) $f(x)$ is many-one (d) $f(x)$ is on-to

14. If $f : A \to B$ defined by $f(x) = \sqrt{3}.cos\ x - sin\ x + 4$ is onto then B is

(a) $[3,\ 5]$ (b) $[2,\ 4]$ (c) $[-1,\ 3]$ (d) $[2,\ 6]$

15. $f : R \to R$ be a function defined as $f(x) = x|x|$, for each $x \in R$, R being the set of all real numbers. Then

(a) f is one-one but not onto (b) f is onto but not one-one

(c) f is both one-one and onto (d) f is neither one-one nor onto

16. Consider the following statements.

(i) The number of functions which are one-one and on-to that can be defined from a set containing 5 elements to a set containing 6 elements is zero.

(ii) The number of injective functions that can be defined from a set containing 3 elements to a set containing 4 elements is 24. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

17. It is given that the function $f(x) = \frac{x + k}{x - k},\ x \neq k$ for some real number k, is one-one on a domain containing more than one element. Then k cannot be

(a) 1 (b) -1 (c) 0 (d) $1/2$

18. If $f(x) = ax + b,\ g(x) = cx + d$ then $f(g(x)) = g(f(x))$ iff

(a) $f(d) = g(b)$ (b) $f(a) = g(a)$ (c) $f(c) = g(a)$ (d) $f(b) = g(b)$

19. If $f(x) = \log_e\left(\frac{1+x}{1-x}\right)$ and $f\big(g(x)\big) = 3\log_e\left(\frac{1+x}{1-x}\right)$ then $g(x) =$

(a) $\frac{3x + x^3}{1 - 3x^2}$ (b) $\frac{3x + x^3}{1 + 3x^2}$ (c) $\frac{3x - x^3}{1 - 3x^2}$ (d) $\frac{3x - x^3}{1 + 3x^2}$

20. If $f : R \to R,\ g : R \to R,\ g(x) = x + 3$ and if $(fog)(x) = (x+3)^2$ then

(a) $f(x)$ has a minimum at $x = -3$ (b) $f(x)$ has a minimum at $x = 0$

(c) $f(-3)$ is 12 (d) $f(0)$ does not exist

21. The function, $f : \left[\frac{3}{2}, \frac{5}{2}\right] \to B$ defined by $f(x) = x^2 - 3x + 7$ is invertible. The set B is

(a) $[13/4,\ 19/4]$ (b) $[19/4,\ 23/4]$ (c) $[1/4,\ 9/4]$ (d) $[13/4,\ 19/4]$

22. If $f : C \to C$, where C is the set of all complex numbers, is defined by $f(x) = x^4$ then number of elements in the set $f^{-1}(64)$ is

(a) 1 (b) 2 (c) 3 (d) 4

23. If $f(x) = \frac{1}{1-x},\ x \neq 1,\ x \neq 0$ then $f^{-1}(x) =$

(a) $f\Big(f\big(f(x)\big)\Big)$ (b) $f(x)$ (c) $f\big(f(x)\big)$ (d) x

24. Assuming all the necessary conditions, if $f(x) = (ax^2 + b)^3,\ x > 0$ then a function $g(x)$ such that $f(g(x)) = g\big(f(x)\big) = x$ is given by

(a) $\frac{1}{(ax^2 + b)^3}$ (b) $(ax^2 + b)^{1/3}$ (c) $\sqrt{\frac{x^{1/3} - b}{a}}$ (d) $\sqrt{\frac{b - x^{1/3}}{a}}$

25. Let R be a relation from $A = \{1,2,3,4\}$ to $B = \{1,3,5\}$ such that $R = \{(a,b) : a < b\}$. Then RoR^{-1} is

(a) $\{(1,1),(1,3),(3,1),(3,3)\}$ (b) $\{(1,1),(1,5),(5,1),(5,5)\}$

(c) $\{(3,3),(3,5),(5,3),(5,5)\}$ (d) $\{(1,1),(1,3),(3,1),(3,3),(3,5),(5,3),(5,5)\}$

26. If $f : [0,\infty) \to$ (range of f) is defined by $f(x) = \frac{x^2+3}{2}$, then the domain of its inverse function is ?

(a) $[3/2, \infty)$ (b) $[0,\infty)$ (c) R (d) $(0, 3/2]$

27. If $f(x) = x^4,\ x > 1$ and $g(x) = \sqrt[3]{x^2 + 1},\ x > 0$ then $f^{-1} o\, g^{-1}(x) =$

(a) $\sqrt[3]{x^4 - 1}$ (b) $\sqrt[3]{x^8 - 1}$ (c) $\sqrt[8]{x^3 - 1}$ (d) $\sqrt[6]{x^3 - 1}$

28. The inverse of the function $f(x) = \frac{e^x - 2e^{-x}}{e^x + 2e^{-x}} + 1$ is

(a) $\log_e\left(\frac{2x}{2-x}\right)$ (b) $\log_e\left(\frac{x}{x-2}\right)$ (c) $\frac{1}{2}\log_e\left(\frac{2x}{2-x}\right)$ (d) $\frac{1}{2}\log_e\left(\frac{2x}{x-2}\right)$

29. The operation $*$ defined on $R-\{1\}$ by $a * b = a+b-ab,\ \forall\, a,b \in R-\{1\}$ is

(a) binary, commutative but not associative

(b) binary, commutative and associative

(c) commutative but neither binary nor associative

(d) not commutative but binary and associative

30. The identity of the set Z, under $*$, defined by $a * b = a + b - 2,\ \forall\, a,\ b \in Z$ is

(a) 2 (b) 3 (c) -1 (d) 0

31. Which of the following operation $*$ is binary on the set of real numbers?

(a) $a * b = a - 2b$ (b) $a * b = \frac{3a}{b}$ (c) $a * b = \frac{1}{a+b}$ (d) $a * b = \sqrt{ab+1}$

32. If $*$ is a binary operation defined on the set of all natural numbers, by $a * b = a^b$ then the value of $\{(1 * 2) * 3\} + \{1 * (2 * 3)\}$ is

(a) 3 (b) 4 (c) 9 (d) 2

33. In the set of 2×2 matrices of the form, $\begin{pmatrix} x & x \\ x & x \end{pmatrix}$, $x \neq 0,\ x \in R$, under the binary operation, 'matrix multiplication', the matrix whose inverse is itself, is

(a) $\begin{pmatrix} 1/4 & 1/4 \\ 1/4 & 1/4 \end{pmatrix}$ (b) $\begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix}$ (c) $\begin{pmatrix} -1/2 & -1/2 \\ -1/2 & -1/2 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

Correct options

1.(b) 2.(c) 3.(a) 4.(d) 5.(b) 6.(b) 7.(c) 8.(c) 9.(a) 10.(a) 11.(c) 12.(c)
13.(c) 14.(d) 15.(c) 16.(c) 17.(c) 18.(a) 19.(b) 20.(b) 21.(b) 22.(d) 23.(c) 24.(c)
25.(c) 26.(a) 27.(c) 28.(c) 29.(b) 30.(a) 31.(a) 32.(d) 33.(c)

Unit test

1. The relation R defined by $R = \{(a,\ b) :\ |a^2 - b^2| < 8\}$ on $A = \{1,\ 2,\ 3,\ 4,\ 5\}$ is

(a) not reflexive (b) not transitive (c) equivalence (d) not symmetric

2. A relation R is defined on the set of positive integers by xRy iff $x \leq y^2$. Then R is

(a) neither reflexive nor symmetric but transitive

(b) neither symmetric nor transitive but reflexive

(c) neither reflexive nor transitive but symmetric

(d) not reflexive, not symmetric, not transitive

3. Which of the following is FALSE with regard to the relation

$R = \{(x,\ y) :\ 2x + y = 10,\ x \in N,\ y \in N\}$?

(a) R is not reflexive (b) R is not symmetric

(c) R is not transitive (d) R is equivalence

4. The function $f : R \to R,\ f(x) = 3x^3$ is

(a) neither one-one nor on-to (b) only on-to

(c) only one-one (d) both one-one and onto

5. If $A = \{\, x :\ x \in R$ and $0 \le x \le 1\}$ then $f: A \to R$ defined by $f(x) = cos\left(\frac{\pi}{2}.x\right)$ is

(a) one-one but not on-to (b) both one-one and on-to

(c) on-to but not one-one (d) neither one-one nor on-to

6. If $f = \{(1,2),\ (3,5),\ (4,1)\}$ and $g = \{(2,3),(5,1),(1,3)\}$ then consider the following statements. (i) domain of gof is $\{1,3,4\}$, (ii) range of gof is $\{1,3\}$. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) is true (d) neither (i) nor (ii) is true

7. If $f: R \to R$ and $g : R \to R$ are two functions defined by $f(x) = |x| + x$ and $g(x) = |x| - x$ then $fog(x) =$

(a) $\begin{cases} 4x, & x < 0 \\ 0, & x \ge 0 \end{cases}$ (b) $\begin{cases} -4x, & x < 0 \\ 0, & x \ge 0 \end{cases}$ (c) $\begin{cases} -2x, & x < 0 \\ 0, & x \ge 0 \end{cases}$ (d) $\begin{cases} 2x, & x < 0 \\ 0, & x \ge 0 \end{cases}$

8. If the function $f : R \to R$ be defined by $f(x) = 2x - 3$ and $g : R \to R$ by $g(x) = x^3 + 5$ then $(fog)^{-1} =$

(a) $\{(x-7)/2\}^{1/3}$ (b) $\{(x+7)/2\}^{1/3}$ (c) $\{(x-2)/7\}^{1/3}$ (d) $\{(x+2)/7\}^{1/3}$

9. Let $f(x) = \frac{ax}{x+1}$, $x \neq -1$. The value of 'a' for which $f = f^{-1}$, is

(a) 1 (b) $1/2$ (c) -1 (d) $-1/3$

10. On Q the set of all rational numbers a binary operation $*$ defined by, $a * b = \frac{2ab}{k}$, $k \in N$. If the identity of the set is e then $k =$

(a) e (b) $e - 1$ (c) $2e$ (d) $e/2$

11. In the set of integers, a binary operation $*$ is defined by $a * b = a + b + 5,\ \forall\, a, b \in Z$. The root of the equation $2 * x^{-1} = 3$ is

(a) -6 (b) 10 (c) -5 (d) 9

Correct options

1.(b) 2.(b) 3.(d) 4.(d) 5.(a) 6.(c) 7.(b) 8.(a) 9.(c) 10.(c) 11.(a)

2. INVERSE TRIGONOMETRIC FUNCTIONS

1. $sin^{-1}(cos\, 2020°) + cos^{-1}(sin\, 2020°) =$

(a) $100°$ (b) $80°$ (c) $40°$ (d) $50°$

2. The value of $tan\left\{cos^{-1}\left(-\frac{2}{7}\right) - \frac{\pi}{2}\right\} =$

(a) $4/3\sqrt{5}$ (b) $2/\sqrt{5}$ (c) $1/\sqrt{5}$ (d) $2/3\sqrt{5}$

3. The value of the expression $sin^{-1}\left[cot\left\{sin^{-1}\sqrt{\frac{2-\sqrt{3}}{4}} + cos^{-1}\left(\frac{\sqrt{12}}{4}\right) + sec^{-1}\sqrt{2}\right\}\right]$ is

(a) 0 (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/2$

4. The domain of $cos^{-1}(x^2 - 4)$ is

(a) $[-\sqrt{5}, \sqrt{3}]$ (b) $[-1, 1]$ (c) $[-\sqrt{5}, -\sqrt{3}] \cup [\sqrt{3}, \sqrt{5}]$ (d) $[-\sqrt{3}, \sqrt{5}]$

5. If $f(x) = sin^{-1}\sqrt{x^2 - 1}$ then

(a) $1 \le |x| \le 2,\ 0 \le f(x) \le \frac{\pi}{2}$ (b) $1 \le |x| \le \sqrt{2},\ 0 \le f(x) \le \pi$

(c) $0 \le |x| \le 2,\ 0 \le f(x) \le \pi$ (d) $0 \le |x| \le \sqrt{2},\ 0 \le f(x) \le \frac{\pi}{2}$

6. The sum of the smallest and greatest values of $tan^{-1}\left(\frac{1-x}{1+x}\right),\ 0 \le x \le 1$ are

(a) $\pi/4$ (b) $\pi/2$ (c) 2π (d) π

7. $sec^2(tan^{-1} 5) + cosec^2(cot^{-1} 4\sqrt{3}) =$

(a) 75 (b) 35 (c) 7 (d) 11

8. $sin^2\left(\frac{\pi}{4} - tan^{-1}\left(\frac{1}{8}\right)\right) + sin^2\left(\frac{\pi}{4} + tan^{-1}\left(\frac{1}{8}\right)\right) =$

(a) 2 (b) 1 (c) 1/2 (d) 2/3

9. $tan\left[cos^{-1}\left(\frac{3}{5}\right) + tan^{-1}\left(\frac{1}{4}\right)\right] =$

(a) $7/8$ (b) $25/8$ (c) $19/8$ (d) $34/8$

10. $cos\left(\frac{1}{2}.cot^{-1}\left(\frac{4}{3}\right)\right) =$

(a) $3/10$ (b) $\sqrt{3}/10$ (c) $3/\sqrt{10}$ (d) $2/\sqrt{5}$

11. $sin^{-1}\frac{4}{5} + 2tan^{-1}\frac{1}{3} =$

(a) $\pi/3$ (b) $\pi/12$ (c) $\pi/4$ (d) $\pi/2$

12. If two angles of a triangle are $tan^{-1}3$ and $tan^{-1}2$ then the third angle of the triangle is

(a) $45°$ (b) $30°$ (c) $60°$ (d) $15°$

13. If a and b are the values of x, $0 < x < \frac{\pi}{2}$ satisfying the equation $9sin^2x - 9sin\,x + 2 = 0$ then $tan^{-1}(sin\,a) + tan^{-1}(sin\,b) =$

(a) $tan^{-1}(9/7)$ (b) $tan^{-1}(1/7)$ (c) $tan^{-1}3$ (d) $tan^{-1}(1/2)$

14. If $\pi \leq x \leq 2\pi$ then $cos^{-1}cos\,x =$

(a) $-x$ (b) $2\pi - x$ (c) $\pi - x$ (d) x

15. If $\frac{1}{2} < x < 1$ then $sin^{-1}x + sin^{-1}\left[\frac{x}{2} + \frac{\sqrt{3 - 3x^2}}{2}\right] =$

(a) $-\pi/3$ (b) $-\pi/6$ (c) $5\pi/6$ (d) $2\pi/3$

16. If $sin^{-1}\left(\frac{2x}{3}\right) + cos^{-1}\left(\frac{3}{2y}\right) = \frac{\pi}{2}$ then $xy =$

(a) 2 (b) $1/3$ (c) 1 (d) $9/4$

17. If $\alpha = cot^{-1}x$ and $\beta = tan^{-1}x$ and if $3\alpha - \beta = \frac{\pi}{2}$ then $cos^{-1}(1 - 2x^2) =$

(a) $\pi/2$ (b) 0 (c) π (d) $\pi/4$

18. The sum of the squares of the roots of the equation $3cos^{-1}(x^2 - 6x + 8.5) = \pi$ is

(a) 20 (b) 17 (c) 13 (d) 25

19. If $2cot^{-1}3 + cot^{-1}7 = \left|sin^{-1}\left(\frac{x}{\sqrt{2}}\right)\right|$ then $x =$

(a) $\pm 1/3$ (b) 0 (c) 2 (d) ± 1

20. If $cosec^{-1}x + cosec^{-1}3 = \frac{\pi}{2}$ and $x = \frac{a}{b\sqrt{2}}$ where a and b are relatively prime then $a + b =$

(a) 4 (b) 5 (c) 7 (d) 6

21. If $3cot^{-1}x + 2cot^{-1}(1/x) = \frac{7\pi}{4}$, then the prime number very near to $|x|$ is

(a) 7 (b) 5 (c) 3 (d) 2

22. If $2.tan^{-1}(cos\,\theta) = tan^{-1}(2.cosec\,\theta)$ then $\theta =$

(a) $n\pi + \frac{\pi}{4}$, $n \in Z$ (b) $n\pi \pm \frac{\pi}{4}$, $n \in Z$ (c) $2n\pi + \frac{\pi}{4}, n \in Z$ (d) $2n\pi \pm \frac{\pi}{4}, n \in Z$

23. If $cos^{-1}\left(\frac{x}{2}\right) + cos^{-1}\left(\frac{y}{3}\right) = \theta$ then $36sin^2\theta + 12xy.cos\,\theta =$

(a) $9x^2 + 4y^2$ (b) $4x^2 - 9y^2$ (c) $9x^2 - 4y^2$ (d) $4x^2 + 9y^2$

24. The least value of $(sin^{-1}x)^3 + (cos^{-1}x)^3$ is

(a) $\pi^3/32$ (b) $\pi^3/16$ (c) $-\pi^3/32$ (d) $-\pi^3/16$

Correct options

1.(b) 2.(d) 3.(a) 4.(c) 5.(d) 6.(a) 7.(a) 8.(b) 9.(c) 10.(c) 11.(d) 12.(a)
13.(a) 14.(b) 15.(d) 16.(d) 17.(c) 18.(a) 19.(d) 20.(b) 21.(d) 22.(a) 23.(a) 24.(a)

Unit test

1. $sin^{-1}(sin\,5^c) =$

(a) $-\,5^c$ (b) $3\pi - 5^c$ (c) $\pi - 5^c$ (d) $2\pi - 5^c$

2. The domain of the function, $f(x) = sin^{-1}\left(\frac{x-3}{2}\right) + \log_e(4-x)$ is

(a) $[1, 4]$ (b) $[1, 5)$ (c) $(-1, 4)$ (d) $[1, 4)$

3. The value of $sin\left\{2.cot^{-1}\left(-\frac{5}{12}\right)\right\}$ is

(a) $-120/169$ (b) $120/169$ (c) $60/169$ (d) $-\,60/169$

4. $tan^{-1}\left(-\frac{4}{3}\right) - 2tan^{-1}(-3) =$

(a) $-\,\pi/4$ (b) $\pi/4$ (c) $\pi/2$ (d) $-\pi/2$

5. If $0 < x < 1$ then $sin\left[tan^{-1}\left(\frac{1-x^2}{2x}\right) + cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right] =$

(a) 0 (b) $\sqrt{2}$ (c) $1/\sqrt{2}$ (d) 1

6. If $cosec^{-1}x + cosec^{-1}y = \frac{\pi}{2}$ then $x^2 + y^2 =$

(a) x^2y^2 (b) xy (c) $x + y$ (d) $x^2y + xy^2$

7. If $cos\left\{sin^{-1}\left(\frac{2}{5}\right) + cos^{-1}x\right\} = 0$ then x

(a) $= -\,2/5$ (b) $= 2/5$ (c) does not exist (d) $= 1$

8. If $2tan^{-1}\frac{1}{3} + tan^{-1}\frac{1}{7} = tan^{-1}\left(\frac{2x-1}{1+3x}\right)$ then $x =$

(a) -2 (b) 1 (c) $-\,3$ (d) 2

9. If $x^3 + \frac{1}{x^3} = 2,\ x \in R$ then $tan^{-1}\left(2x + \frac{\sqrt{3}}{x}\right) =$

(a) $45°$ (b) $75°$ (c) $30°$ (d) $60°$

10. If $2.tan^{-1}(cos\,\theta) = tan^{-1}(2.cosec\,\theta)$ then $\theta =$

(a) $n\pi + \frac{\pi}{4},\ n \in Z$ (b) $n\pi \pm \frac{\pi}{4},\ n \in Z$

(c) $2n\pi + \frac{\pi}{4},\ n \in Z$ (d) $2n\pi \pm \frac{\pi}{4},\ n \in Z$

Correct options 1.(d) 2.(d) 3.(a) 4.(c) 5.(d) 6.(a) 7.(b) 8.(a) 9.(b) 10.(a)

3. MATRICES

1. If $a_{ij} = |-2i + 3j|$ then the sum of the elements of the matrix $\left(a_{ij}\right)_{2\times 2} =$

(a) 30 (b) 8 (c) 10 (d) 0

2. The total number of 3×3 matrices with each entry 2 or 0 is

(a) 2 (b) 512 (c) 18 (d) 4

3. If a matrix has 28 elements then which of the following CANNOT be the order of the matrix?

(a) 1×28 (b) 4×7 (c) 14×2 (d) 2×9

4. Let $X = \begin{bmatrix} 3 & 1 & -1 \\ 5 & -2 & -3 \end{bmatrix}$ and $Y = \begin{bmatrix} 2 & 1 & -1 \\ 7 & 2 & 4 \end{bmatrix}$. The matrix Z such that $X + Y + Z$ is a null matrix, is

(a) $\begin{bmatrix} 5 & 2 & 2 \\ 12 & 0 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 5 & 2 & -2 \\ 12 & 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} -5 & -2 & 2 \\ -12 & 0 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & -2 & 2 \\ 12 & 0 & -1 \end{bmatrix}$

5. Let X and Y be two 2×2 matrices satisfying

$2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} -2 & 2 \\ 1 & -5 \end{bmatrix}$.

Statement (i) $X = \begin{bmatrix} -2 & 0 \\ -1 & -3 \end{bmatrix}$ and statement (ii) $Y = \begin{bmatrix} 2 & 1 \\ 2 & 2 \end{bmatrix}$. Then

(a) only (i) is true (b) only (ii) is true

(c) neither (i) nor (ii) is true (d) both (i) and (ii) are true

6. If $A = \begin{pmatrix} 0 & 2 \\ 3 & -4 \end{pmatrix}$ and $kA = \begin{pmatrix} 0 & 4a \\ 3b & 24 \end{pmatrix}$ then the $a + b =$

(a) -4 (b) -9 (c) -2 (d) -7

7. If $\begin{bmatrix} 2x & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = O$ then $x =$

(a) $0, -23/2$ (b) $1, -13/2$ (c) $0, 41/2$ (d) $1, -31/2$

8. If $P = \begin{bmatrix} x & 0 \\ 0 & y \end{bmatrix}$ and $Q = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ then which of the following is TRUE?

(a) $PQ = QP$ (b) $P^2 = Q^2$ (c) $P(QP) = Q(PQ)$ (d) $PQ = QP = O$

9. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ then

(a) $(A - B)(A + B) = A^2 - B^2$ (b) $(A - B)(A + B) \neq A^2 - B^2$

(c) $AB = BA$ (d) $A^2 - B^2 = B^2 - A^2$

10. If A is a non-identity square matrix such that $A^2 = A$, then which of the following is FALSE?

(a) $(I+A)^3 = 7A + I$ (b) $(A-I)^3 + (A+I)^3 = 8A$

(c) $(A-I)^2 + (A+I)^2 = 2(A+I)$ (d) $A^4 = I$

11. If $\begin{bmatrix} 4 \\ 1 \\ 3 \end{bmatrix} A = \begin{bmatrix} -4 & 8 & 4 \\ -1 & 2 & 1 \\ -3 & 6 & 3 \end{bmatrix}$ then the sum of the elements of A is equal to

(a) 2 (b) -3 (c) 4 (d) -6

12. If $P(x) = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ then $P(x).P(y) = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ then $x + y =$

{Here $n \in Z$.}

(a) $2n\pi$ (b) $(2n+1)\pi$ (c) $(2n+1)\frac{\pi}{2}$ (d) $\frac{n\pi}{4}$

13. If $A = \begin{bmatrix} -1 & 1 \\ 1 & 0 \end{bmatrix}$ then $(A^2 + A)^{100} =$

(a) I (b) $-A$ (c) $200I$ (d) $-200A$

14. If $A = \begin{bmatrix} a & b \\ 0 & 1 \end{bmatrix}$ then $A^n =$

(a) $\begin{bmatrix} a^n & b^n \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} a^n & \frac{b(a^n - 1)}{a-1} \\ 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} a^n & b^n.a + b^n \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} a^n & nb \\ 0 & 1 \end{bmatrix}$

15. If $A = \begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix}$ and $\sum_{n=1}^{m} A^n = kA$ then $k =$

(a) $2^m - 1$ (b) $\frac{4^m - 1}{3}$ (c) m (d) $\frac{m \times (m+1)}{2}$

16. If $A(\alpha) = \begin{bmatrix} \cos^2\alpha & \cos\alpha.\sin\alpha \\ \cos\alpha.\sin\alpha & \sin^2\alpha \end{bmatrix}$ and $\alpha,\ \beta$ are two angles differ by $\pi/2$ then $A(\alpha).A(\beta)$

(a) is a zero matrix (b) is an unit matrix (c) does not exist (d) I

17. Let $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$, where $a,\ b$ are natural numbers, then which one of the following is correct?

(a) There exist more than one but finite number of B such that $AB = BA$.

(b) There exist exactly one B such that $AB = BA$.

(c) There exist infinite matrices B such that $AB = BA$.

(d) There cannot exist any B such that $AB = BA$.

18. If A and C are the matrices of order 2×3 and 2×5 respectively and $AB = C$ then the order of $(BC')'$ is

(a) 3×5 (b) 5×3 (c) 2×3 (d) 5×2

19. If A and B are symmetric matrices of same order then $AB' - BA'$ is always

(a) null (b) symmetric (c) skew-symmetric (d) identity

20. If $\begin{pmatrix} a & x & z \\ y-1 & 0 & y+1 \\ 4 & y-1 & y \end{pmatrix}$ is a skew-symmetric matrix then $x + y + z =$

(a) -2 (b) -5 (c) -3 (d) -1

21. A square matrix which is both symmetric and skew symmetric is always a

(a) non zero diagonal matrix (b) non zero square matrix

(c) square zero matrix (d) identity matrix

22. If $A' = A^{-1}$ for $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ then $(x,\ y,\ z) =$

(a) $\left(\pm \frac{1}{\sqrt{2}}, \pm \frac{1}{\sqrt{6}}, \pm \frac{1}{\sqrt{3}}\right)$ (b) $\left(\pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{6}}, \pm \frac{1}{\sqrt{2}}\right)$

(c) $\left(\pm \frac{1}{\sqrt{2}}, \pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{6}}\right)$ (d) $\left(\pm \frac{1}{\sqrt{6}}, \pm \frac{1}{\sqrt{2}}, \pm \frac{1}{\sqrt{3}}\right)$

23. If A and B are two non-singular square matrices of the same order satisfying, $B = -A^{-1}BA$, then

(a) $(A + B)^2 = A + B$ (b) $(A - B)^2 \neq (A + B)^2$

(c) $(A + B)^2 = A^2 + B^2$ (d) $(A - B)^2 = A - B$

24. If $\begin{bmatrix} 1 & -3 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ then the matrix equation obtained by the operation, $C_2{}' \to C_2 - 2C_1$ is

(a) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ 2 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -3 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ -2 & 1 \end{bmatrix} \begin{bmatrix} 3 & -5 \\ 2 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -5 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 13 & -5 \\ 2 & 0 \end{bmatrix}$

Correct options

1.(b) 2.(b) 3.(d) 4.(c) 5.(d) 6.(b) 7.(a) 8.(a) 9.(b) 10.(d) 11.(a) 12.(b)
13.(a) 14.(b) 15.(b) 16.(a) 17.(c) 18.(c) 19.(c) 20.(c) 21.(c) 22.(a) 23.(c) 24.(a)

Unit test

1. If $a_{ij} = 1 - 2i + 3j$ then the sum of the elements of the matrix $\left(a_{ij}\right)_{2 \times 2}$ is equal to

(a) 30 (b) 4 (c) 10 (d) 0

2. If X and Y are the matrices of order 2×2 each and

$2X - 3Y = \begin{bmatrix} -7 & 0 \\ 7 & -13 \end{bmatrix}$ and $3X + 2Y = \begin{bmatrix} 9 & 13 \\ 4 & 13 \end{bmatrix}$ then $Y =$

(a) -10 (b) -15 (c) -30 (d) -20

3. If $x\begin{bmatrix} 2 \\ 1 \end{bmatrix} + y\begin{bmatrix} 3 \\ 5 \end{bmatrix} + \begin{bmatrix} -8 \\ -11 \end{bmatrix} = O$ then $(x,\ y) =$

(a) $(2,\ -2)$ (b) $(1, 2)$ (c) $(1, -2)$ (d) $(2, 2)$

4. If $A(x) = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ then $\left\{A\left(\frac{\pi}{4}\right)\right\}^4 =$

(a) $-4I$ (b) $4I$ (c) I (d) $-I$

5. If $A = \begin{bmatrix} 3 & -4 \\ 1 & 1 \\ 2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 2 & 4 \end{bmatrix}$ then which of the following is NOT true?

(a) BAA is defined (b) $(AB)^2 \neq B^2A^2$ (c) ABA is defined (d) $AB \neq BA$

6. If $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ then

(a) $A^2 = 2I$ (b) $A^3 = -A$ (c) $A^4 = I$ (d) $A^2 = -A$

7. If $3A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ x & 2 & y \end{pmatrix}$ and $AA' = I$ then $x - y =$

(a) -3 (b) -1 (c) 2 (d) -2

8. If $\begin{bmatrix} 1 & -3 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ then the matrix equation obtained by the operation, $R_1{}' \rightarrow R_1 - 3R_2$ is

(a) $\begin{bmatrix} -5 & -15 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} -3 & -11 \\ 2 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} -5 & -15 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -4 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$

(c) $\begin{bmatrix} -5 & -15 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} -8 & -4 \\ -6 & 1 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ (d) $\begin{bmatrix} -5 & -15 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ -10 & 4 \end{bmatrix}$

Correct options

1.(c) 2.(c) 3.(b) 4.(d) 5.(a) 6.(c) 7.(b) 8.(b)

4. DETERMINANTS

1. If $f(t) = \begin{vmatrix} \cos t & t & 1 \\ 2.\sin t & t & 2t \\ \sin t & t & t \end{vmatrix}$ then $\lim_{t \to 0} \frac{f(t)}{t^2} =$

(a) -1 (b) 0 (c) 1 (d) 2

2. Which of the following is NOT necessarily possible when $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 0$?

(a) $a = b = c$ (b) $a + b + c = 0$

(c) $a^2 + b^2 + c^2 = 0$ (d) $a^3 + b^3 + c^3 = 3abc$

3. The set of all values of $\begin{vmatrix} \cos x & -\sin x & 1 \\ \sin x & \cos x & 1 \\ \cos(x+y) & \sin(x+y) & 0 \end{vmatrix}$ for real $x, y,$ is

(a) $[-1, 1]$ (b) $[-2, 2]$ (c) $[0, 1]$ (d) $[-\sqrt{2}, \sqrt{2}]$

4. If $\begin{vmatrix} 1 & z & -y \\ -z & 1 & x \\ y & -x & 1 \end{vmatrix} = 2 - 2\sum xy$ then $x + y + z =$

(a) 1 (b) ± 1 (c) 0 (d) ± 2

5. If $\begin{vmatrix} x-1 & x+2 & 2x-3 \\ 3x & 4 & -x+3 \\ 1 & x-1 & x-1 \end{vmatrix} = ax^3 + bx^2 + cx + d$ then $a - b + c - d =$

(a) 10 (b) -10 (c) 12 (d) 12

6. If $p + q + r = 0 = a + b + c$ then $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix} =$

(a) $pa + qb + rc$ (b) 0 (c) 1 (d) $pqrabc$

7. If $\begin{vmatrix} x & -3i & 1 \\ y & 1 & i \\ 0 & 2i & -i \end{vmatrix} = 6 + 11i,\ i = \sqrt{-1}$ then $x =$

(a) 3 (b) -3 (c) 1 (d) -2

8. The product of the roots of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ is

(a) 126 (b) -126 (c) -144 (d) 144

9. Consider the matrices $A = \begin{pmatrix} 1 & 2 & 1 \\ a & 2a & 1 \\ b & 2b & 1 \end{pmatrix}$ and $B = \begin{pmatrix} c & 2c & 1 \\ a & 2a & 1 \\ b & 2b & 1 \end{pmatrix}$. If $|A| = k|B|$ then k

(a) $= 0$ only (b) $= 0$ or 1 only (c) is any real number (d) does not exist

10. $\begin{vmatrix} 1 & 1 & 1 \\ {}^{n}C_1 & {}^{n+2}C_1 & {}^{n+4}C_1 \\ {}^{n}C_2 & {}^{n+2}C_2 & {}^{n+4}C_2 \end{vmatrix} =$

(a) 8 (b) 1 (c) 3 (d) 2

11. The maximum value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 + \sin\theta & 1 \\ 1 + \cos\theta & 1 & 1 \end{vmatrix}$ is

(a) $\sqrt{2}$ (b) 0 (c) 1 (d) 0.5

12. The roots of the equation, $\begin{vmatrix} 4-x & 4+x & 4+x \\ 4+x & 4-x & 4+x \\ 4+x & 4+x & 4-x \end{vmatrix} = 0$ are

(a) $0, -12$ (b) $0, \pm 12$ (c) $1, 0, -12$ (d) $-1, 0, -12$

13. Let $A = \begin{bmatrix} \sqrt{23} + \sqrt{3} & \sqrt{5} & \sqrt{5} \\ \sqrt{15} + \sqrt{46} & 5 & \sqrt{10} \\ 3 + \sqrt{115} & \sqrt{15} & 5 \end{bmatrix}$. Then

(a) A is singular (b) A is symmetric (c) A invertible (d) A is skew symmetric

14. The determinant $\begin{vmatrix} x+1 & x+2 & x+4 \\ x+3 & x+5 & x+8 \\ x+7 & x+10 & x+14 \end{vmatrix}$ is

(a) independent of x (b) a multiple of x^3 (c) a quadratic in x (d) linear in x

15. It is given that $\begin{vmatrix} a & b & a\alpha + b \\ b & c & b\alpha + c \\ a\alpha + b & b\alpha + c & 0 \end{vmatrix} = 0$ and $b^2 \neq ac$ then α is a root of the equation

(a) $ax^2 + bx + c = 0$ (b) $ax^2 + 2bx + c = 0$ (c) $2bx + c = 0$ (d) $2ax + b = 0$

16. If $D = \begin{vmatrix} ax & x^2 & 1 \\ by & y^2 & 1 \\ cz & z^2 & 1 \end{vmatrix}$ and $D_1 = \begin{vmatrix} a & b & c \\ x & y & z \\ yz & zx & xy \end{vmatrix}$ then

(a) $D_1 = -D$ (b) $D_1 = D$ (c) $D_1 = abcD$ (d) $D_1 = xyzD$

17. If A is a 3×3 matrix such that $AA' = I$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ -3 & 0 & 2 \\ 2 & 5 & 0 \end{bmatrix}$ then $|AB| =$

(a) ± 47 (b) ± 48 (c) ± 17 (d) ± 18

18. If $a_1, a_2, a_3, \ldots, a_n, \ldots$ are in G.P. then $\begin{vmatrix} a_{r+1} & a_{r+5} & a_{r+7} \\ a_{r+7} & a_{r+11} & a_{r+15} \\ a_{r+11} & a_{r+15} & a_{r+21} \end{vmatrix} =$

(a) $9a_1$ (b) $3a_1$ (c) 1 (d) 0

19. If A and B are square matrices of order 3 such that $|A| = -1$ and $|B| = 3$ then the determinant of $3AB$ is equal to

(a) -27 (b) -81 (c) -9 (d) -36

20 If x is a positive integer then $\begin{vmatrix} x! & (x+1)! & (x+2)! \\ (x+1)! & (x+2)! & (x+3)! \\ (x+2)! & (x+3)! & (x+4)! \end{vmatrix}$ is

(a) 2 (b) $2x!\,(x+1)!\,(x+2)!$ (c) $2(x+1)^2!$ (d) $(x+1)^2$

21. If $\begin{vmatrix} a & b & c \\ l & m & n \\ p & q & r \end{vmatrix} = 2$ then $\begin{vmatrix} 6a & 3b & 15c \\ 2l & m & 5n \\ 2p & q & 5r \end{vmatrix} =$

(a) 10 (b) 20 (c) 40 (d) 60

22. If $\begin{vmatrix} x & p & q \\ p & x & q \\ q & q & x \end{vmatrix} = k(x^2 + px - 2q^2)$ then $k =$

(a) $-x$ (b) x (c) $x + p$ (d) $x - p$

23. If the ΔABC is isosceles then $\begin{vmatrix} cos^2A & sin^2A & sinA \\ cos^2B & sin^2B & sinB \\ cos^2C & sin^2C & sinC \end{vmatrix} =$

(a) -1 (b) 1 (c) 0 (d) 3

24. If $\begin{vmatrix} a+3d & 3 & 1 \\ a+7d & 7 & 1 \\ a+13d & 13 & 1 \end{vmatrix} = 0$ then d is

(a) any real number (b) $= 1$ only (c) $= 0$ only (d) $= 9$ only

25. If $D = \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$ and $D_1 = \begin{vmatrix} 1 & 1 & 1 \\ yz & zx & xy \\ x & y & z \end{vmatrix}$ then

(a) $D_1 = D$ (b) $D_1 = -D$ (c) $D_1 = 2D$ (d) $D_1 = -2D$

26. If (x_1, y_1), (x_2, y_2) and (x_3, y_3) are vertices of an equilateral triangle and if length of the side of the triangle is a units then $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2 =$

(a) $3a^4/4$ (b) $a^4/4$ (c) $3a^4/2$ (d) $a^4/2$

27. The lines $ax+hy+g=0,\ hx+by+f=0$ and $gx+fy+c=0$ are concurrent.

The value of $\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix} =$ (a) 3 (b) 0 (c) 2 (d) 6

28. If $A=\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ then $A^{-1} =$

(a) $\frac{1}{2}\begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 1 \\ -1 & 1 & 0 \end{bmatrix}$ (b) $\frac{1}{2}\begin{bmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$ (c) $\begin{bmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 & 1 \\ -1 & 0 & 1 \\ -1 & 1 & 0 \end{bmatrix}$

29. The matrix $\begin{bmatrix} \sin A & \cos A & \sin A+\cos B \\ \sin B & \cos A & \sin B+\cos B \\ \sin C & \cos A & \sin C+\cos B \end{bmatrix}$ is

(a) invertible (b) symmetric (c) identity when $A = B = C$ (d) singular

30. If $A=\begin{bmatrix} 0 & 1 & 3 \\ 1 & 2 & x \\ 2 & 3 & 1 \end{bmatrix}$ and $A^{-1}=\begin{bmatrix} 1/2 & -4 & 5/2 \\ -1/2 & 3 & -3/2 \\ 1/2 & y & 1/2 \end{bmatrix}$ then $(x,y) =$

(a) $(1,\ -1)$ (b) $(-1,\ 1)$ (c) $(1,\ 1)$ (d) $(-1,\ -1)$

31. If $A=\begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 1 \\ 1 & -2 & 3 \end{bmatrix}$ then $adj\ (A^{-1}) =$

(a) $\frac{1}{2}A$ (b) $2A$ (c) $8A$ (d) $\frac{1}{8}A$

32. If A is a non-singular matrix of order n and k is a positive real number then the value of $\det(kA)^{-1}.\det A$ is

(a) nk (b) k^n (c) $1/k^n$ (d) $1/nk$

33. If adjoint of a square matrix A is $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 1 \\ -2 & 1 & 2 \end{bmatrix}$ then $|A| =$

(a) $\pm\sqrt{11}$ (b) $\sqrt{10}$ (c) $\pm\sqrt{12}$ (d) $\sqrt{14}$

34. If $A=\begin{bmatrix} 1 & -\tan x \\ \tan x & 1 \end{bmatrix}$ then $A.(A')^{-1} =$

(a) $\begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$ (b) $\begin{bmatrix} \cos 2x & -\sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$

(c) $\begin{bmatrix} \cos 2x & \sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$ (d) $\begin{bmatrix} \cos 2x & \sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$

35. If A and B are two invertible matrices and if $(2A.3B)^{-1}=kB^{-1}A^{-1}$. Then $k =$

(a) $1/6$ (b) $1/12$ (c) 12 (d) 6

36. The system of equations, $x - 2y = 10,\ \ 2x - y - z = 8,\ -2y + z = 7$ is

(a) consistent and has infinite number of solutions (b) consistent and has unique solution

(c) inconsistent (d) consistent and has two solutions

37. It is given that $\begin{bmatrix} 3 & 2 & -2 \\ 1 & 2 & 3 \\ 2 & -1 & 1 \end{bmatrix}^{-1} = k\begin{bmatrix} 5 & 0 & 10 \\ 5 & 7 & -11 \\ -5 & 7 & 4 \end{bmatrix}$.

If $x,\ y,\ z$ are the roots of $3x + 2y - 2z = 3,\ x + 2y + 3z = 6$ and $2x - y + z = 2$ then $xyz =$

(a) -2 (b) 1 (c) 2 (d) -1

38. The system of equations, $\lambda x + y + z = 0,\ \lambda y + z - x = 0,\ \lambda z - x - y = 0,$ $\lambda \in R$, will have a nonzero solution if $\lambda =$

(a) – 1 (b) 3 (c) 0 (d) 2

39. The system of linear equations $kx + y + z = 1,\ x + ky + z = 1$ and $x + y + kz = 1$ has unique solution. Then

(a) $k \neq -2$ only (b) $k \neq 1$ only (c) $k \neq -2$ and $k \neq 1$ (d) $k \neq -2$ or $k \neq 1$

Correct options

1.(b) 2.(c) 3.(d) 4.(b) 5.(c) 6.(b) 7.(b) 8.(b) 9.(c) 10.(a) 11.(d) 12.(a) 13.(a) 14.(a) 15.(b) 16.(b) 17.(a) 18.(d) 19.(b) 20.(b) 21.(d) 22.(d) 23.(c) 24.(a) 25.(b) 26.(c) 27.(b) 28.(b) 29.(d) 30.(a) 31.(a) 32.(c) 33.(a) 34.(a) 35(a) 36.(b) 37.(b) 38.(c) 39.(c)

Unit test

1. If $cos\ 2\theta = 0,\ -\pi \leq \theta \leq \pi$ then one of the values of $\begin{vmatrix} 0 & cos\ \theta & sin\ \theta \\ cos\ \theta & sin\ \theta & 0 \\ sin\ \theta & 0 & cos\ \theta \end{vmatrix}^2$ is

(a) 0 or $1/2$ (b) 2 or $1/2$ (c) 1 or $1/2$ (d) $\sqrt{2}$ or $1/2$

2. If x, y, z are all different from zero and $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = 0$ then $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} =$

(a) 0 (b) -1 (c) 3 (d) 1

3. The sum of the moduli of the roots of the equation $\begin{vmatrix} 1 & -2 & 5 \\ 2 & x & -1 \\ 0 & 4 & 2x \end{vmatrix} = 0$ is

(a) $\sqrt{11}$ (b) $\sqrt{22}$ (c) $2\sqrt{11}$ (d) $2\sqrt{22}$

4. If $\begin{vmatrix} a-b & b+c & a \\ b-c & c+a & b \\ c-a & a+b & c \end{vmatrix} = k \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then $k =$

(a) 2 (b) 1 (c) -1 (d) -2

5. $\begin{vmatrix} y^2z^2 & yz & y+z \\ z^2x^2 & zx & z+x \\ x^2y^2 & xy & x+y \end{vmatrix} =$

(a) 0 (b) $2xyz$ (c) $2(xy+yz+zx)$ (d) $2(x+y+z)$

6. If $\begin{vmatrix} 2a & 3r & x \\ 4b & 6s & 2y \\ -2c & -3t & -z \end{vmatrix} = m \begin{vmatrix} a & r & x \\ b & s & y \\ c & t & z \end{vmatrix}$ then $m =$

(a) 12 (b) -12 (c) 7 (d) -7

7. If $A = \begin{pmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ -2 & -3 & 0 \end{pmatrix}$ then $|A^2| =$

(a) 0 (b) 21 (c) -11 (d) 4

8. If $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ b & c & a \end{vmatrix} = k[(a-b)^2 + (b-c)^2 + (c-a)^2]$ then k is

(a) $-1/2$ (b) $1/2$ (c) 2 (d) 1

9. If (x_1, y_1), (x_2, y_2) and (x_3, y_3) are vertices of an equilateral triangle of perimeter 6 units then $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} =$

(a) $\sqrt{3}$ (b) $-\sqrt{3}$ (c) $4\sqrt{3}$ (d) $2\sqrt{3}$

10. If a, b, c are in A.P. then $\begin{bmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{bmatrix}$ is

(a) singular (b) invertible (c) symmetric (d) null

11. If A is a 3×3 matrix and $|A| = 4$ then $|adj(A^{-1})| =$

(a) 16 (b) 8 (c) $1/8$ (d) $1/16$

12. The matrix A satisfying $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$ is

(a) $\begin{bmatrix} 1 & 4 \\ 1 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ (c) $\begin{bmatrix} -1 & 4 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 4 \\ -1 & 0 \end{bmatrix}$

13. The number of values of k for which the system $x+y+z=6,\ 4x+ky-kz=0$ and $3x+2y-4z=-8$ has no solution is

(a) 1 (b) 2 (c) 0 (d) 3

14. It is given that $A=\begin{bmatrix}2 & 2 & -4\\ -4 & 2 & -4\\ 2 & -1 & 5\end{bmatrix}$ and $B=\begin{bmatrix}1 & -1 & 0\\ 2 & 3 & 4\\ 0 & 1 & 2\end{bmatrix}$. The value of k such that $adj\ A=kB$ is

(a) 216 (b) 36 (c) 6 (d) 1

15. If $A=\begin{bmatrix}x & 5 & 2\\ 2 & y & 3\\ 1 & 1 & z\end{bmatrix}$, $xyz=80$ and $3x+2y+10z=20$ then $A.adj\ A=$

(a) $100I$ (b) $80I$ (c) $119I$ (d) $79I$

Correct options

1.(a) 2.(b) 3.(d) 4.(c) 5.(a) 6.(b) 7.(a) 8.(a) 9.(d) 10.(a) 11.(d) 12.(b) 13.(a) 14.(c) 15.(d)

Filler

1. If $f(\theta)=\begin{vmatrix}1 & \cos\theta & 1\\ -\cos\theta & 1 & \cos\theta\\ -1 & -\cos\theta & 1\end{vmatrix}$ then $\lim_{\theta\to 0}\frac{4-f(\theta)}{\theta^2}=$

(a) 2 (b) 1 (c) $1/2$ (d) 0

Ans(a): $f(\theta)=1(1+\cos^2\theta)-\cos\theta(-\cos\theta+\cos\theta)+1(\cos^2\theta+1)$

$=2(1+\cos^2\theta)$.

$\therefore \lim_{\theta\to 0}\frac{4-f(\theta)}{\theta^2}=\lim_{\theta\to 0}\frac{4-2(1+\cos^2\theta)}{\theta^2}=\lim_{\theta\to 0}\frac{2(1-\cos^2\theta)}{\theta^2}=\lim_{\theta\to 0}\frac{2\sin^2\theta}{\theta^2}$

$=2\times 1^2=2.$

2. If $\sin 2x=1$ then $\begin{vmatrix}0 & \cos x & -\sin x\\ \sin x & 0 & \cos x\\ \cos x & \sin x & 0\end{vmatrix}=$

(a) $\sqrt{2}$ (b) 0 (c) 1 (d) 2

2.Ans(b): By using definition,

$$\begin{vmatrix}0 & \cos x & -\sin x\\ \sin x & 0 & \cos x\\ \cos x & \sin x & 0\end{vmatrix}=0-\cos x\{-\cos^2x\}-\sin x\{\sin^2x\}=\cos^3x-\sin^3x.$$

If $\sin 2x=1$ then $2x=2n\pi+\frac{\pi}{2},\ n\in Z.\ \therefore x=n\pi+\frac{\pi}{4}.$

When $x=n\pi+\frac{\pi}{4},\ \cos x=\sin x.\ \therefore D=0.$

5. CONTINUITY AND DIFFERENTIABILITY

1. The function $f(x) = \begin{cases} 3x+5, & x \geq 2 \\ x^2, & x < 2 \end{cases}$. Then

(a) f is continuous at $x = 2$ (b) f is continuous only at $x = 2$

(c) f is discontinuous at $x = 2$ (d) f is discontinuous at infinite number of points

2. The function $f(x) = \begin{cases} \frac{|x-4|}{2(x-4)}, & x \neq 4 \\ 0, & x = 4 \end{cases}$. Then

(a) f is continuous at $x = 4$ (b) f is continuous only at $x = 4$

(c) f is discontinuous at infinite number of points (d) f is discontinuous at $x = 4$

3. Consider the function $f(x) = \frac{1 - \sin x}{(\pi - 2x)^2}$. (i) $\lim_{x \to \pi/2} f(x) = \frac{1}{8}$ (ii) The value of $f\left(\frac{\pi}{2}\right)$ so that the function $f(x)$ is continuous at $x = \frac{\pi}{2}$ is $\frac{1}{8}$. Then

(a) only (i) is true (b) both (i) and (ii) are true

(c) only (ii) is true (d) neither (i) nor (ii) is true

4. The value of k so that the function $f(x) = \begin{cases} \frac{2^{x+2} - 16}{4^x - 16}, & x \neq 2 \\ k, & x = 2 \end{cases}$ is continuous, is

(a) 1 (b) $3/2$ (c) $1/2$ (d) 4

5. If the function $f(x) = \frac{x^2 - (A+2)x + A}{x - 2}$, for $x \neq 2$ and $f(2) = 2$, is continuous then $A =$

(a) 2 (b) 0 (c) $2/3$ (d) $1/3$

6. The value of $f\left(\frac{\pi}{4}\right)$ so that the function $f(x) = \frac{\sqrt{2}.\cos x - 1}{\cot x - 1}$, $x \neq \frac{\pi}{4}$ is continuous, is

(a) $1/2$ (b) $\sqrt{2}$ (c) $1/\sqrt{2}$ (d) $2\sqrt{2}$

7. The set of all points of discontinuity of the function, $f(t) = \frac{1}{t^2 + t - 2}$ where $t = \frac{1}{x-1}$, is

(a) $\left\{1, -\frac{1}{2}, 2\right\}$ (b) $\left\{-1, \frac{1}{2}, 0\right\}$ (c) $\left\{1, \frac{1}{2}, 2\right\}$ (d) $\left\{1, \frac{1}{2}, 0\right\}$

8. The set of all points of discontinuity of the function $f(x) = \frac{1}{x - [x]}$, where $[.]$ indicates the greatest integer function, is

(a) Q (b) R (c) Z (d) $\{\}$

9. The function $f(x) = \frac{\log_e(1 + 4x - 3x^2)}{x}$ is continuous for all $x \in R$. Then $f(0) =$

(a) 4 (b) 1 (c) $\log_e 2$ (d) 0

10. The function $f(x) = \begin{cases} \frac{e^{1/x}}{1 + e^{1/x}}, & x \neq 0 \\ 0, & x = 0 \end{cases}$. Then

(a) f is continuous at $x = 0$ (b) f is continuous only at $x = 0$

(c) f is discontinuous at $x = 0$ (d) f is discontinuous at infinite number of points

11. The left hand derivative of $f(x) = sin\, \pi[x]$, {where $[x]$ indicates greatest integer not greater than x} at $x = 1$ is

(a) 0 (b) 1 (c) -1 (d) 0.5

12. The function $f(x) = |x - 3| cos\, x$ is

(a) differentiable and continuous for any x (b) differentiable and not continuous

(c) not differentiable only when $x = 3$ (d) continuous everywhere nowhere differentiable

13. A function $f : R \to R$ satisfies the equation $f(x + y) = f(x).f(y),\ \forall\, x,\ y \in R$ and $f(x) \neq 0$. Suppose that the function is differentiable at $x = 0$ and $f'(0) = 2$. Then $\frac{f'(x)}{f(x)} =$

(a) 1 (b) 0 (c) -1 (d) 2

14. The function $f(x) = |sin\, x|$ is

(a) differentiable and continuous for any x

(b) not differentiable when $x = (2n + 1)\frac{\pi}{2},\ n \in Z$

(c) not differentiable when $x = n\pi,\ n \in Z$

(d) continuous everywhere nowhere differentiable

15. Suppose that $[x]$ denotes the greatest integer not greater than x.

The function $f(x) = \begin{cases} x[x], & 0 \leq x < 2 \\ (x - 1)x, & 2 \leq x < 3 \end{cases}$ is

(a) differentiable at $x = 2$ (b) not differentiable at $x = 2$

(b) differentiable at $x = 1$ (d) not differentiable at $x = 5/2$

16. If $g(x) = sin^3 x$ then $\lim_{x \to \pi/2} \frac{g(x) - g(\pi/2)}{x - \pi/2} =$

(a) 3 (b) 1 (c) 0 (d) -3

17. If g is the inverse of f and $f'(x) = 1 + x^2$ then $g'(x) =$

(a) $\frac{1}{1 + x^2}$ (b) $1 + g^2(x)$ (c) $\frac{1}{1 + g^2(x)}$ (d) $1 + x^2$

18. If $x.sin\,(a+y) + sin\,a.cos\,(a+y) = 0$ then $\frac{dx}{dy} =$

(a) $-sin\,a.\left\{1+\left(\frac{x}{sin\,a}\right)^2\right\}$ (b) $1+\left(\frac{x}{sin\,a}\right)^2$ (c) $sin\,a.\left\{1+\left(\frac{x}{sin\,a}\right)^2\right\}$ (d) $-1+\left(\frac{x}{sin\,a}\right)^2$

19. If $\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = k$ and $x \neq y$ then $\frac{dy}{dx} =$

(a) $-x/y$ (b) $-y/x$ (c) x/y (d) y/x

20. If $x^2 + y^2 = t + \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$ then $x^3y.\frac{dy}{dx} =$

(a) 1 (b) -1 (c) 2 (d) -2

21. If $y = sin\,x + \cfrac{1}{sin\,x + \cfrac{1}{sin\,x + \cdots\infty}}$ then $y_1 =$

(a) $\frac{y^2.cos\,x}{1+y^2}$ (b) $\frac{(1+y^2)cos\,x}{y^2}$ (c) $\frac{1+y^2}{y^2cos\,x}$ (d) $\frac{y^2}{(1+y^2)cos\,x}$

22. The value of $\frac{dy}{dx}$ at $(-1,3)$ on the curve $3x^2 + 4xy + 2y^2 + x = 8$ is

(a) $4/3$ (b) $-4/3$ (c) $7/8$ (d) $-7/8$

23. If $y = tan\,(x+y)$ then $\frac{dy}{dx} =$

(a) $-(1+y^2)/y^2$ (b) $(1+y^2)/y^2$ (c) $-(1+y^2)/y$ (d) $(1+y^2)/y$

24. If $y = sin^{-1}\left\{\frac{sin\,\alpha.sin\,x}{1-cos\,\alpha.sin\,x}\right\}$ then $\frac{dy}{dx}$ at $x=0$ is

(a) $tan\,\alpha$ (b) $sin\,2\alpha$ (c) $2.cos\,\alpha$ (d) $sin\,\alpha$

25. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x-y)$ then $\frac{dy}{dx} =$

(a) $\frac{x}{y}$ (b) $\sqrt{\frac{1-y}{1-y}}$ (c) $\frac{y}{x}$ (d) $\sqrt{\frac{1-y^2}{1-x^2}}$

26. If $y = tan^{-1}(sec\,x + tan\,x)$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$ then $\frac{dy}{dx} =$

(a) -2 (b) $-1/2$ (c) 2 (d) $1/2$

27. The derivative of $cot^{-1}\left(\frac{x\sqrt{x}-1}{\sqrt{x}+x}\right)$ w. r. t. x at $x=1$ is

(a) $3/2$ (b) $-3/4$ (c) $3/4$ (d) $-3/2$

28. If $\frac{d}{dx}\left\{\log_e\left(x+\sqrt{x^2+a}\right)\right\} = \frac{1}{f(x)}$ then $f^2\left(\sqrt{3a}\right) =$

(a) $4a$ (b) $4\sqrt{a}$ (c) $2a$ (d) $2\sqrt{a}$

29. If $f'(x) = sin \log_e x$ and $y = f\left(\frac{2x+3}{3-2x}\right)$ then $\frac{dy}{dx}$ at $x = 1$ is

(a) $6. sin \log_e 5$ (b) $12. sin \log_e 5$ (c) $2. sin \log_e 5$ (d) $3. sin \log_e 5$

30. If $sin\, y + e^{-x.cos\, y} = e$ then $\frac{dy}{dx}$ at $(1, \pi)$ is

(a) $-2e$ (b) $2e$ (c) $-e$ (d) e

31. If $2f'(1) = f(1)$ then the derivative of $\log_e[f(e^x)]$ at $x = 0$ is

(a) 2 (b) $1/4$ (c) 4 (d) $1/2$

32. If $2^x + 2^y = 2^{(x+y)}$ then $\frac{dy}{dx}$ at $x = y = 1$ is

(a) 2 (b) 1 (c) 0 (d) -1

33. $\lim_{x\to 0}\left(\frac{1 + a^3 + 8.e^{1/x}}{1 + (1 - b^3).e^{1/x}}\right) = 2$ then $(a, b) =$

(a) $(1, -\sqrt[3]{3})$ (b) $(1, 2)$ (c) $(2, \sqrt[3]{3})$ (d) $(0, 1)$

34. $\lim_{x\to 1}\left(\frac{x^x - 1}{x.\log_e x}\right) =$

(a) $\log_e 2$ (b) $1/2$ (c) 1 (d) 2

35. $\lim_{x\to 0}\frac{sin^{-1}x - x}{tan^{-1}x + x} =$

(a) 1 (b) $1/2$ (c) 0 (d) 2

36. $\lim_{x\to 0}(1 + 2. sin\, x)^{cos\, x} =$

(a) 1 (b) 0 (c) e (d) 2

37. If $yx^{1/x} = 1$ then $\frac{dy}{dx} =$

(a) $(\log_e x + 1)/x^{2 + (1/x)}$ (b) $(\log_e x - 1)/x^{2 + (1/x)}$

(c) $(\log_e x - 1)/x^{2 - (1/x)}$ (d) $(\log_e x + 1)/x^{2 - (1/x)}$

38. If $x = e^{x/y}$ then $\frac{dy}{dx} =$

(a) $(x + y)/x.\log_e x$ (b) $\frac{x - y}{x.\log_e x}$ (c) $\frac{\log_e x + 1}{(\log_e x)^2}$ (d) $(\log_e x)^2$

39. If $f(x) = tan\, x. tan\, 2x. tan\, 3x$ then $cosec\, 2x + 2. cosec\, 4x + 3. cosec\, 6x =$

(a) $-f'(x)/2. f(x)$ (b) $-f'(x)/f(x)$ (c) $f'(x)/f(x)$ (d) $f'(x)/2. f(x)$

40. If $x^2y = (x + y)^n$ and $\frac{dy}{dx} = \frac{y}{x}$ then $n =$

(a) 3 (b) -1 (c) -2 (d) 5

41. If $y = 12(1 - cos\, t),\ x = 10(t - sin\, t),\ -\frac{\pi}{2} < x < \frac{\pi}{2}$ and $\frac{dy}{dx} = k.cot\,\frac{t}{2}$ then $k =$

(a) $6/5$ (b) $5/6$ (c) $-5/6$ (d) $-\ 6/5$

42. The derivative of $tan^{-1}\frac{\sqrt{1-x^2}}{x}$ w. r. t. $cos^{-1}\left(2x\sqrt{1-x^2}\right),\ \frac{1}{\sqrt{2}} < x < 1$, is

(a) $-1/2$ (b) 2 (c) $1/2$ (d) -2

43. The functions $u = e^x sinx,\ v = e^x cosx$ satisfy the equation $\frac{du}{dv} = 2 - \sqrt{3}$. A value for $x =$

(a) $-\ \pi/3$ (b) $-\ \pi/4$ (c) $-\ \pi/2$ (d) $-\ \pi/6$

44. If $x = e^{\theta}\left(\theta + \frac{1}{\theta}\right)$ and $y = e^{-\theta}\left(\theta - \frac{1}{\theta}\right)$ then $\frac{dy}{dx}$ at $\theta = 1$ is

(a) $1/e^2$ (b) $-\ 1/e^2$ (c) e^2 (d) $-e^2$

45. If $\frac{d^2}{dx^2}(sec^2x - 1) = 2f(x)\{3f(x) - 2\}$ then $f(x) =$

(a) $2sec^2x$ (b) $sec^2x.tan\, x$ (c) $2secx.tan\, x$ (d) sec^2x

46. If $y = \frac{e^{2x} - 1}{e^{2x} + 1}$ then $y_2 =$

(a) $2yy_1$ (b) ${y_1}^2$ (c) $-\ 2yy_1$ (d) $e^{2x}.{y_1}^2$

47. If $y = \log_e\left(\frac{1 + sin\, x}{1 - sin\, x}\right),\ 0 < x < \frac{\pi}{2}$ then $y_2 =$

(a) $\frac{y_1}{4}.\sqrt{{y_1}^2 - 4}$ (b) $y_1.\sqrt{{y_1}^2 - 4}$ (c) $\frac{y_1}{2}.\sqrt{{y_1}^2 - 4}$ (d) $2y_1.\sqrt{{y_1}^2 - 4}$

48. If $x = a(cos\, t + t.sin\, t)$ and $y = a(sin\, t - t.cos\, t)$ then $\frac{d^2y}{dx^2} =$

(a) $sec^2t/at.sin\, t$ (b) $sec^2t/at.cos\, t$ (c) $-sec^2t/at.sin\, t$ (d) $-sec^2t/at.cos\, t$

49. If $3f(x) + f\left(\frac{1}{x}\right) = x$ then $f\,''(x)$ at $x = 1$ is

(a) $1/4$ (b) $-1/4$ (c) $-1/8$ (d) $1/8$

50. If $x^2 - 3xy + 2y^2 = 6$ then $\frac{d^2y}{dx^2}$ at $(1,\ -1)$ is

(a) $1/343$ (b) $-\ 12/343$ (c) $-\ 3/343$ (d) $-\ 2/343$

51. If $x = e^{y + e^{y + e^{y + \cdots \infty}}}$ then $\frac{d^2y}{dx^2} =$

(a) $1/x^2$ (b) $-\ 1/x^2$ (c) $(1 - x)/x$ (d) $x/(x + 1)$

52. If $x = sin\, t,\ y = sin\, pt$ and $(1 - x^2)y_2 + g(x)y_1 + p^2y = 0$ then $g(x) =$

(a) $-x$ (b) $-\ 2x$ (c) x (d) $2x$

53. If $y = b.cos\left(n.\log_e\left(\frac{x}{n}\right)\right)$ then

(a) $x^2y_2 - xy_1 + n^2y = 0$ (b) $x^2y_2 + xy_1 + n^2y = 0$

(c) $x^2y_2 + xy_1 - n^2y = 0$ (d) $x^2y_2 - xy_1 - n^2y = 0$

54. If $x = \sqrt{\frac{1-v^2}{1+v^2}}$ and $y = \frac{\sqrt{1+v^2} - \sqrt{1-v^2}}{\sqrt{1+v^2} + \sqrt{1-v^2}}$ where v is a parameter, then

$(1 + x)y_2 + 2y_1 =$

(a) $2y$ (b) $-y$ (c) $-2y$ (d) 0

55. The value of c satisfying the mean value theorem for $f(x) = x + \frac{1}{x}$, $x \in [1, 3]$ is

(a) $\sqrt{3}$ (b) $\sqrt{4.5}$ (c) $\sqrt{5}$ (d) $5/2$

56. Consider the function, $f(x) = sin^4x + cos^4x$, $x \in \left[0, \frac{\pi}{2}\right]$. Which of the following is FALSE?

(a) $f(x)$ is continuous in $\left[0, \frac{\pi}{2}\right]$ (b) $f(x)$ is differentiable in $\left(0, \frac{\pi}{2}\right)$

(c) there exists unique value, $c \in \left(0, \frac{\pi}{2}\right)$ such that $f'(c) = 0$

(d) there exist three values, $c \in \left(0, \frac{\pi}{2}\right)$ such that $f'(c) = 0$

57. For the function, $f(x) = x(x+3)e^{-x/2}$, $x \in [-3, 0]$, which of the following is FALSE?

(a) $f(x)$ is continuous in $[-3, 0]$ (b) $f(x)$ is differentiable in $(-3, 0)$

(c) there exists unique value, $c \in (-3, 0)$ such that $f'(c) = 0$

(d) there exist no, $c \in (-3, 0)$ such that $f'(c) = 0$

Correct options

1.(c) 2.(d) 3.(b) 4.(c) 5.(b) 6.(a) 7.(c) 8.(c) 9.(a) 10.(c) 11.(a) 12.(c)
13.(d) 14.(c) 15.(b) 16.(c) 17.(c) 18.(c) 19.(d) 20.(b) 21.(a) 22.(d) 23.(a) 24.(d)
25.(d) 26.(d) 27.(b) 28.(a) 29.(b) 30.(d) 31.(d) 32.(d) 33.(a) 34.(c) 35.(c) 36.(a)
37.(b) 38.(b) 39.(d) 40.(3) 41.(a) 42.(a) 43.(d) 44.(a) 45(d) 46.(c) 47.(c) 48.(b)
49.(a) 50.(b) 51.(b) 52.(a) 53.(b) 54.(d) 55.(a) 56.(d) 57.(d)

Unit test

1. The set of points where the function, $f(x) = \frac{1}{\log_2(x-2)} + \sqrt{3-x}$ is continuous is

(a) $\{x : 2 < x < 4\}$ (b) $\{x : 1 < x < \infty\}$

(c) $\{x : 2 < x < 3\}$ (d) $\{x : 0 < x < \infty\}$

2. It is given that the function $f(x) = \begin{cases} ax^2 + b, & x \leq 2 \\ 2, & x = 2 \\ 2ax - b, & x > 2 \end{cases}$ is continuous. The value of $a - b =$

(a) $1/2$ (b) 1 (c) 0 (d) 4

3. Let $f : A \to R$, where $A = R - \{0\}$ be function defined by $f(x) = \frac{x + |x|}{x}$. The number of points where the function is not continuous is

(a) 1 (b) 0 (c) 2 (d) infinite

4. If $c > 0$ and $4a + c < 2b$ then one of the roots of $ax^2 - bx + c = 0$ will necessarily lie in the interval

(a) $(-2, 0)$ (b) $(2, 3)$ (c) $(0, 2)$ (d) $(3, 4)$

5. If $f(x) = (x - 1)|x - 1|$, $x \neq 1$ then $f'(x) =$

(a) $-2|x - 1|$ (b) $|x - 1|$ (c) $2|x - 1|$ (d) $-|x - 1|$

6. If $f'(x) = g(x)$ and $g'(x) = -f(x)$ for all x and $f(a) = 1 = g(a)$ for some real number a then $f^2(x) + g^2(x) =$

(a) 1 (b) 4 (c) $1/2$ (d) 2

7. If $\frac{x^3}{y^3} + \frac{y^3}{x^3} = 1$ then $\frac{dy}{dx} =$

(a) 1 (b) xy (c) y/x (d) $2x$

8. If $y = cos^{-1}\left\{\frac{sin\, x + cos\, x}{\sqrt{2}}\right\}$, $-\frac{\pi}{4} < x < \frac{\pi}{4}$ then $\frac{dy}{dx} =$

(a) -1 (b) 0 (c) 1 (d) $-\sqrt{5}$

9. If $y = sin^{-1}\left[x\sqrt{1 - x} - \sqrt{x}\sqrt{1 - x^2}\right]$, $0 < x < 1$ then $\frac{dy}{dx}$ at $x = \frac{1}{2}$

(a) $(2 - \sqrt{3})/3$ (b) $(2 + \sqrt{3})/\sqrt{3}$ (c) $(2 - \sqrt{3})/\sqrt{3}$ (d) $(2 + \sqrt{3})/3$

10. If $g(x) = x^2$ and $h(x) = \log_e x$ then the derivative of $h(g^2(x))$ w. r. t. x is

(a) $4/x$ (b) $4x$ (c) $2/x$ (d) $2x$

11. If $\lim_{x \to a} \left\{\frac{a^x - x^a}{x^x - a^a}\right\} = -1$ then $a =$

(a) 0 (b) 2 (c) 1 (d) 2

12. $\lim_{x \to 0} \frac{x}{sin\, x - \log_e(1 - x)} =$

(a) $1/e$ (b) $1/2$ (c) $3/2$ (d) $3/e$

13. If $y = (1+x)^y$ then $\frac{dy}{dx}$ at $(0,1)$ is

(a) 1 (b) $1/2$ (c) 2 (d) $2/3$

14. The derivative of $(x-3)^{x^2}$ w. r. t. x is $(x-3)^{x^2}.f(x)$ then $(x-3)\{f(x) - 2x.\log_e(x-3) =$

(a) $2x^2$ (b) $-x^2$ (c) x^2 (d) $-2x^2$

15. If $u = e^{ax} sin\, bx$ and $v = e^{ax} cos\, bx$ then $\frac{d}{dx}\left\{u\frac{du}{dx} + v\frac{dv}{dx}\right\} =$

(a) $4a^2e^{2ax}$ (b) $2e^{2ax}$ (c) $2ae^{2ax}$ (d) $2a^2e^{2ax}$

16. If $y^{1/m} = x + \sqrt{x^2+1}$ then $(x^2+1)y_2 + xy_1 =$

(a) m^2y (b) $-m^2y$ (c) $2my$ (d) $-2my$

17. The second derivative of $u = a\, sin^3 t$ w. r. t. $v = a\, cos^3 t$ at $t = \frac{\pi}{4}$ is

(a) $2\sqrt{2}/3a$ (b) $4\sqrt{2}a$ (c) $2\sqrt{2}a$ (d) $4\sqrt{2}/3a$

18. If $y = x + e^x$ then $\frac{d^2x}{dy^2} =$

(a) $\frac{-e^x}{(1+e^x)^2}$ (b) $\frac{e^x}{(1+e^x)^3}$ (c) $\frac{-e^x}{(1+e^x)^3}$ (d) $\frac{e^x}{(1+e^x)^2}$

19. The value of c satisfying the mean value theorem for $f(x) = \frac{1}{4x-1}$, $x \in [1,4]$ is

(a) $-\frac{3\sqrt{5}+1}{4}$ (b) $\frac{-3\sqrt{5}+1}{4}$ (c) $\frac{3\sqrt{5}-1}{4}$ (d) $\frac{3\sqrt{5}+1}{4}$

20. If the function $f(x) = \begin{cases} (cos\, x)^{1/x}, & x \neq 0 \\ k, & x = 0 \end{cases}$, is continuous at $x = 0$ then $k =$

(a) 0 (b) -1 (c) 1 (d) e

21. $f(x) = (x+1)^{cot\, x}$ is continuous at $x = 0$ then $f(0) =$

(a) $1/e$ (b) 1 (c) e (d) 0

Correct options

1.(c) 2.(a) 3.(b) 4.(c) 5.(c) 6.(d) 7.(c) 8.(a) 9.(c) 10.(a) 11.(c) 12.(b) 13.(a) 14.(c) 15.(d) 16.(a) 17.(d) 18.(c) 19.(d) 20.(c) 21.(c)

6. APPLICATION OF DERIVATIVES

1. A particle moves according to the law $s = \sqrt{1-t}$. If cube of the velocity is k times the acceleration then $k =$

(a) $-1/4$ (b) $-1/2$ (c) $1/2$ (d) $1/4$

2. The velocity v of a particle at any instant of time t moving in a straight line is given by $v = s + 1$, where $s\ m$ is the distance travelled in t sec. The time in second taken by the particle to cover a distance of $9\ m$, is

(a) $\log_e 10$ (b) $\log_e 10$ (c) $2.\log_e 10$ (d) 10

3. Let $y = x^3 - 5x^2 + 5x + 8$, where both x and y are functions of time. The set of values of x for which the rate of change of y is greater than twice the rate of change of x is

(a) $(-\infty, -3) \cup (1/3, \infty)$ (b) $(-\infty, 1/3) \cup (3, \infty)$

(c) $(1/3, 3)$ (d) $(-3, -1/3)$

4. A kite is moving horizontally at a height of $200\ m$. Let the speed of kite be $10\ m/sec$. When the kite is $250\ m$ away from the boy, who is flying the kite, the speed of the string being let out, is {here height of boy is negligibly small}

(a) $6\ m/sec$ (b) $60\ m/sec$ (c) $2\ m/sec$ (d) $20\ m/sec$

5. The two equal sides of an isosceles triangle with fixed base b are decreasing at the rate of 3 cm per second. The rate at which the area decreasing when the two equal sides are equal to the base, is (in sq cm /sec)

(a) $b\sqrt{3}$ (b) $2b\sqrt{3}$ (c) $3b\sqrt{3}$ (d) $4b\sqrt{3}$

6. A circular blot of ink increases in area in such a way that the radius $r\ cm$ at time t is given by $r = 2t^2 - \frac{t^3}{4}$. The ratio between the rate of increase of the area and the rate of increase of the radius when $t = 4\ sec$, is

(a) 24π (b) 32π (c) 36π (d) 18π

7. The function $f(x) = 2x^3 + 9x^2 + 12x - 1$ is decreasing in the interval

(a) R (b) $(-1, \infty)$ (c) $(-\infty, -2)$ (d) $(-2, -1)$

8. If $f(x) = kx^3 - 10x^2 + 9x + 3$ is monotonically increasing in every interval then k cannot be

(a) -1 (b) 5 (c) 2 (d) 4

9. The function, $f(x) = \frac{2x^2 - 1}{x^4}$, $x > 0$ is decreasing, in the interval

(a) $(-\infty, 1)$ (b) $(1, 4)$ (c) $(1, \infty)$ (d) R

10. The function $f(x) = cos(\pi/x)$, $x \neq 0$ is increasing in the interval (a, b), $a \in R, b \in R$ then maximum of $\frac{1}{a} - \frac{1}{b} =$

(a) 2 (b) 0.5 (c) 1 (d) π

11. The function $f(x) = sin\, x - ax + b$ increase on R when

(a) $a > -1$ (b) $a < -1$ (c) $a > 1$ (d) $a < 1$

12. The function $f(x) = x - \frac{1}{2}.\log_e(x^2 + 1)$ is

(a) increasing (b) decreasing (c) stationary (d) a constant

13. The acute angle made by the normal to the curve $y = 8t^2 - 1$, $x = 4t^2 + 3$ with y-axis is

(a) $tan^{-1}2$ (b) $tan^{-1}(1/2)$ (c) $tan^{-1}(1/3)$ (d) $tan^{-1}3$

14. Equation of the tangent to the curve $x = acos^3t$, $y = asin^3t$ at 't' is

(a) $x.sec\, t + y.cosec\, t = a$ (b) $x.sec\, t - y.cosec\, t = a$

(c) $x.cosec\, t + y.sec\, t = a$ (d) $x.cosec\, t - y.sec\, t = a$

15. Tangent at (x_1, y_1) to the curve $y = sinx$ passes through the origin. Then $\sqrt{\frac{{x_1}^2 - {y_1}^2}{{x_1}^2}} =$

(a) $|tan\, x_1|$ (b) $|cos\, x_1|$ (c) $|sin\, x_1|$ (d) $|cot\, x_1|$

16. If the area of the triangle formed by a tangent to the curve, $2xy = a^2$ and the co-ordinate axes is 16 then $a =$

(a) ± 2 (b) ± 3 (c) ± 4 (d) ± 1

17. The point where the tangent to the curve $e^y = x^x$ makes an angle of $45°$ with the positive direction of x-axis is (h, k). Then $h + k =$

(a) 1 (b) 2 (c) 3 (d) 1/2

18. The equation of the tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at (a, b) is $Ax + ay + C = 0$. Then $aA + ab + C =$

(a) $4ab$ (b) $2ab$ (c) ab (d) 0

19. The angle of intersection of the curves $y = 4 - x^2$ and $y = x^2$ is

(a) $tan^{-1}(4/7)$ (b) $\pi/2$ (c) $tan^{-1}(4\sqrt{2}/7)$ (d) $\pi/4$

20. The point at which the curves $y = 4x^2 + 2x - 8$ and $y = x^3 - x + 10$ touch each other is (h, k). The value of $h + k =$

(a) 6 (b) 4 (c) -12 (d) 37

21. The curves $xy = c^2$ and $y^2 = 4ax$ cut at right angles. At the point of intersection $(x,\ y)$ of two curves, the ratio $|y| : |x|$ is

(a) $\sqrt{3} : 1$ (b) $\sqrt{2} : 1$ (c) $2 : 1$ (d) $3 : 1$

22. The approximate very close value of $(1.999)^5$ is

(a) 32 (b) 30.23 (c) 29.87 (d) 31.92

23. The approximate volume of metal in a hollow spherical shell whose internal and external radii are 3 cm and 3.0005 cm, is

(a) $0.018\pi\ cm^3$ (b) $0.18\pi\ cm^3$ (c) $9.003\pi\ cm^3$ (d) $0.9003\pi\ cm^3$

24. The function $f(x) = x - 3x^{1/3}$ has

(a) minimum at $x = 0$ (b) minimum at $x = -1$

(c) minimum at $x = 1$ (d) minimum at $x = 2$

25. For the function $f(x) = x^5 - 5x^4 + 5x^3 - 1$

(a) the point of local maximum is $x = 3$ (b) the point of local minimum is $x = 1$

(c) the point of inflection is $x = 0$ (d) function has no local maximum point

26. The maximum value of $f(x) = \frac{1}{4x^2 + 2x + 1}$ is

(a) $4/3$ (b) $1/2$ (c) $3/4$ (d) 2

27. The minimum value of $27^{-\cos 2x}.81^{-\sin 2x}$ is

(a) 243 (b) $1/27$ (c) 27 (d) $1/243$

28. The maximum value of $f(x) = x^2e^{-2x},\ x > 0$ is

(a) 1 (b) e^{-1} (c) e^{-2} (d) 2

29. The two positive numbers x and y are such that $x + y = 12$ and xy^2 is maximum. The value of $x^2 + y^2$ is

(a) 80 (b) 104 (c) 72 (d) 74

30. A telephone company in a town has 500 subscribers on its list and collects fixed charges of ₹300 one subscriber per year. The company proposes to increase the annual subscription and it is believed that for every increase of ₹1, one subscriber will discontinue. The increase in subscription which will bring maximum profit is

(a) 400 (b) 100 (c) 200 (d) 50

31. The length of the side of the rectangle of largest area that can be inscribed in a semicircle of radius r is

(a) r (b) $r\sqrt{2}$ (c) $r/2$ (d) $2r$

32. A rectangle of perimeter $36\ cm$ is revolved about one of its sides. The volume swept by the revolving rectangle is as large as possible. The maximum volume swept out is

(a) 144π (b) 576π (c) 864π (d) 256π

33. Height of a cylinder of maximum volume inscribed in a sphere of radius R is

(a) $2R/\sqrt{3}$ (b) $R/2$ (c) $R/\sqrt{3}$ (d) R

Correct options

1.(c) 2.(b) 3.(b) 4.(a) 5.(a) 6.(b) 7.(d) 8.(c) 9.(c) 10.(c) 11.(b) 12.(a)
13.(a) 14.(a) 15.(c) 16.(c) 17.(a) 18.(d) 19.(c) 20.(d) 21.(b) 22.(d) 23.(a) 24.(c)
25.(c) 26.(a) 27.(d) 28.(c) 29.(a) 30.(b) 31.(b) 32.(c) 33.(a)

Unit test

1. Two men A and B start with velocities v at the same time from the junction of two roads inclined at $45°$ to each other. If they travel by different roads, the rate at which they are being separated, is

(a) $2\left(2+\sqrt{2}\right)v$ (b) $2\left(2-\sqrt{2}\right)v$ (c) $\left(2+\sqrt{2}\right)v$ (d) $\left(2-\sqrt{2}\right)v$

2. A spherical ball of salt is dissolving in water in such a manner that the rate of decrease of the volume at any instant is proportional to the surface. The radius is decreasing at

(a) a rate $= r$ (b) a rate $= 2r$ (c) a constant rate (d) a rate $= 0$

3. The function $f(x) = 4sin^3x - 6sin^2x + 12\ sin\ x + 100$ is strictly decreasing in

(a) $(0,\ \pi)$ (b) $(\pi/2,\ \pi)$ (c) $(3\pi/2,\ 2\pi)$ (d) $(\pi,\ 2\pi)$

4. The function, $y = a.sin\ x + b.cos\ x$, when a and b are positive constants, is increasing in an interval $(c,\ d)$ then maximum value of $d - c =$

(a) π (b) $\pi/2$ (c) 2π (d) $\pi/4$

5. The curve $y - e^{xy} + x = 0$ has a vertical tangent at the point

(a) $(1,1)$ (b) $(1,0)$ (c) $(2,0)$ (d) $(1,2)$

6. The line $y = mx + 1$ is a tangent to the curve $y^2 = 4x$. The value of m is

(a) 0 (b) -1 (c) 2 (d) 1

7. The condition for the curves $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $xy = c^2$ to intersect orthogonally is

(a) $a = b$ (b) $ab = c^2$ (c) $ab = c$ (d) $ab \neq c$

8. The approximate very close value of $\sqrt{0.082}$ is

(a) 0.28667 (b) 0.28113 (c) 0.29667 (d) 0.29113

9. The velocity of telegraphic communication is given by $v = x^2.\log_e\left(\frac{1}{x}\right)$, where x is the displacement. The value of x, for which the velocity is maximum, is

(a) $e^{1/2}$ (b) $e^{-1/2}$ (c) $(2e)^{-1}$ (d) $2e^{-1/2}$

10. An open box with square base is to be made of a card board of area c^2. The maximum volume of the box is

(a) $c^3/6\sqrt{3}$ (b) $c^3/3\sqrt{3}$ (c) $2c^3/3\sqrt{3}$ (d) $c^3/2\sqrt{3}$

11. The critical points of the function $f(x) = \left(\alpha - \frac{1}{\alpha} - x\right)(4 - 3x^2)$, $\alpha > 0$, are

(a) $\frac{-2\alpha}{3}, \frac{2}{3\alpha}$ (b) $\frac{2\alpha}{3}, \frac{-2}{3\alpha}$ (c) $\frac{\alpha}{3}, \frac{-2\alpha}{3}$ (d) $\frac{-\alpha}{3}, \frac{2}{3\alpha}$

12. For $x > 0$, the function $f(x) = \log_e(1 + x) - \frac{x}{1 + x}$ is

(a) increasing (b) decreasing (c) stationary (d) a constant

13. Water is dripping out at a steady rate of 1 cm^3/sec through a tiny hole at the vertex of a conical vessel, whose axis is vertical. When the slant height of the water in the vessel is 4 cm, the rate of decrease of the slant height of water, where the semi vertical angle of the conical vessel is $\pi/6$, is

(a) $1/\sqrt{3}\pi\ cm/sec$ (b) $1/2\pi\ cm/sec.$ (c) $1/2\sqrt{3}\pi\ cm/sec$ (d) $2/\sqrt{3}\pi\ cm/sec$

Correct options

1.(d) 2.(c) 3.(b) 4.(a) 5.(b) 6.(d) 7.(a) 8.(a) 9.(b) 10.(a) 11.(b) 12.(a) 13.(c)

7. INTEGRALS

1. If $\int \frac{x^2 - 1}{x^2 + 1}\, dx = x - g(x) + c$ then $g\left(tan\, \frac{\pi}{8}\right) =$

(a) $\pi/8$ (b) $\pi/4$ (c) $\pi/2$ (d) $\pi/16$

2. If $x > -1$ and $\int \frac{x^8}{\sqrt{1 + x^3}}\, dx = \frac{2}{3}\left[\frac{t^5}{5} - \frac{2t^3}{3} + t\right] + c$ then $t =$

(a) $x^3 + 1$ (b) x^3 (c) $\sqrt{x^3 + 1}$ (d) $(x^3 + 1)^{3/2}$

3. If $\int \frac{x^{1/2} dx}{x^{3/4} + 1} = k\{x^{3/4} - \log_e |1 + x^{3/4}|\} + c$ then $k =$

(a) $3/4$ (b) $1/2$ (c) $3/2$ (d) $4/3$

4. If $C_1, C_2, ..., C_n$ are the binomial coefficients of order n then

$\int (C_1 + 2. C_2 x + 3. C_3 x^2 + 4. C_4 x^3 + \cdots + n. C_n x^{n-1})\, dx =$

(a) $\frac{(1 + x)^{n - 1}}{n} + c$ (b) $\frac{(1 + x)^{n + 1}}{n + 1} + c$ (c) $n(1 + x)^n + c$ (d) $(1 + x)^n + c$

5. If $\int (sin\, 2x + cos\, 2x)\, dx = \frac{1}{\sqrt{2}}. sin(2x - a) + c$ then $a =$

(a) $\pi/8$ (b) $3\pi/4$ (c) $\pi/2$ (d) $\pi/4$

6. If $\int \frac{x^3}{x + 1}\, dx = \frac{f(x)}{3} - \frac{3g(x)}{2} - \log_e h(x) + c$ then $f(1) : g(1) : h(1) =$

(a) $8 : 1 : 2$ (b) $8 : 2 : 1$ (c) $2 : 1 : 3$ (d) $2 : 3 : 1$

7. $\int \frac{1}{x + \sqrt{x}}\, dx =$

(a) $\log_e\left(\sqrt{x} + 1\right) + c$ (b) $2 \log_e\left(\sqrt{x} + x\right) + c$

(c) $2 \log_e\left(\sqrt{x} + 1\right) + c$ (d) $2 \log_e\left(\sqrt{x} + x\right) + c$

8. If $\int \frac{1}{1 + e^x} dx = x - \log_e f(x) + c$ then $f(\log_e 3) =$

(a) 5 (b) 2 (c) 4 (d) 3

9. If $\int \frac{\sqrt{x}}{x^3 + 1}\, dx = \frac{2}{3}. tan^{-1} f(x) + c$ then $f(4) =$

(a) $4x^3$ (b) x^6 (c) $2x$ (d) x^3

10. If $\int \frac{cos\, x + x. sin\, x}{x(x + cos\, x)}\, dx = \log_e |f(x)| + c$ then $f(x) =$

(a) $\frac{x + cos\, x}{x}$ (b) $\frac{x}{x + cos\, x}$ (c) $\frac{x + cos\, x}{x + 2}$ (d) $\frac{x + 2}{x + cos\, x}$

11. If $\int \frac{\cos 3x}{\sin x}\, dx = \log_e|\sin x| + f(x) + c$ where $f(x)$ is independent of constant terms then $f\left(\frac{\pi}{2}\right) =$

(a) 1 (b) -1 (c) $\sqrt{3}$ (d) $-\sqrt{3}$

12. If $\int \tan^8 x . \sec^4 x\, dx = f(x) + c$ then $f\left(\frac{\pi}{4}\right) =$

(a) $10/33$ (b) $19/99$ (c) $20/33$ (d) $20/99$

13. $\int \frac{\cos x - \cos 2x}{1 - \cos x}\, dx =$

(a) $\sin x + x + c$ (b) $-2.\sin x + x + c$ (c) $2.\sin x + x + c$ (d) $-\sin x + x + c$

14. If $\int \frac{1}{1+\sin x}\, dx = \tan\left(\frac{x}{2} + a\right) + c$ then $a =$

(a) $\pi/8$ (b) $3\pi/4$ (c) $-\pi/4$ (d) $-\pi/8$

15. $\int \frac{1 - \sin^2 x}{\sin^4 x}\, dx =$

(a) $\frac{\tan^3 x}{3} + c$ (b) $-\frac{\tan^3 x}{3} + c$ (c) $\frac{\cot^3 x}{3} + c$ (d) $-\frac{\cot^3 x}{3} + c$

16. If $\int \sec(x-a).\sec x\, dx = \frac{1}{\sin a}\log_e f(x) + c$ then $f(x) =$

(a) $\left|\frac{\cos(x-a)}{\sin x}\right|$ (b) $\left|\frac{\sin(x-a)}{\cos x}\right|$ (c) $\left|\frac{\cos(x-a)}{\cos x}\right|$ (d) $\left|\frac{\sin(x-a)}{\sin x}\right|$

17. $\int \frac{x^3 + x}{x^4 - 9}\, dx =$

(a) $\frac{1}{4}\log_e|x^4 - 9| + \frac{1}{12}\log_e\left|\frac{x^2-3}{x^2+3}\right| + c$ (b) $\frac{1}{2}\log_e|x^4 - 9| - \frac{1}{12}\log_e\left|\frac{x^2-3}{x^2+3}\right| + c$

(c) $\frac{1}{4}\log_e|x^4 - 9| - \frac{1}{12}\log_e\left|\frac{x^2-3}{x^2+3}\right| + c$ (d) $\log_e|x^4 - 9| + \frac{1}{6}\log_e\left|\frac{x^2-3}{x^2+3}\right| + c$

18. If $\int \frac{3x-1}{\sqrt{x^2+9}}\, dx = 3f(x) - \log_e|x + f(x)| + c$ then $f(4) =$

(a) 9 (b) 5 (c) 4 (d) 3

19. If $\int \frac{\sqrt{x}}{\sqrt{a^3 - x^3}}\, dx = a.\sin^{-1}\left(\frac{x}{a}\right)^b + c$ then $a + \frac{1}{b} =$

(a) $2/3$ (b) $4/3$ (c) $1/3$ (d) 1

20. If $x > 1$ and $\int \frac{1}{x\sqrt{x^4-1}}\, dx = \frac{1}{2}f(x) + c$ then $f\left(\sqrt[4]{2}\right) =$

(a) $\pi/4$ (b) $\pi/6$ (c) $\pi/3$ (d) $\pi/2$

21. If $\int \frac{1}{5 + 4.\cos 2x}.dx = \frac{1}{3}.\tan^{-1} f(x) + c$ then $f(x) =$

(a) $(\sec x)/2$ (b) $(\tan x)/3$ (c) $(\tan x)/2$ (d) $(\sec x)/3$

22. If $0 < x < \frac{3}{2}$ and $\int \frac{1}{\sqrt{3x - 2x^2}}\, dx = \frac{1}{\sqrt{2}} f(x) + c$ then $\sin f(3) =$

(a) 1 (b) 3 (c) 2 (d) $1/2$

23. $\int \frac{1}{\sqrt{x}\,(4x - 4\sqrt{x} + 17)}\, dx = \frac{1}{4}.\tan^{-1} y + c$ then $y =$

(a) $\frac{2\sqrt{x} - 1}{2\sqrt{2}}$ (b) $\frac{2\sqrt{x} - 1}{16}$ (c) $\frac{2\sqrt{x} - 1}{2}$ (d) $\frac{2\sqrt{x} - 1}{4}$

24. If $\int \frac{1}{\sqrt{1 - 12x + 4x^2}}\, dx = \frac{\log_e|f(x)|}{2} + c$ then $f(3) =$

(a) 6 (b) 4 (c) 2 (d) 3

25. If $\int \frac{1}{(1 + 3e^{-x})(3e^x + 1)}\, dx = \frac{-1}{8}.\log_e|f(x)| + c$ then $f(x) =$

(a) $\frac{e^x + 3}{3e^x + 3}$ (b) $\frac{3e^x + 1}{e^x + 3}$ (c) $\frac{e^x + 3}{3e^x + 1}$ (d) $\frac{3e^x + 3}{e^x + 3}$

26. If $\int \frac{dx}{x^4 + x^2 - 2} = -\frac{1}{3}\int f(x)dx + \frac{1}{3}\int g(x)\, dx$ (where $f(x)$ is always a positive function) then $\frac{1}{f(x)} - \frac{1}{g(x)} =$

(a) 3 (b) 2 (c) -3 (d) 1

27. If $x > 0$ and $\int \frac{1}{x(x^n + 1)}\, dx = \frac{1}{n}.\log_e f(x) + c$ then $f(x) =$

(a) $\left|\frac{x}{x^n + 1}\right|$ (b) $\left|\frac{x^n}{x^n + 1}\right|$ (c) $\left|\frac{x^n + 1}{x^n}\right|$ (d) $\left|\frac{x^n + 1}{x}\right|$

28. If $\int \frac{dx}{4 + 3\cos x} = p.\tan^{-1}\left(q.\tan\left(\frac{x}{2}\right)\right) + c$ then $(p,\ q) =$

(a) $\left(\frac{1}{\sqrt{7}}, \frac{2}{\sqrt{7}}\right)$ (b) $\left(\frac{1}{\sqrt{7}}, -\frac{2}{\sqrt{7}}\right)$ (c) $\left(-\frac{2}{\sqrt{7}}, \frac{1}{\sqrt{7}}\right)$ (d) $\left(\frac{2}{\sqrt{7}}, \frac{1}{\sqrt{7}}\right)$

29. If $\int \frac{1}{2\sin^2 x + 5\cos^2 x}\, dx = \frac{1}{\sqrt{10}}.\tan^{-1} f(x) + c$ then $f\left(\frac{\pi}{4}\right) =$

(a) $\sqrt{1/5}$ (b) $\sqrt{3/10}$ (c) $\sqrt{1/10}$ (d) $\sqrt{2/5}$

30. If $\int \frac{\tan x}{1 + \tan x}\, dx = \frac{1}{2}\{x - \log_e|f(x)|\} + c$ then $f\left(\frac{\pi}{4}\right) =$

(a) $1/2$ (b) 2 (c) 1 (d) $\sqrt{2}$

31. If $\int \frac{\sqrt{1 + x^2}}{x^4}\, dx = -\frac{1}{3} t^{3/2} + c$ then $t =$

(a) $\frac{1}{x^3} + 1$ (b) $-\left(\frac{1}{x^2} + 1\right)$ (c) $\frac{1}{x^2} + 1$ (d) $-\left(\frac{1}{x^3} + 1\right)$

32. If $\int \frac{\sqrt{a^2 - x^2}}{x}\, dx = a.\log_e \tan\left(\frac{\theta}{2}\right) + \cos\theta + c$ then $\theta =$

(a) $\sec^{-1}(x/a)$ (b) $\cos^{-1}(x/a)$ (c) $\sin^{-1}(x/a)$ (d) $\tan^{-1}(x/a)$

33. If $\int \frac{x^2+1}{x^4+1}\,dx = \frac{1}{\sqrt{2}}.\tan^{-1} f(x) + c$ then $f(\sqrt{2}) =$

(a) 2 (b) $\sqrt{2}$ (c) $1/\sqrt{2}$ (d) $1/2$

34. If $x > 0$ then $\int \frac{\log_e x}{(x+1)^2}\,dx = \frac{f(x)}{x+1} + g(x) + c$ then $f(x) - g(x) =$

(a) $\log_e(x+1)$ (b) $\log_e x$ (c) $-\log_e(x+1)$ (d) $-\log_e x$

35. If $I_n = \int \frac{e^x}{x^n} dx$ then $(n-1)I_n - I_{n-1} =$

(a) $\frac{e^x}{x^{n-1}}$ (b) $-\frac{e^x}{x^{n-1}}$ (c) $-\frac{ne^x}{x^{n-1}}$ (d) $\frac{ne^x}{x^{n-1}}$

36. If $\int \sin x. f(x)\,dx = g(x)$ then $\int \cos x\,.f'(x)\,dx =$

(a) $-\cos x. f(x) + g(x) + c$ (b) $\cos x. f(x) - g(x) + c$

(c) $\cos x. f(x) + g(x) + c$ (d) $-\cos x. f(x) - g(x) + c$

37. If $\int \{f(x). g''(x) - g(x). f''(x)\}dx = a. f(x) - b. g(x) + c$ then $(a, b) =$

(a) $(f'(x), g'(x))$ (b) $(2f'(x), 2g'(x))$ (c) $(g'(x), f'(x))$ (d) $(2g'(x), 2f'(x))$

38. If $\int \sec^{-1}x\,dx = x.\sec^{-1}x - \log_e|f(x)| + c$ then $f(\sqrt{5}) =$

(a) $3+\sqrt{5}$ (b) $3-\sqrt{5}$ (c) $\sqrt{5}-2$ (d) $\sqrt{5}+2$

39. $\int e^x \left(\frac{1-x}{1+x^2}\right)^2 dx =$

(a) $\frac{2e^x}{1+x^2} + c$ (b) $\frac{e^x}{(1+x^2)^2} + c$ (c) $\frac{e^x}{1+x^2} + c$ (d) $\frac{2e^x}{(1+x^2)^2} + c$

40. If $\int e^{\tan^{-1}x}\left(\frac{1+x+x^2}{1+x^2}\right) dx = e^{\tan^{-1}x} f(x) + c$ then $f(10) =$

(a) 20 (b) 10 (c) 100 (d) 5

41. If $\int e^{\sin x}(x.\cos x - \sec x.\tan x)\,dx = f(x).e^{\sin x} + c$ then $f(x) =$

(a) $x + \sec x$ (b) $x + 2\sec x$ (c) $x - 2\sec x$ (d) $x - \sec x$

42. If $a < x < 2a$ and $\int \sqrt{2ax - x^2}\,dx = f(x)\sqrt{2ax - x^2} + g(x).\sin^{-1}\left(\frac{x-a}{a}\right) + c$ then $\frac{f(x)}{g(x)} =$

(a) $\frac{x-a}{2}$ (b) $\frac{x-a}{a^2}$ (c) $\frac{a^2}{2}$ (d) $\frac{x-a}{a}$

43. If $\int (x+2)\sqrt{x^2+2}\,dx = \frac{1}{3}\{f(x)\}^3 + x.g(x) + 2\log_e|x + h(x)| + c$ then $f(x) : g(x) : h(x) =$

(a) $1 : 1 : 2$ (b) $2 : 1 : 1$ (c) $1 : 2 : 1$ (d) $1 : 1 : 1$

44. $\int_0^1 \frac{1}{\sqrt{1+x}-\sqrt{x}}\,dx =$

(a) $4\sqrt{2}/3$ (b) $2\sqrt{2}/3$ (c) $\sqrt{2}/3$ (d) $4\sqrt{2}$

45. $\lim\limits_{n\to\infty}\int_0^n e^{-x}\,dx =$

(a) 1 (b) 0 (c) -1 (d) $-e$

46. $\int_{\pi/3}^{\pi/2} \frac{\sqrt{1+\cos x}}{(1-\cos x)^{5/2}}\,dx =$

(a) $5/2$ (b) $3/2$ (c) $1/2$ (d) 2

47. $\int_0^1 \frac{x^5}{1+x^4}\,dx =$

(a) $(2-\pi)/8$ (b) $(8-\pi)/8$ (c) $(1-\pi)/8$ (d) $(4-\pi)/8$

48. $\int_0^{1/2} \frac{1}{(1+x^2)\sqrt{1-x^2}}\,dx =$

(a) $\frac{\sqrt{3}}{\sqrt{2}}.\tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{3}}\right)$ (b) $\sqrt{2}.\tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{3}}\right)$ (c) $\tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{3}}\right)$ (d) $\frac{1}{\sqrt{2}}.\tan^{-1}\left(\frac{\sqrt{2}}{\sqrt{3}}\right)$

49. $\int_1^4 e^{\sqrt{x}}\,dx =$

(a) $2e$ (b) $4e^2$ (c) $3/e$ (d) $2e^2$

50. $\int_0^{\pi/2} \sin 2x.\log_e \tan x\,\,dx =$

(a) $\pi\log 2$ (b) $\log 2$ (c) 0 (d) 2

51. $\int_0^{\pi/6} \frac{\tan^3 3x.dx}{1+\tan^3 3x} =$

(a) $\pi/3$ (b) $\pi/6$ (c) $\pi/12$ (d) $\pi/4$

52. $\int_1^3 \frac{\sqrt{x-1}}{\sqrt{x-1}+\sqrt{3-x}}\,dx =$

(a) $\pi/2$ (b) 1 (c) $1/2$ (d) π

53. $\int_{-\pi/3}^{\pi/3} \frac{e^{2x}\sec^2 x}{e^{4x}-1}.dx =$

(a) -1 (b) 4 (c) 2 (d) 0

54. $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right)dx =$

(a) 1 (b) 0 (c) 2 (d) -1

55. If $f(x) = |x+1| + |x| + |x-1|$ then $\int_{-1}^{0} f(x)dx =$

(a) $29/2$ (b) $9/2$ (c) $5/2$ (d) $1/2$

56. $\int_0^1 x(1-x)^{5/2}\,dx =$

(a) $8/63$ (b) $4/63$ (c) $2/63$ (d) $1/63$

57. $\int_{-1}^{1} \log\left[x+\sqrt{x^2+1}\right]\,dx =$

(a) 0 (b) -1 (c) 1 (d) 2

58. $\int_{-\pi/2}^{\pi/2} \sqrt{\cos x - \cos^3 x}\,dx =$

(a) 1 (b) 0 (c) $4/3$ (d) $3/4$

59. If $\frac{1}{m}.\int_{am}^{bm} f\left(\frac{x}{m}\right)\,dx = \frac{b^2-a^2}{2}$ then $f(x) =$

(a) x^2 (b) x (c) $2x$ (d) $x/2$

60. If $I_n = \int_{\pi/4}^{\pi/2} \cot^n x\,dx,\ n \geq 2$ then $(n-1)[I_n + I_{n-2}] =$

(a) 1 (b) 0 (c) 2 (d) 3

61. $\lim\limits_{n\to\infty} \left\{\frac{1^m+2^m+3^m+\cdots+n^m}{n^{m+1}}\right\} =$

(a) $1/m$ (b) $1/(m+1)$ (c) $1/(m+2)$ (d) $m/(m+1)$

62. If $[.]$ indicates the greatest integer function then $\int_0^\infty \left[\frac{2}{e^x}\right]\,dx =$

(a) $\log_e 2$ (b) $-\log_e 2$ (c) 0 (d) 1

63. If $\int_0^\pi x.\log_e \sin x\,dx = k\int_0^{\pi/2} \log_e \sin x\,dx$ then $k =$

(a) $\pi/2$ (b) 2π (c) π (d) 1

Correct options

1.(b) 2.(c) 3.(d) 4.(d) 5.(d) 6.(a) 7.(c) 8.(c) 9.(d) 10.(b) 11.(b) 12.(d)
13.(c) 14.(c) 15.(d) 16.(c) 17.(a) 18.(b) 19.(b) 20.(a) 21.(b) 22.(b) 23.(d) 24.(b)
25.(c) 26.(a) 27.(b) 28.(d) 29.(d) 30.(d) 31.(c) 32.(c) 33.(d) 34.(c) 35.(b) 36.(c)
37.(c) 38.(d) 39.(c) 40.(b) 41.(d) 42.(b) 43.(d) 44.(a) 45(a) 46.(b) 47.(d) 48.(d)
49.(d) 50.(c) 51.(d) 52.(b) 53.(d) 54.(b) 55.(c) 56.(b) 57.(a) 58.(c) 59.(b) 60.(a)
61.(b) 62.(a) 63.(c)

Unit test

1. If $\pi < x < \frac{3\pi}{2}$ then $\int \sin^{-1}(\cos x)\,dx =$

(a) $-\frac{3\pi}{2}x+\frac{x^2}{2}+c$ (b) $\frac{\pi}{2}x-\frac{x^2}{2}+c$ (c) $\frac{\pi}{2}x+\frac{x^2}{2}+c$ (d) $-\frac{3\pi}{2}x-\frac{x^2}{2}+c$

2. If $\int \frac{x^4 - 2x^2 + 1}{x^6 + 1}\, dx = a.tan^{-1}x + b.tan^{-1}x^3 + c$ then $ab =$

(a) $-1/3$ (b) $1/3$ (c) $-2/3$ (d) $1/3$

3. If $\int \frac{\cos x}{\cos(x - a)}\, dx = mx + n.\log_e|\cos(x - a)| + c$ then $\frac{m}{n} =$

(a) $tan\ a$ (b) $sin\ a$ (c) $cot\ a$ (d) $cos\ a$

4. If $0 < x < \frac{\pi}{2}$ and $\int \frac{1}{\sqrt{\sin^2 x + \cos x(\cos x + 2\sin x)}}\, dx = \frac{1}{\sqrt{2}}\log_e|sec\ y + tan\ y| + c$

then $y =$

(a) $x - \pi/4$ (b) $x + \pi/4$ (c) $2x - \pi/4$ (d) $2x + \pi/4$

5. If $x > 1$ and $\int \frac{1}{x}\sqrt{\frac{x - 1}{x + 1}}\, dx = \log_e|f(x)| - sec^{-1}x + c$ then $f(x) =$

(a) $x + \sqrt{x^2 - 1}$ (b) $x - \sqrt{x^2 - 1}$ (c) $\sqrt{x^2 - 1}$ (d) $x\sqrt{x^2 - 1}$

6. If $-\frac{1}{2} < x < \frac{3}{2}$ and $\int \frac{1}{\sqrt{1 - x^2 + x}}\, dx = sin^{-1}f(x) + c$ then $f\left(\frac{1}{2}\right) =$

(a) -1 (b) $-1/\sqrt{5}$ (c) $1/\sqrt{5}$ (d) 0

7. If $\int \frac{e^x}{(e^x + 1)(e^x + 2)}\, dx = \log_e f(x) + c$ then $f(\log_e 2) =$

(a) $1/3$ (b) $2/3$ (c) $3/4$ (d) $1/4$

8. If $\int \frac{1}{1 + 2\cos x}\, dx = k.\log_e\left|\frac{\sqrt{3} + tan\frac{x}{2}}{\sqrt{3} - tan\frac{x}{2}}\right| + c$ then $k =$

(a) $1/3$ (b) $-1/\sqrt{2}$ (c) $1/2$ (d) $1/\sqrt{3}$

9. If $\int \frac{(x^8 - x)^{1/8}}{x^9}\, dx = \frac{8}{63}\left(f(x)\right)^{9/8} + c$ then $f(x) =$

(a) $1 - \frac{1}{x^9}$ (b) $1 - \frac{1}{x^8}$ (c) $1 - \frac{1}{x^7}$ (d) $1 - \frac{1}{x}$

10. If $\int e^{-x} \sin x\, dx = -\frac{1}{2}.e^{-x}f(x) + c$ then $f(0) =$

(a) 0 (b) 1 (c) $\sqrt{2}$ (d) 2

11. $\int e^{sec^{-1}x}\left(1 + \frac{1}{\sqrt{x^2 - 1}}\right) dx =$

(a) $-x.e^{sec^{-1}x} + c$ (b) $-2x.e^{sec^{-1}x} + c$ (c) $x.e^{sec^{-1}x} + c$ (d) $2x.e^{sec^{-1}x} + c$

12. If $\int \sqrt{5 - 2x + x^2}\, dx = f(x)\sqrt{5 - 2x + x^2} + g(x).\log_e\left|x - 1 + \sqrt{5 - 2x + x^2}\right| + c$ then $f(x).g(x) =$

(a) $x - 1$ (b) $x - 2$ (c) $x + 1$ (d) $x + 2$

13. $\int_1^{\infty} \frac{\log_e x}{1 + x^2}\, dx =$

(a) $\int_0^{\infty} \frac{\log_e x}{1 + x^2}\, dx$ (b) $\int_0^{1} \frac{\log_e x}{1 + x^2}\, dx$ (c) $\int_{-1}^{\infty} \frac{\log_e x}{1 + x^2}\, dx$ (d) $\int_1^{0} \frac{\log_e x}{x^2 + 1} . dx$

14. $\int_0^{sin^2 x} sin^{-1}\sqrt{t}\ dt =$

(a) $-x.\frac{cos\, 2x}{2} + \frac{sin\, 2x}{4}$ (b) $x.\frac{cos\, 2x}{2} - \frac{sin\, 2x}{4}$

(c) $x.\frac{cos\, 2x}{2} + \frac{sin\, 2x}{4}$ (d) $-x.\frac{cos\, 2x}{2} - \frac{sin\, 2x}{4}$

15. If $n \in N$ then $\int_{1/2}^{2} \frac{1}{x} cosec^{(2n+1)}\left(x - \frac{1}{x}\right) dx =$

(a) $3/2$ (b) $5/2$ (c) 0 (d) 1

16. $\int_1^3 (x-1)(x-2)(x-3)\ dx =$

(a) 1 (b) 0 (c) 6 (d) 3

17. If $0 < x < 1,\ n > 0$ then

$$\int_0^1 \{x(1-x)^n + x(1-x)^{n+1} + x(1-x)^{n+2} + \cdots\ to\ \infty\}\, dx =$$

(a) $1/n$ (b) $1/2(n+1)$ (c) $1/2n$ (d) $1/(n+1)$

18. If $I_1 = \int_0^1 \frac{tan^{-1}x}{x}\, dx$ and $I_2 = \frac{1}{2}\int_0^{\pi/2} \frac{t}{sin\, t}\, dt$ then

(a) $I_1 = 2I_2$ (b) $2I_1 = I_2$ (c) $I_1 = I_2$ (d) $I_1 = 4I_2$

19. If $f(a+b-x) = f(x)$ then $\int_a^b x.f(x)\ dx =$

(a) $\frac{a+b}{4}\int_a^b f(x)\ dx$ (b) $(a+b)\int_a^b f(x)\ dx$

(c) $\frac{a+b}{2}\int_a^b f(x)\ dx$ (d) $2(a+b)\int_a^b f(x)\ dx$

20. If $\int_{-\pi/4}^{\pi/4} \log_e(sin\, x + cos\, x)\, dx = k\int_0^{\pi/4} \log_e cos\, 2x\ dx$ then $k =$

(a) $\pi/2$ (b) π (c) 2π (d) 1

21. $\lim_{n\to\infty} \left\{\frac{1}{\sqrt{n^2}} + \frac{1}{\sqrt{n^2 - 2^2}} + \frac{1}{\sqrt{n^2 - 2^2}} + \cdots + \frac{1}{\sqrt{2n - 1}}\right\} =$

(a) π/4 (b) π/2 (c) π/3 (d) π/6

Correct options

1.(a) 2.(a) 3.(c) 4.(a) 5.(a) 6.(d) 7.(c) 8.(d) 9.(c) 10.(b) 11.(c) 12.(a)
13.(d) 14.(a) 15.(c) 16.(b) 17.(d) 18.(c) 19.(c) 20.(d) 21.(b)

8. APPLICATION OF INTEGRALS

1. The area of the region enclosed by the curve $y = 2.\cos x$, the x-axis between the lines $x = 0$ and $x = 2\pi$ is (in sq units)

(a) 2 (b) 8 (c) 4 (d) 1

2. The area of the region bounded by $x^2 - 2x = y$ and the x-axis (in sq. units) is

(a) $4/3$ (b) $1/2$ (c) $2/3$ (d) $8/3$

3. The area of the region enclosed by the curve $x^2 = y$, the line $y = x + 2$ and the x-axis is (in sq units)

(a) $23/6$ (b) $1/6$ (c) $5/6$ (d) $7/6$

4. The area of the region bounded by $y = |\cos x|$, $0 < x < \pi$ (in sq. units) is

(a) 6 (b) 8 (c) 4 (d) 2

5. The area enclosed between the curves $y^2 = 12x$ and the lines $x = 0$ and $y = 6$ is (in sq. units)

(a) 2 (b) 4 (c) 6 (d) 8

6. The area of the region enclosed by $x = y^2$, the y-axis and the lines $y = 3$ and $y = 4$ is (in sq units)

(a) $55/3$ (b) $19/3$ (c) $37/3$ (d) $2/3$

7. The area of the region enclosed by $ay^2 = x^3$, the y-axis and the lines $y = a$ and $y = 2a$ is (in sq units)

(a) $\frac{3a^2}{10}\left[2^{5/3} - 1\right]$ (b) $\frac{3a^2}{5}\left[2^{5/3} - 1\right]$ (c) $\frac{a^2}{5}\left[2^{5/3} - 1\right]$ (d) $\frac{a^2}{10}\left[2^{5/3} - 1\right]$

8. The area of the region enclosed by $y = x + 1$ and $x = 2$ and $x = 3$ and the x-axis is (in sq units)

(a) 5 (b) 6 (c) 3.5 (d) 6.5

9. The area of the region enclosed by $y = 1 + |x + 1|$, $x = -3$, $x = 3$ and $y = 0$ is (in sq units)

(a) 64 (b) 32 (c) 24 (d) 16

10. The area of the region enclosed between $x^2 + y^2 = 32$, the line $y = x$, $x > 0$ and the x-axis is (in sq units)

(a) 2π (b) 8π (c) π (d) 4π

11. The area of the smaller region bounded

(i) by the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and the line $\frac{x}{a}+\frac{y}{b}=1$ is $\frac{ab\pi}{4}-\frac{ab}{2}$

(ii) by the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ and the line $\frac{x}{3}+\frac{y}{2}=1$ is $\frac{3\pi}{2}-3$. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

12. The area of the region enclosed between the curves $\{(x,y): y=\sqrt{4-x^2}\}$ and $\{(x,y): y=\sqrt{16-x^2}\}$ and the x-axis is (in sq units)

(a) 6π (b) 12π (c) 3π (d) π

13. The area of the region enclosed between $y^2=8x$ and the line $x=2$ is (in sq units)

(a) $5/3$ (b) $16/3$ (c) $32/3$ (d) 8

14. The area of the region enclosed between the curves $y^2=x$ and $2y=x$ is (in sq units)

(a) $4/3$ (b) $8/3$ (c) $16/3$ (d) $28/3$

15. The area of the region bounded between the curves $x^2=4y$ and $y=k|x|$, $k>0$, is $16/3$. The value of k is

(a) 4 (b) 1 (c) 2 (d) $1/2$

16. The area of the region enclosed by the curve $y=|x^3|$ and the line $y=1$ is (in sq units)

(a) 4 (b) $3/2$ (c) 3 (d) 2

17. The area of the ergion enclosed between the curves $x^2=4y$ and $x=4y-2$ is (in sq units)

(a) $4/3$ (b) $9/8$ (c) $8/3$ (d) $2/3$

18. The area of the region enclosed by the curve $y=-x^2$ and the line $x+y+2=0$ is (in sq units)

(a) $7/2$ (b) 3 (c) 4 (d) $9/2$

19. The area of the region bounded by $y=x^3$ and the lines $y=x+6$ and $x=0$ is (in sq units)

(a) 6 (b) 8 (c) 4 (d) 3

20. The area of the region enclosed by the curves, $y=\cos x$ and $y=\sin\left(\frac{3\pi}{2}-x\right)$ between the lines $x=-\pi/2$ and $x=\pi/2$ is (in sq units)

(a) 3 (b) 4 (c) 6 (d) 2.5

21. Find the area of the region bounded by y-axis the curves $y = cos\ x$ and $y = sin\ x$ where $0 \leq x \leq \frac{\pi}{2}$ is (in sq units)

(a) $2\sqrt{2} - 1$ (b) $\sqrt{2} - 1$ (c) $2\sqrt{2} - 2$ (d) 2

22. The area of the region lying between $y = tan\ x$ and $y = cot\ x$, $0 < x < \pi/2$ and the x-axis (in sq. units) is

(a) $\log_e 4$ (b) $\log_2 e$ (c) $\log_e 2$ (d) $\log_4 e$

23. Consider the statements (i) and (ii) in the following:

(i) The area of the region enclosed between the parabolas $y^2 = 6x$ and $x^2 = 6y$ is equal to 12 sq units. (i)The area of the region enclosed between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is equal to $\frac{16a^2}{3}$ sq units. Then

(a) (i) and (ii) are true and (ii) is the correct explanation for (i)

(b) (i) and (ii) are true and (ii) is not the correct explanation for (i)

(c) (i) is true and (ii) is false (d) (i) is false and (ii) is true

24. Area of the region bounded between the curves, $y = \log_2 x$ and $y = \log_{1/2} x$ and the line $x = 1/2$ is (in sq units)

(a) $2\log_2 e$ (b) $\log_2 e + 1$ (c) 1 (d) $\log_2 e - 1$

Correct options

1.(b) 2.(a) 3.(c) 4.(d) 5.(c) 6.(c) 7.(b) 8.(c) 9.(d) 10.(d) 11.(c) 12.(a)
13.(c) 14.(a) 15.(b) 16.(b) 17.(b) 18.(d) 19.(a) 20.(b) 21.(b) 22.(c) 23.(a) 24.(d)

Unit test

1. The area of the region bounded by $y = e^{|x|}$, the x-axis, between the lines $|x| = 1$ (in sq. units) is

(a) $2e + 1$ (b) $2(e - 1)$ (c) $2e - 1$ (d) $2(e + 1)$

2. The area bounded the curve $y = 2x(x - 3)$ and the x–axis is (in sq. units)

(a) 9 (b) 18 (c) 21 (d) 34

3. The area of the region enclosed between $y^2 = 2x$ and $x - y - 4 = 0$ is (in sq units)

(a) 18 (b) 9 (c) $8/3$ (d) $17/3$

4. The area of the region enclosed by $x = 2y + 3$ and $y = 1$ and $y = -1$ and the y-axis is

(a) 4 (b) 5 (c) 6 (d) 1

5. The area of the region enclosed by $x = at^2,\ y = 2at,\ a > 0$ from $t = 1$ and $t = 2$ is (in sq units)

(a) $28a^2/3$ (b) $56a^2/3$ (c) $4a^2/3$ (d) $8a^2/3$

6. The area of the region bounded by $y = x^2$, the lines $x = 1,\ x = 2$ and the x-axis is (in sq units)

(a) $5/3$ (b) $7/3$ (c) $1/3$ (d) $2/3$

7. The area of the region enclosed by the circle $x^2 + y^2 = 16$ exterior to the parabola $y^2 = 6x$ is (in sq units)

(a) $\frac{8\pi}{3} - \frac{2\sqrt{3}}{3}$ (b) $\frac{8\pi}{3} - \frac{4\sqrt{3}}{3}$ (c) $\frac{32\pi}{3} - \frac{4\sqrt{3}}{3}$ (d) $\frac{32\pi}{3} - \frac{2\sqrt{3}}{3}$

8. If the area of the region enclosed between the curves $mx^2 = y$ and $my^2 = x$ is $1/81$ (in sq. units) then $m =$

(a) $3\sqrt{3}$ (b) $1/3\sqrt{3}$ (c) 3 (d) $1/3$

9. Area of the region (in sq. units) enclosed between $x^2 = -4(y-1)$ and $x^2 = 4(y+1)$ is

(a) $32/3$ (b) $8/3$ (c) $48/3$ (d) $16/3$

10. The area of the region between the curve $y = \cos 3x,\ 0 \le x \le \frac{\pi}{6}$ and the coordinate axes is

(a) 1 (b) $1/2$ (c) $1/3$ (d) 3

Correct options

1.(b) 2.(a) 3.(a) 4.(c) 5.(b) 6.(b) 7.(c) 8.(a) 9.(d) 10.(c)

Filler

The area of the region enclosed between the curves $y = \sqrt{x}$ and $y = x$ is (in sq units)

(a) $27/2$ (b) $1/6$ (c) $3/2$ (d) $1/2$

Ans(b): $\sqrt{x} = x \Rightarrow x = 0,\ 1$. The two curves intersect at $x = 0$ and $x = 1$.

Between $x = 0$ and $x = 1$ both $\sqrt{x}$ and x are positive.

Also between $x = 0$ and $x = 1$, $\sqrt{x} > x$.

$\therefore$ Required area $= \int_0^1 \left(\sqrt{x} - x\right) dx = \left[\frac{x^{3/2}}{3/2} - \frac{x^2}{2}\right]_0^1 = \frac{2}{3} - \frac{1}{2} = \frac{1}{6}$ sq units.

9. DIFFERENTIAL EQUATIONS

1. For which of the following differential equations order is different from the order of the other?

(a) $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 + 6y^5 = 0$ (b) $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x.sin\ \frac{dy}{dx}$

(c) $\frac{d^2y}{dx^2} + e^{dy/dx} = 0$ (d) $\frac{d^3y}{dx^3} + cos\ \frac{dy}{dx} = x^2$

2. For which of the following differential equations degree is NOT 2?

(a) $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} = x$ (b) $\sqrt{1 + \frac{d^2y}{dx^2}} = x + \frac{dy}{dx}$

(c) $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2} = \frac{d^2y}{dx^2}$ (d) $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^{1/2} = x$

3. The order of the differential equation of the family of curves,

$y = C_1.cos\ (2x + C_2) - (C_3 + C_4)a^{x + C_5} + C_6.sin\ (x - C_7)$ is

(a) 3 (b) 2 (c) 1 (d) 5

4. The differential equation of the family of circles of given radius a has order m and degree n. The value of $m + n =$

(a) 4 (b) 3 (c) 5 (d) 6

5. The differential equation of the family of curves represented by $y = a + be^{5x} + ce^{7x}$ where b and c are the arbitrary constants is $35y - 12y_1 + y_2 = k$. The value of $k =$

(a) $42a$ (b) $7a$ (c) $28a$ (d) $35a$

6. The differential equation of the family of curves given by $y = e^x(a.cos\ x + b.sin\ x)$, where a and b are arbitrary constants, is $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = g(x)$. Then $g(x) =$

(a) $-ye^x$ (b) ye^x (c) $-e^x$ (d) e^x

7. The differential equation of the family of curves represented by $y = (sin^{-1}x)^2 + Acos^{-1}x + B$, where A and B are arbitrary constants, is $(1 - x^2)y_2 + Cxy_1 = D$. Then $C + D =$

(a) 4 (b) 3 (c) 2 (d) 1

8. The differential equation of the family of non-horizontal lines is

(a) $\frac{dy}{dx} = 0$ (b) $\frac{d^2y}{dx^2} = 1$ (c) $\frac{d^2x}{dy^2} = 0$ (d) $\frac{dx}{dy} = 1$

9. The differential equation of the family of circles in the first quadrant which touch the coordinate axes, is $p(x-y)^2 = (x + yy')^2$. Then $p =$

(a) $1 + y'^2$ (b) $1 - y'^2$ (c) $2 + y'^2$ (d) $2 - y'^2$

10. The general solution of $\frac{dy}{dx} = 2xe^{x^2 - y}$ is

(a) $-e^{-y} = xe^{x^2} + c$ (b) $-e^{-y} = e^{x^2} + c$

(c) $-e^{-y} = 2e^{x^2} + c$ (d) $e^{-y} = e^{x^2} + c$

11. A solution curve of the equation $\frac{dy}{dx} = 2^{y-x}$ passing through $(1, 2)$ also passes through $(-2, y)$. The value of y is

(a) $\log_2\left(\frac{31}{4}\right)$ (b) $\log_2\left(\frac{4}{31}\right)$ (c) $\log_2\left(\frac{15}{4}\right)$ (d) $\log_2\left(\frac{4}{15}\right)$

12. The equation of the curve whose tangent at any point on it, different from the origin, has the slope $y + \frac{y}{x}$, is $\log_e\left|\frac{y}{x}\right| = f(x) + c$. The graph of $y = f(x)$ is a straight line

(a) parallel to x-axis (b) cutting negative y-axis

(c) having positive intercepts (d) passing through the origin

13. If the population of a country doubles in 50 years, then the number of years in which the population will be triple under the assumption that the rate of increase is proportional to the number of inhabitants, is

(a) $50\log_2 3$ (b) 50 (c) $25\log_2 3$ (d) $\log_2 3$

14. The particular solution of the differential equation $(1 + e^{2x})dy + (1 + y^2)e^x dx = 0$, given that $y = 1$, when $x = 0$, is $m.tan^{-1}y + n.tan^{-1}(e^x) = \frac{\pi}{2}$. The value of $m + n =$

(a) 3 (b) 1 (c) 2 (d) 0

15. Which of the following is FALSE?

(a) $f(x, y) = cos^2\left(\frac{y}{x}\right) + \frac{y}{x}$ is homogeneous of degree zero

(b) $g(x, y) = \frac{\sqrt{x^2 + y^2} + y}{x}$ is homogeneous of degree zero

(c) $h(x, y) = \frac{x^2 + y^2}{x - y}$ is homogeneous of degree one

(d) $k(x, y) = 2x$ is homogeneous of degree zero

16. The general solution of $y^2\frac{dy}{dx} + y^2 + 1 = 0$ is $x + y = f(y) + c$ where c is a constant. Then $f\left(\sqrt{3}\right) =$

(a) $\pi/6$ (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/2$

17. The general solution of $x^2\frac{dy}{dx} = x^2 + xy + y^2$ is $tan^{-1}\frac{y}{x} = f(x) + c$. The value of $f(e^4) =$

(a) 1 (b) $\sqrt{2}$ (c) 2 (d) 4

18. The general solution of $\frac{dx}{dy} = \frac{x^2\log_e\left(\frac{x}{y}\right) - x^2}{xy.\log_e\left(\frac{x}{y}\right)}$ is $\left(\log_e\left(\frac{x}{y}\right)\right)^2 + \log_e f(y) = c$ for some constant c. The value of $f(2) =$

(a) 1 (b) 4 (c) 2 (d) $\sqrt{2}$

19. The general solution of $x\frac{dy}{dx} = y + x.tan\,\frac{y}{x}$ is

(a) $y = -\,sin^{-1}(cx)$ (b) $y = 2x.sin^{-1}(cx)$
(c) $y = sin^{-1}(cx)$ (d) $y = x.sin^{-1}(cx)$

20. The general solution of $\frac{dy}{dx} + y.sec\,x = tan\,x,\ \ 0 < x < \frac{\pi}{2}$, is $y(sec\,x + tan\,x) = f(x) + c$. Then $f\left(\frac{\pi}{4}\right) =$

(a) $\sqrt{2} + 1 - \frac{\pi}{4}$ (b) $\sqrt{2} - 1 - \frac{\pi}{4}$ (c) $\sqrt{2} + 1 + \frac{\pi}{4}$ (d) $\sqrt{2} - 1 + \frac{\pi}{4}$

21. The general solution of $(1 - x^2)\frac{dy}{dx} - xy = 1,\ |x| > 1$ is $y\sqrt{x^2 - 1} = c - f(x)$ then $f(2) =$

(a) $\log_e\{2 + \sqrt{5}\}$ (b) $2\log_e\{2 + \sqrt{3}\}$ (c) $\log_e\{2 + \sqrt{3}\}$ (d) $2\log_e\{2 + \sqrt{5}\}$

22. The curve $y = y(x)$ satisfying $\frac{dy}{dx}.(x.\log_e x) + y = 2.\log_e x$ passes through $(2, 0)$. The value of $y(4) =$

(a) $\frac{1}{2}\log_e 2$ (b) $-\frac{3}{2}\log_e 2$ (c) $\frac{3}{2}\log_e 2$ (d) $-\frac{1}{2}\log_e 2$

23. The general solution of $(x + 2y^3)\frac{dy}{dx} = y$ is

(a) $x = 2y^3 + cy$ (b) $x = y^3 + cy$ (c) $x = y^3 + cy^2$ (d) $2x = y^3 + cy$

24. The general solution of $(1 + y^2) + \left(x - e^{tan^{-1}y}\right)\frac{dy}{dx} = 0$ is $x = f(y) + ce^{-\,tan^{-1}y}$ where c is a constant. The value of $f(0) =$

(a) $1/2$ (b) 1 (c) 2 (d) 0

25. The general solution of $cos\, x.\frac{dy}{dx} + y.sin\, x = 1$ is $y.sec\, x = f(x) + c$. Then $f\left(\frac{7\pi}{4}\right) =$ (a) -1 (b) 1 (c) $\sqrt{3}$ (d) $-\sqrt{3}$

26. The general solution of $\frac{dy}{dx} + 1 = e^{x+y}$ is $-e^{-(x+y)} = f(x) + c$. Then $f(x) =$

(a) x^2 (b) $-x$ (c) x (d) $-x^2$

27. The general solution of the differential equation $ye^{x/y}.dx = (xe^{x/y} + y^2)dy,\ y \neq 0$, is $xe^{x/y} = f(y)$. Then $f(y) =$

(a) $y^2 + c$ (b) $y^2 + cy$ (c) $y + c$ (d) c

Correct options

1.(d) 2.(b) 3.(d) 4.(a) 5.(d) 6.(a) 7.(d) 8.(c) 9.(a) 10.(d) 11.(d) 12.(d)
13.(a) 14.(c) 15.(d) 16.(b) 17.(d) 18.(b) 19.(d) 20.(a) 21.(c) 22.(c) 23.(b) 24.(a)
25.(a) 26.(c) 27.(b)

Unit test

1. The order of the differential equation representing the family of ellipses having center at the origin and foci on x-axis, is

(a) 1 (b) 2 (c) 0 (d) 3

2. The differential equation of the family of circles passing through the origin having center on the y-axis is

(a) $xy + (y^2 - x^2)y_1 = 0$ (b) $2xy - (y^2 - x^2)y_1 = 0$
(c) $2xy + (y^2 - x^2)y_1 = 0$ (d) $xy - (y^2 - x^2)y_1 = 0$

3. The differential equation of the family of curves represented by $y^2 = 4a(x + a)$, where a is an arbitrary constant, is

(a) $y = 2xy_1 + 2yy_1{}^2$ (b) $y = xy_1 + yy_1{}^2$
(c) $y = 2y_1 + yy_1{}^2$ (d) $y = 2xy_1 + yy_1{}^2$

4. A solution curve $y = y(x)$ of $\frac{dy}{dx} = \left(\frac{y}{x}\right)^{1/3}$ passes through $(27, 8)$. The value of y when $x = 64$ is

(a) $11^{3/2}$ (b) 12 (c) $15^{3/2}$ (d) 18

5. The solution $y = y(x)$ of the equation, $2(y + 3) - xy\frac{dy}{dx} = 0$ satisfies $y(1) = -2$. The value of $|x|$ when $y = -4$ is

(a) $2e$ (b) e (c) $2e^{-1}$ (d) e^{-1}

6. The equation of the curve passing through $(2, 1)$ having the slope of the tangent at (x, y) is $\frac{x^2 + y^2}{2xy}$ is

(a) $x^2 - y^2 = \frac{3}{2}x$ (b) $x^2 + y^2 = \frac{5}{2}x$ (c) $x^2y^2 = 5$ (d) $x + y = 3$

7. The integrating factor of $(1 + tan\ y)(dx - dy) + 2x\ dy = 0$ is

(a) $e^{-y}.(cos\ y - sin\ y)$ (b) $e^{-y}.(cos\ y + sin\ y)$

(c) $e^{y}.(cos\ y - sin\ y)$ (d) $e^{y}.(cos\ y + sin\ y)$

8. The general solution of $y + \frac{d}{dx}(xy) = x.(sin\ x + \log_e x)$ is

$y.x^2 = -x^2 cos\ x + 2\{x.sin\ x + cos\ x\} + \frac{x^3}{3}.g(x) + c$. Then $g(x) =$

(a) $3\log_e x - \frac{1}{3}$ (b) $\log_e x + \frac{1}{3}$ (c) $\log_e x - \frac{1}{3}$ (d) $3\log_e x + \frac{1}{3}$

9. The general solution of $(x + y)(dx - dy) = dx + dy$ is $t + \log_e t = 2x + k$ then $t =$

(a) $x + y + 1$ (b) $x + y$ (c) $x + y - 1$ (d) $2(x + y)$

10. The differential equation satisfying $x^2 = 2y^2 \log_e y$ is

(a) $(x^2 + y^2)\frac{dy}{dx} + xy = 0$ (b) $(x^2 + y^2)\frac{dy}{dx} - xy = 0$

(c) $(x^2 - y^2)\frac{dy}{dx} - xy = 0$ (d) $(x^2 - y^2)\frac{dy}{dx} + xy = 0$

Correct options

1.(b) 2.(c) 3.(d) 4.(a) 5.(d) 6.(a) 7.(d) 8.(c) 9.(b) 10.(b)

Filler

The general solution of $\frac{dy}{dx} + y = 5$ is represented by $y - 5 = f(x)$. If $f(2) = e^{-2}$ then $f(3) =$

(a) 0 (b) 1 (c) e^{-1} (d) e^{-3}

Ans(d): $\frac{dy}{dx} + y = 5 \Rightarrow \frac{dy}{dx} = -y + 5 \Rightarrow dy = -(y - 5)dx \Rightarrow \frac{dy}{y-5} = -dx$.

Integrating, $\log_e|y - 5| = -x + c$.

$\therefore |y - 5| = e^{-x+c} \Rightarrow |y - 5| = e^{-x}e^{c} \Rightarrow y - 5 = ke^{-x}$ where k is a constant. $\therefore f(x) = ke^{-x}$. $\therefore f(2) = e^{-2} \Rightarrow ke^{-2} = e^{-2} \Rightarrow k = 1$. $\therefore f(x) = e^{-x}$. $\therefore f(3) = e^{-3}$.

10. VECTOR ALGEBRA

1. A vector of magnitude 14 units in the direction opposite to $\overrightarrow{PQ}$, where $P \equiv (1,3,2)$ and $Q \equiv (-1,0,8)$ is

(a) $-2\hat{\imath} + 3\hat{\jmath} - 6\hat{k}$ (b) $2\hat{\imath} + 3\hat{\jmath} - 6\hat{k}$ (c) $-4\hat{\imath} + 6\hat{\jmath} - 12\hat{k}$ (d) $4\hat{\imath} + 6\hat{\jmath} - 12\hat{k}$

2. The line BA is produced to C such that $BC = 1.5BA$. If $\overrightarrow{OA} = \vec{a}$ and $\overrightarrow{OB} = \vec{b}$ then the position vector of C is

(a) $\frac{3\vec{a} - \vec{b}}{2}$ (b) $2\vec{a} - \vec{b}$ (c) $-2\vec{a} + \vec{b}$ (d) $\frac{-3\vec{a} + \vec{b}}{2}$

3. If the position vectors of 3 points are $\vec{a} - 2\vec{b} + 3\vec{c}$, $2\vec{a} + 3\vec{b} - 4\vec{c}$, $-7\vec{b} + 10\vec{c}$ then the 3 points are

(a) coincident (b) non collinear (c) non coplanar (d) collinear

4. If $\vec{a} = 3\hat{\imath}$, $\vec{b} = 4\hat{\jmath}$ and $\vec{c} = -2\hat{k}$ then the centroid of the triangle formed by the vectors $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ is

(a) $\frac{3\hat{\imath} + 4\hat{\jmath} - 2\hat{k}}{6}$ (b) $\frac{6\hat{\imath} + 8\hat{\jmath} - 4\hat{k}}{3}$ (3) $\frac{6\hat{\imath} + 8\hat{\jmath} - 4\hat{k}}{6}$ (4) $\frac{3\hat{\imath} + 4\hat{\jmath} - 2\hat{k}}{3}$

5. $ABCD$ is a quadrilateral whose diagonals are AC and BD. Then $\overrightarrow{BA} + \overrightarrow{CD} =$

(a) $\overrightarrow{AC} + \overrightarrow{DB}$ (b) $\overrightarrow{BD} + \overrightarrow{CA}$ (c) $\overrightarrow{AC} + \overrightarrow{BD}$ (d) $\overrightarrow{BC} + \overrightarrow{AD}$

6. The vectors $2\hat{\jmath} + \hat{k}$ and $3\hat{\imath} - \hat{\jmath} + 4\hat{k}$ are two sides of a triangle. The length of the median of the triangle through the common point of the given vectors is

(a) $\sqrt{26}/2$ (b) $4\sqrt{2}$ (c) $\sqrt{35}/2$ (d) $8\sqrt{2}$

7. If $|\vec{a}| = 4$ and $-3 \le k \le 2$ then the sum of the maximum and minimum values of $|k\vec{a}|$ is

(a) 8 (b) 4 (c) 20 (d) 12

8. If $\vec{a}, \vec{b}, \vec{c}$ are non collinear vectors such that $\vec{a} + \vec{b}$ is parallel to $\vec{c}$ and $\vec{c} + \vec{a}$ is parallel to $\vec{b}$ then

(a) $\vec{a}, \vec{b}, \vec{c}$ are the sides of the triangle (b) $\vec{a} + \vec{b} = \vec{a} + \vec{c}$

(c) $\vec{a} + \vec{c} = \vec{b}$ (d) $\vec{a} + \vec{b} = \vec{c}$

9. If the direction cosines of a vector are $\frac{1}{\sqrt{5}}$, $\frac{2}{\sqrt{5}}$, n then the angle made by the vector with the positive direction of the z-axis is

(a) 0° (b) 90° (c) 30° (d) 60°

10. If $\vec{a}, \vec{b}, \vec{c}$ are not the sides of a triangle and are such that $\vec{a} + \vec{b} + \vec{c} = \vec{o}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$ then $|\vec{c}| =$

(a) 4 or 64 (b) 2 or 8 c 3 or 5 (d) 1 or 2

11. Let A, B, C, D be the vertices of a parallelogram whose diagonals intersect at P and let O be the origin, then $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD} =$

(a) $3\overrightarrow{OP}$ (b) $2\overrightarrow{OP}$ (c) $\overrightarrow{OP}$ (d) $4\overrightarrow{OP}$

12. If $\vec{a} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$, $\vec{b} = \hat{\imath} + \hat{\jmath} - 2\hat{k}$ and $\vec{c} = \hat{\imath} + 3\hat{\jmath} - \hat{k}$ then the value of m so that $\vec{a}$ is perpendicular to $m\vec{b} + \vec{c}$ is

(a) 2 (b) 3 (c) -1 (d) -2

13. The vectors $\vec{a} = 3\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ and $\vec{b} = -\hat{\imath} - 2\hat{k}$ are the adjacent sides of a parallelogram. The angle between the diagonals is

(a) 30° (b) 60° (c) 45° (d) 90°

14. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $\vec{a} + \vec{b}$ is a vector of magnitude k units then the set of all possible values of k is

(a) $[1, 2]$ (b) $[0, 2]$ (c) $[0, 1]$ (d) $[1, 3]$

15. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\sqrt{3}\vec{a} - \vec{b}$ is also a unit vector then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $5\pi/6$ (b) $2\pi/3$ (c) $\pi/6$ (d) $\pi/3$

16. If in a right-angled triangle ABC, the hypotenuse $AB = p$ then $\overrightarrow{AB}.\overrightarrow{AC} + \overrightarrow{BC}.\overrightarrow{BA} + \overrightarrow{CA}.\overrightarrow{CB} =$

(a) p^2 (b) p (c) $3p^2$ (d) $3p$

17. If $\vec{a}, \vec{b}$ and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes, then the angle between $\vec{a} + \vec{b} + \vec{c}$ and $\vec{a}$, is

(a) $cos^{-1}(2/\sqrt{3})$ (b) $cos^{-1}(1/\sqrt{3})$ (c) $cos^{-1}(1/3)$ (d) $cos^{-1}(2/3)$

18. If the unit vectors, $\vec{a}, \vec{b}, \vec{c}$ are the sides of an equilateral triangle, satisfying $\vec{a} + \vec{b} + \vec{c} = \vec{o}$, then $\vec{a}.\vec{b} + 2\vec{b}.\vec{c} + 3\vec{c}.\vec{a} =$

(a) 2 (b) -6 (c) -3 (d) 3

19. If $\vec{a} + \vec{b} + \vec{c} = \vec{o}$ and if $|\vec{a} + \vec{b}| = |\vec{b} + \vec{c}| = |\vec{a} + \vec{c}| = 1$ then angle between $\vec{a} + \vec{b}$ and $\vec{b} + \vec{c}$ is

(a) $45°$ (b) $120°$ (c) $30°$ (d) $150°$

20. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are the three vectors such that each is inclined at an angle $\pi/3$ with the other two and $|\vec{a}| = 1$, $|\vec{b}| = 2$ and $|\vec{c}| = 3$ then the dot product of $\vec{a} - 4\vec{b}$ and $\vec{a} + 3\vec{c}$ is

(a) $25/2$ (b) $-85/2$ (c) 25 (d) 85

21. The vectors of magnitude $10\sqrt{3}$ that are perpendicular to the plane containing the vectors $\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $-\hat{\imath} + 3\hat{\jmath} + \hat{k}$ are given by

(a) $\pm\sqrt{10}(-\hat{\imath} - 2\hat{\jmath} + 5\hat{k})$ (b) $\pm\sqrt{10}(-\hat{\imath} + 2\hat{\jmath} + 5\hat{k})$

(c) $\pm\sqrt{10}(-\hat{\imath} + 2\hat{\jmath} - 5\hat{k})$ (d) $\pm\sqrt{10}(-\hat{\imath} - 2\hat{\jmath} - 5\hat{k})$

24. The vectors from the origin to the points A and B are $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ and $\vec{b} = 2\hat{\imath} + 3\hat{\jmath} + \hat{k}$ respectively. The area of the ΔOAB is

(a) $\sqrt{269}/2$ (b) $27/2$ (c) $14\sqrt{2}$ (d) $\sqrt{229}/2$

25. If the area of the parallelogram (in sq. units) whose adjacent sides are $\vec{a}$ and $\vec{b}$ is 5 sq units then the area of the parallelogram having vectors $2\vec{a} - \vec{b}$ and $4\vec{a} + \vec{b}$ as its diagonals, is (a) $3/\sqrt{2}$ (b) 15 (c) 12 (d) 25

26. If the vectors $\vec{c}$, $\vec{a} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and $\vec{b} = \hat{\jmath}$ are such that $\vec{a}$, $\vec{b}$, $\vec{c}$ form a right handed system then $\vec{c}$ is in the direction of

(a) $x\hat{k} - z\hat{\imath}$ (b) $\vec{o}$ (c) $x\hat{k} + z\hat{\imath}$ (d) $y\hat{\jmath}$

27. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are the three consecutive vertices of a parallelogram having area 10 $sq.units$ then $|(\vec{c} - \vec{a}) \times (2\vec{b} - \vec{a} - \vec{c})| =$

(a) 20 (b) 5 (c) 10 (d) 40

28. In the parallelogram $OACB$ the side $\overrightarrow{OA} = 2\hat{\imath} + \hat{\jmath} + \hat{k}$ and a diagonal $\overrightarrow{OC} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$. The area of the parallelogram (in sq. units) is

(a) $\sqrt{35}$ (b) $\sqrt{10}$ (c) $\sqrt{12}$ (d) $\sqrt{32}$

29. If $\vec{a} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ then $|\vec{a} \times j|^2 =$

(a) 13 (b) 14 (c) 10 (d) 21

30. $\frac{\vec{a}.\,(\vec{b}\times 2\vec{c})}{\vec{c}.\,(\vec{a}\times 3\vec{b})}+\frac{\vec{b}.\,(\vec{c}\times 3\,\vec{a})}{\vec{c}.\,(\vec{b}\times 2\,\vec{a})}=$

(a) $-5/6$ (b) $5/6$ (c) $8/9$ (d) $-8/9$

31. If $\vec{a}, \vec{b}, \vec{c}$ are nonzero, coplanar vectors then $[2\vec{a}-\vec{b}\quad 2\vec{b}-\vec{c}\quad 2\vec{c}-\vec{a}]=$

(a) 0 (b) $\vec{a}\times(\vec{b}\times\vec{c})$ (c) 8 (d) 1

32. If $p\hat{\imath}+\hat{\jmath}+2\hat{k},\ \hat{\imath}+p\hat{\jmath}-\hat{k}$ and $2\hat{\imath}-\hat{\jmath}+p\hat{k}$ are coplanar then $p=$

(a) $1\pm\sqrt{3},\ -2$ (b) $-1\pm\sqrt{3},\ -2$ (c) $1\pm\sqrt{3},\ 2$ (d) $-1\pm\sqrt{3},\ 2$

33. If $\vec{a}=2\hat{\imath},\ \vec{b}=3\hat{\jmath}$ and $\vec{c}=4\hat{k}$ then $\vec{a}\times(\vec{b}\times\vec{c})+(\vec{a}\times\vec{b})\times\vec{c}=$

(a) $\vec{b}$ (b) $\vec{a}$ (c) $\vec{o}$ (d) $\vec{c}$

Correct options

1.(d) 2.(a) 3.(d) 4.(b) 5.(b) 6.(c) 7.(d) 8.(a) 9.(b) 10.(b) 11.(d) 12.(d)
13.(c) 14.(b) 15.(c) 16.(a) 17.(b) 18.(c) 19.(b) 20.(b) 21.(a) 22.(a) 23.(c) 24.(d)
25.(b) 26.(a) 27.(a) 28.(a) 29.(a) 30.(a) 31.(a) 32.(a) 33.(c)

Unit test

1. The projection of a line segment on the x-, y- and z- axes respectively are $2, 3, 6$. The angle made by the line segment with the positive direction of the y-axis is

(a) $cos^{-1}(3/7)$ (b) $cos^{-1}(2/7)$ (c) $cos^{-1}(4/7)$ (d) $cos^{-1}(6/7)$

2. If $\vec{a}$ and $\vec{b}$ are two adjacent sides of a square then the diagonal of the square is a multiple of (a) $\frac{\vec{a}}{|\vec{b}|}+\frac{\vec{b}}{|\vec{a}|}$ (b) $\frac{\vec{a}}{|\vec{a}|}+\frac{\vec{b}}{|\vec{b}|}$ (c) $\frac{\vec{a}+\vec{b}}{|\vec{b}|}+\frac{\vec{a}-\vec{b}}{|\vec{a}|}$ (d) $\frac{\vec{a}+\vec{b}}{|\vec{a}|}+\frac{\vec{a}-\vec{b}}{|\vec{b}|}$

3. P and Q are two mid points of the sides AD and CD of the quadrilateral $ABCD$ then $\overrightarrow{AP}+\overrightarrow{QC}=$

(a) $\overrightarrow{AC}$ (b) $\frac{1}{2}\overrightarrow{AC}$ (c) $\overrightarrow{BC}$ (d) $\frac{1}{2}\overrightarrow{BC}$

4. The length of the vector $p(2\hat{\imath}-\hat{\jmath}+2\hat{k})$ is 3 units. The magnitude of the projection of the vector on the z-axis is

(a) 2 (b) 6 (c) 3 (d) 1

5. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors such that $|\vec{a}+\vec{b}+\vec{c}|=1$ and $\vec{a}$ is perpendicular to $\vec{b}$. If $\vec{c}$ makes angles α and β with $\vec{a}$ and $\vec{b}$ respectively then $cos\,\alpha+cos\,\beta=$

(a) 1 (b) $1/2$ (c) $-3/2$ (d) -1

6. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $2\vec{a} - \vec{b}$ and $5\vec{a} + 4\vec{b}$ are perpendicular to each other then the angle between $\vec{a}$ and $\vec{b}$ is

(a) $\pi/3$ (b) $2\pi/3$ (c) $3\pi/4$ (d) $\pi/12$

7. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{o}$ and $\vec{a} \times \vec{b} + \vec{c} \times \vec{a} = k(\vec{b} \times \vec{c})$ then the value of k, is

(a) 5 (b) 7 (c) 4 (d) 6

8. The area of the parallelogram having the vertices A, B, C, D whose position vectors are $-\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$ and $-\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$, is (in sq. units)

(a) 1 (b) 2 (c) 4 (d) 6

9. $\left(\frac{1}{\sqrt{5}}, 0, \frac{2}{\sqrt{5}}\right)$ is a unit vector perpendicular to the plane of the triangle having $\vec{a} = m\hat{\imath} + 3\hat{\jmath} - \hat{k}$ and $\vec{b} = 4\hat{\jmath}$ as its sides. The value of m is

(a) 1 (b) 2 (c) 4 (d) 3

10. Let $\vec{r} = l(\vec{b} \times \vec{c}) + m(\vec{c} \times \vec{a}) + n(\vec{a} \times \vec{b})$ and $[\vec{a} \quad \vec{b} \quad \vec{c}] = 2$ then $l + m + n =$

(a) $-(\vec{a} + \vec{b} + \vec{c}).\vec{r}$ (b) $(\vec{a} + \vec{b} + \vec{c}).\vec{r}$

(c) $\frac{1}{2}(\vec{a} + \vec{b} + \vec{c}).\vec{r}$ (d) $2(\vec{a} + \vec{b} + \vec{c}).\vec{r}$

11. If $\vec{c}$ is a unit vector $\perp$ to both $\vec{a}$ and $\vec{b}$ and if the angle between $\vec{a}$ and $\vec{b}$ is $\pi/6$ then $[\vec{a} \ \vec{b} \ \vec{c}]^2 =$

(a) $\frac{3}{4}$ (b) $\frac{1}{4}|\vec{a}|^2|\vec{b}|^2$ (c) $\frac{3}{4}|\vec{a}|^2|\vec{b}|^2$ (d) 1

12. It is given that $\vec{\alpha}$ and $\vec{\beta}$ are non-collinear. Suppose that $\vec{u} = 2x\vec{\alpha} + y\vec{\beta}$, $\vec{v} = 2y\vec{\alpha} + 3x\vec{\beta}$ and $\vec{w} = 2\vec{\alpha} - 5\vec{\beta}$ are such that $\vec{u} = \vec{v} + \vec{w}$. Then $xy =$

(a) -2 (b) 3 (c) -3 (d) 2

Correct options

1.(a) 2.(b) 3.(b) 4.(a) 5.(d) 6.(b) 7.(a) 8.(b) 9.(b) 10.(c) 11.(b) 12.(d)

11. THREE DIMENSIONAL GEOMETRY

1. A line make angles $\pi/4$ with both y- and z- axes. The angle made by the line with the positive direction of the x-axis is

(a) $90°$ (b) $0°$ (c) $30°$ (d) $60°$

2. A line makes the same angle α with each of the x and y-axes. If the angle θ, which it makes with the z-axis, is such that $sin^2\theta = 2.sin^2\alpha$ then the value of α is

(a) $\pi/4$ (b) $\pi/6$ (c) $\pi/3$ (d) $\pi/2$

3. The angle made by the line joining the points $A(2,3,5)$ and $B(-1,2,4)$ with the positive direction of the y-axis is

(a) $cos^{-1}(3/\sqrt{11})$ (b) $cos^{-1}(1/\sqrt{11})$ (c) $cos^{-1}(2/\sqrt{11})$ (d) $cos^{-1}(5/\sqrt{11})$

4. The angle between the lines whose direction ratios are $a,\ b,\ c$ and $b-c,\ c-a,\ a-b$ is

(a) $90°$ (b) $60°$ (c) $30°$ (d) $45°$

5. The equation of the line parallel to the vector $3\hat{\imath} - 2\hat{\jmath} + 6\hat{k}$ and which passes through the point $(1,-2,3)$ also passes through

(a) $\left(0,-\frac{2}{3},2\right)$ (b) $(-2,0,-3)$ (c) $\left(\frac{1}{2},1,0\right)$ (d) $(1,-2,-3)$

6. The direction ratios $l,\ m,\ n$ of two lines are given by $2l + 2m - n = 0$ and $lm + mn + nl = 0$. The lines

(a) are parallel (b) are coincident (c) are perpendicular (d) does not exist

7. The perpendicular distance of a corner of a unit cube from a diagonal not passing through it is

(a) $1/3$ (b) $2/3$ (c) $\sqrt{2/3}$ (d) $\sqrt{1/3}$

8. The foot of the perpendicular drawn from the point $A(1,\ 8,\ 4)$ to the line joining the points $B(0,-1,3)$ and $C(2,-3,-1)$ is

(a) $\left(-\frac{5}{3},\ \frac{2}{3},\ \frac{19}{3}\right)$ (b) $\left(\frac{5}{3},\ -\frac{2}{3},\ -\frac{19}{3}\right)$ (c) $\left(-\frac{1}{3},\ \frac{7}{3},\ \frac{11}{3}\right)$ (d) $\left(\frac{1}{3},-\frac{7}{3},\ \frac{-11}{3}\right)$

9. If two lines L_1 and L_2 in space are defined by

$L_1 : \{x = py + (p-1),\ z = (p-1)y + p\}$ and

$L_2 : \{x = q.y + (1-q),\ z = (1-q)y + q\}$ are such that L_1 is perpendicular to L_2, for all non-negative reals p and q then

(a) $p + q = 1$ (b) $p \neq q$ (c) $p + q = 1$ (d) $p = q = 0$

10. Two lines $\frac{x-3}{1}=\frac{y+1}{3}=\frac{z-6}{-1}$ and $\frac{x+5}{7}=\frac{y-2}{-6}=\frac{z-3}{4}$ intersect at the point R. The reflection of R in the yz-plane has the coordinates,

(a) $(2,4,7)$ (b) $(-2,4,-7)$ (c) $(-2,-4,7)$ (d) $(2,-4,-7)$

11. The distance of the point $(2,-4,1)$ from the line is $\frac{x}{2}=\frac{y}{2}=\frac{z}{4}$ is

(a) 5 units (b) $\sqrt{21}$ units (c) 3 units (d) $\sqrt{5}$ units

12. The foot of the perpendicular drawn from the point $A(2,3,-8)$ to the line $\frac{4-x}{2}=\frac{y}{6}=\frac{1-z}{3}$ is

(a) $(2,\ 6,-2)$ (b) $(6,\ 6,-4)$ (c) $(-2,\ 6,\ 2)$ (d) $(2,\ 6,-4)$

13. The lines AB and CD where $A\equiv(0,-1,-1)$, $B\equiv(4,5,1)$, $C\equiv(3,9,4)$ and $D\equiv(-4,4,4)$ are

(a) intersecting (b) parallel (c) skew lines (d) non coplanar

14. The point of intersection of the lines $\vec{r}=a\hat{\imath}$, $\vec{r}=b\hat{\jmath}$ and $\vec{r}=c\hat{k}$ is

(a) $(1,\ 1,\ 0)$ (b) $(0,\ 0,\ 0)$ (c) $(0,\ 1,\ 1)$ (d) $(1,\ 0,\ 1)$

15. If the lines $\frac{x-1}{-3}=\frac{y-2}{2k}=\frac{z-3}{2}$ and $\frac{x-1}{3k}=\frac{y-5}{1}=\frac{z-6}{-5}$ are perpendicular to each other then $k=$

(a) $5/7$ (b) $7/5$ (c) $-7/10$ (d) $-10/7$

16. The shortest distance between the lines

$\vec{r}=6\hat{\imath}+2\hat{\jmath}+2\hat{k}+\lambda(\hat{\imath}-2\hat{\jmath}+2\hat{k})$ and $\vec{r}=-4\hat{\imath}-\hat{k}+\mu(3\hat{\imath}-2\hat{\jmath}-2\hat{k})$ is

(a) 6 (b) 12 (c) 9 (d) 4

17. The image of the point $A(1,\ 6,\ 3)$ in the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$ is

(a) $(-3,\ 6,\ 7)$ (b) $(2,\ 0,\ 4)$ (c) $(1,-3,\ 7)$ (d) $(1,\ 0,\ 7)$

18. The equation of the line parallel to x-axis and passing through the origin, is (here $\lambda\in R$)

(a) $\vec{r}=\lambda(\hat{\jmath}+\hat{k})$ (b) $\vec{r}=\lambda\hat{\jmath}+m\hat{k}$ (c) $\vec{r}=\lambda\hat{\imath}$ (d) $\vec{r}=\lambda\left(\hat{\imath}+\hat{\jmath}+\hat{k}\right)$

19. The vector equation of the line passing through the point $(1,2,-4)$ and perpendicular to the two lines $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ is $\vec{r}=\vec{a}+\lambda\vec{b}$ where $\vec{b}=2\hat{\imath}+p\hat{\jmath}+q\hat{k}$. The value of $p+q=$

(a) 9 (b) 6 (c) 12 (d) 3

20. The coordinates of the point where the line through $(5,1,6)$ and $(3,4,1)$ crosses the YZ plane at A. The sum of the y- and z-coordinates of A is equal to

(a) 2 (b) 10 (c) 5 (d) 4

21. The equation of the plane passing through the line of intersection of the planes $x - 2y + z - 6 = 0$ and $2x - 3y + 6z + 7 = 0$ and perpendicular to the former plane is

(a) $13x + 26y - 25z + 21 = 0$ (b) $13x - 26y - 25z - 21 = 0$

(c) $x + 5y - 11z + 63 = 0$ (d) $x - 5y - 11z - 63 = 0$

22. The foot of the perpendicular from the origin to a plane is $(5,-3,-2)$. The equation of the plane is

(a) $\vec{r}.\left(5\hat{\imath} - 3\hat{\jmath} - 2\hat{k}\right) = 38$ (b) $\vec{r}.\left(5\hat{\imath} - 3\hat{\jmath} - 2\hat{k}\right) = \sqrt{38}$

(c) $\vec{r}.\left(5\hat{\imath} + 3\hat{\jmath} + 2\hat{k}\right) = 38$ (d) $\vec{r}.\left(5\hat{\imath} + 3\hat{\jmath} + 2\hat{k}\right) = \sqrt{38}$

23. The equation of the plane which bisects the line joining the points $A(2,3,4)$ and $B(4,5,8)$ at right angles is

(a) $2x + 2y + 4z = 19$ (b) $x + y + 2z = 19$

(c) $x + y + 2z = 10$ (d) $2x + 2y + 4z = 10$

24. The equation of the plane passing through the line of intersection of the planes $\vec{r}.\vec{a} = p$ and $\vec{r}.\vec{b} = q, p \neq q$, containing the origin is

(a) $\vec{r}.(p\vec{a} - q\vec{b}) = 0$ (b) $\vec{r}.(q\vec{a} - p\vec{b}) = 0$

(c) $\vec{r}.(\vec{a} \times \vec{b}) = 0$ (d) $\vec{r}.(\vec{a} - \vec{b}) = 0$

25. The equation of the plane passing through (a,b,c) and parallel to the plane $\vec{r}.\left(\hat{\imath} + \hat{\jmath} + \hat{k}\right) = 2$ also passes through

(a) $\left(\frac{a+b}{2}, \frac{b+c}{2}, \frac{c+a}{2}\right)$ (b) $\left(\frac{a+b}{3}, \frac{b+c}{3}, \frac{c+a}{3}\right)$

(c) $(a+b,\ b+c,\ c+a)$ (d) $(a-b,\ b-c,\ c-a)$

26. The equation $xy + yz = 0$ represents

(a) coincident planes (b) a pair of non-coincident parallel planes

(c) a pair of planes perpendicular to each other (d) two lines

27. The equation of the plane passing through the point $(1,-1,-1)$ and perpendicular to each of the planes $x - 2y - 8z = 0$ and $2x + 5y - z = 0$ is

(a) $14x - 3y + z = 16$ (b) $4x - 5y + z = 16$

(c) $14x - 5y + 3z = 16$ (d) $7x - 5y + 3z = 8$

28. The distance of the point having position vector $2\hat{\imath} + \hat{\jmath} - \hat{k}$ from the plane $\bar{r}.(\hat{\imath} - 2\hat{\jmath} + 4\hat{k}) = 9$ is

(a) $5/\sqrt{21}$ (b) $9/\sqrt{21}$ (c) $13/\sqrt{21}$ (d) $10/\sqrt{21}$

29. Two systems of rectangular axes have the same origin. If a plane cuts them at distances a, b, c and p, q, r respectively from the origin, then

(a) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{1}{p} + \frac{1}{q} + \frac{1}{r}$ (b) $\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{p^2} + \frac{1}{q^2} + \frac{1}{r^2}$

(c) $\frac{1}{a^2.b^2.c^2} = \frac{1}{p^2.q^2.r^2}$ (d) $a^2 + b^2 + c^2 = p^2 + q^2 + r^2$

30. The equation of the line passing through $(3, 0, 1)$ and parallel to the planes $x + 2y = 0$ and $3y - z = 0$ is

(a) $x - 2y = 3,\ z + 3y = 1$ (b) $2x - y = 6,\ 3z + y = 3$

(c) $x + 2y = 3,\ z - 3y = 1$ (d) $2x + y = 6,\ 3z - y = 3$

31. The image of the point having position vector $\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ about the plane, $\vec{r}.(2\hat{\imath} - \hat{\jmath} + \hat{k}) = -3$ is

(a) $(1, 0, 7)$ (b) $(-3, 1, -2)$ (c) $(-1, 3, -2)$ (d) $(-3, 5, 2)$

32. The angle made by the plane $2x - 3y + 6z - 11 = 0$ with the positive direction of the x-axis is $sin^{-1}\alpha$. Then $\alpha =$

(a) $4/49$ (b) $5/7$ (c) $2/7$ (d) $25/49$

33. With regard to the line $L : \vec{r} = 2\hat{\imath} - 3\hat{\jmath} - \hat{k} + m(\hat{\imath} - \hat{\jmath} + 2\hat{k})$ and the plane $P : \vec{r}.(3\hat{\imath} + \hat{\jmath} - \hat{k}) + 2 = 0$, the conclusion is

(a) L lies in P (b) L is parallel to P but not coincident

(c) L is perpendicular to P (d) L is inclined to P at $45°$

34. With regard to the plane $2x - 3y + 5z + 4 = 0$, which of the following is FALSE?

(a) lengths of the intercepts on the axes are $2, \frac{4}{3}, \frac{4}{5}$

(b) sum of the intercepts on the axes $= -\frac{22}{15}$.

(c) plane passes through $(1, -1, -1)$ (d) plane cuts the positive y-axis.

35. The angle between the planes represented by the combined equation $x^2 + 3xy + 2y^2 = 0$ is

(a) $cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$ (b) $cos^{-1}\left(\frac{2}{\sqrt{5}}\right)$ (c) $cos^{-1}\left(\frac{2}{\sqrt{10}}\right)$ (d) $cos^{-1}\left(\frac{3}{\sqrt{10}}\right)$

36. If the planes $\vec{r}.(2\hat{\imath} + m\hat{\jmath} + \hat{k}) = 3$ and $\vec{r}.(4\hat{\imath} + \hat{\jmath} + n\hat{k}) = 5$ are parallel then $m : n =$

(a) $1 : 4$ (b) $3 : 2$ (c) $4 : 3$ (d) $1 : 1$

Correct options

1.(a)	2.(a)	3.(b)	4.(a)	5.(b)	6.(c)	7.(c)	8.(a)	9.(d)	10.(c)	11.(b)	12.(a)
13.(a)	14.(b)	15.(d)	16.(c)	17.(d)	18.(c)	19.(a)	20.(a)	21.(d)	22.(a)	23.(b)	24.(b)
25.(a)	26.(c)	27.(c)	28.(c)	29.(b)	30.(c)	31.(d)	32.(c)	33.(b)	34.(c)	35.(d)	36.(a)

Unit test

1. The points $P(2,4,6)$, $Q(-2,-2,-2)$ and $R(6,10,14)$ are

(a) collinear (b) vertices of an isosceles triangle

(c) vertices of a right angled triangle (d) vertices of an equilateral triangle

2. The vertices B and C of a ΔABC lie on the line $\frac{x+2}{3} = \frac{y-1}{0} = \frac{z}{4}$ such that $BC = 5$ units. Then the area in sq. units of this triangle, given that the point $A(1,-1,2)$ is

(a) $2\sqrt{34}$ (b) $\sqrt{34}$ (c) 6 (d) $5\sqrt{17}$

3. The distance of the point having position vector $-\hat{\imath} + 2\hat{\jmath} + 6\hat{k}$ from the straight line passing through the point $(2,3,-4)$ and parallel to the vector $6\hat{\imath} + 3\hat{\jmath} - 4\hat{k}$ is

(a) 7 (b) $4\sqrt{3}$ (c) $2\sqrt{13}$ (d) 6

4. If the foot of the perpendicular drawn from the point $(1,0,3)$ on a line passing through $(\alpha, 7, 1)$ is $\left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$ then α is equal to

(a) 2 (b) 4 (c) 5 (d) 7

5. Let ABC be a triangle with vertices at points $A(2,3,5)$, $B(-1,3,2)$ and $C(\lambda, 5, \mu)$ in three dimensional space. If the median through A is equally inclined with the axes, then which of the following is FALSE?

(a) $10\lambda - 7\mu = 0$ (b) $\lambda^3 + \mu^3 + 5 = 1348$

(c) $(\lambda, \mu) \equiv (7,10)$ (d) $\lambda^2 + \mu^2 = 130$

6. The acute angle between the two lines such that the direction cosines l, m, n of each of them satisfy the equation $l + m + n = 0$ and $l^2 + m^2 - n^2 = 0$ is

(a) $15°$ (b) $30°$ (c) $60°$ (d) $45°$

7. A plane meets the coordinate axes at A, B and C. If the centroid of the triangle, ABC is $(4, 3, -1)$ the equation of the plane is

(a) $8x + 6y - 2z = 1$ (b) $4x + 3y - z = 1$

(c) $\frac{x}{4} + \frac{y}{3} + \frac{z}{-1} = 1$ (d) $\frac{x}{12} + \frac{y}{9} + \frac{z}{-3} = 1$

8. If the line drawn from the point $A(-2, -1, -3)$ meets a plane at right angle at the point $B(1, -3, 3)$. The equation of the plane is

(a) $3x - 2y + 6z = 27$ (b) $3x - 2y + 6z = 15$

(c) $3x + 2y + 6z = 15$ (d) $3x + 2y + 6z = 27$

9. The distance between the planes $\vec{r}.(2\hat{\imath} - \hat{\jmath} + 3\hat{k}) = 3$ and $\vec{r}.(-4\hat{\imath} + 2\hat{\jmath} - 6\hat{k}) = 5$ is

(a) $11/\sqrt{56}$ (b) $11/\sqrt{14}$ (c) $11/2\sqrt{56}$ (d) $11/2\sqrt{14}$

10. The distance between the line $\vec{r} = (2\hat{\imath} - \hat{\jmath} + \hat{k}) + m(2\hat{\imath} - \hat{\jmath} + 3\hat{k})$ and the plane $\vec{r}.(\hat{\imath} + 5\hat{\jmath} + \hat{k}) = 3$ is

(a) $11/\sqrt{27}$ (b) $5/\sqrt{27}$ (c) $10/\sqrt{27}$ (d) $2/\sqrt{27}$

11. The foot of the perpendicular drawn from the origin to a plane is the point $(1, -3, 1)$. The intercept cut on the x-axis by the plane, is

(a) 1 (b) 3 (c) $\sqrt{11}$ (d) 11

12. The plane containing the line $\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-3}{3}$ and parallel to the line $\frac{x}{1} = \frac{y}{1} = \frac{z}{4}$ passes through the point

(a) $(1, -2, 5)$ (b) $(1, 0, 5)$ (c) $(0, 3, -5)$ (d) $(-1, -3, 0)$

13. The position vector of a point A in space such that $\overrightarrow{OA}$ is inclined at $60°$ to OX and at $45°$ to OY and $|\overrightarrow{OA}| = 10$ is

(a) $10\left(\frac{1}{2}\hat{\imath} + \frac{1}{\sqrt{2}}\hat{\jmath} \pm \frac{1}{2}\hat{k}\right)$ (b) $10\left(\frac{1}{2}\hat{\imath} + \frac{1}{\sqrt{2}}\hat{\jmath} \pm \frac{1}{\sqrt{2}}\hat{k}\right)$

(c) $10\left(\frac{1}{\sqrt{2}}\hat{\imath} + \frac{1}{\sqrt{2}}\hat{\jmath} \pm \frac{1}{2}\hat{k}\right)$ (d) $10\left(\frac{1}{2}\hat{\imath} \pm \frac{1}{\sqrt{2}}\hat{\jmath} \pm \frac{1}{2}\hat{k}\right)$

Correct options

1.(a) 2.(b) 3.(a) 4.(b) 5.(d) 6.(c) 7.(d) 8.(a) 9.(a) 10.(b) 11.(d) 12.(b) 13.(a)

12. Linear programming

1. Which of the following is TRUE?

(a) The minimum value of a objective function in a linear programming problem occurs at only one corner point of the feasible region.

(b) If the feasible region of a linear programming problem is bounded then the objective function has both maximum and minimum value.

(c) In a linear programming problem the minimum value of the objective function is always zero.

(d) In a linear programming problem the maximum value of the objective function is not necessarily finite.

2. The corner points of the feasible region determined by the system of linear inequalities $2x + y \le 10,\ x + 3y \le 15,\ x \ge 0,\ y \ge 0$ are $(0,0),\ (5,0),\ (3,4)$ and $(0,5)$. Let $z = px + qy$, where $p,\ q > 0$. The condition on p and q so that the maximum of z occurs at both $(3,4)$ and $(0,5)$, is

(a) $5q = p$ (b) $3p = q$ (c) $q = 5p$ (d) $p = 3q$

3. The corner points of the feasible region determined by a system of linear constraints are $(0,10),\ (5,\ 5),\ (15,15)$ and $(0,\ 20)$. If $z = ax + by$ is the objective function and if the maximum occurs at $(15,15)$ and $(0,\ 20)$ then the relation between a and b is

(a) $5b = a$ (b) $3b = a$ (c) $b = 5a$ (d) $b = 3a$

4. The constraints of a LPP are $2x + 5y \ge 35,\ 3x + 4y \ge 42,\ x \ge 0,\ y \ge 0$. The feasible region is

(a) triangular (b) quadrangular (c) pentagonal (d) unbounded

5. If $z = 8x + 3y$ is the profit function of a LPP subject to the constraints $x + y \le 3,\ 4x + y \le 6,\ x \ge 0,\ y \ge 0$ then the profit is maximum at

(a) $(1,2)$ (b) $(0,6)$ (c) $(3,0)$ (d) $(1.5,0)$

6. The objective function of a LPP is $z = 5x - 2y + 60$ and the vertices of the feasible region are $(3,0),\ (4,0),\ (4,3),\ (2,4),\ (0,4)$ and $(0,3)$. The sum of the maximum and minimum values of z is

(a) 132 (b) 28 (c) 134 (d) 30

7. The maximum value of $z = 2x + 3y$ subject to the constraints $x + y \le 4,\ x \ge 0,\ y \ge 0$ is

(a) 17 (b) 13 (c) 16 (d) 12

8. The non-zero minimum value of $z = 6x + 4y$ subject to constraints $2x + y \leq 30,\ x + y \leq 24,\ x \geq 0,\ y \geq 0$ is

(a) 108 (b) 240 (c) 90 (d) 96

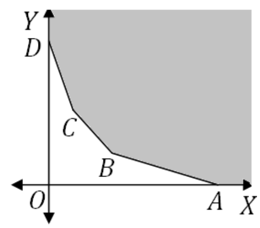
9. The maximum value of $z = 12x + 3y$ subject to the constraints $6x + 5y \leq 30,\ 2x + y \geq 4,\ x + 2y \geq 4,\ x \geq 0,\ y \geq 0$ is

(a) 60 (b) 48 (c) 20 (d) 36

10. The number of corner points corresponding to the minimum value of $z = x + 2y$, subject to the constraints $x + 2y \geq 100,\ 2x - y \leq 0,\ 2x + y \leq 200,\ x \geq 0,\ y \geq 0$ is

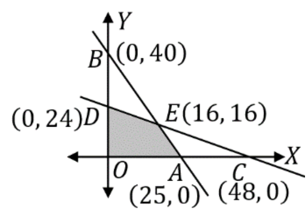
(a) 2 (b) 1 (c) 4 (d) infinite

11. By using all the constraints for the minimization of the objective function $z = 3x + 2y$, we got an unbounded feasible region in the first quadrant with the corner points $A(12, 0)$, $B(4, 2)$, $C(1, 5)$ and $D(0, 10)$. The minimum value of z is



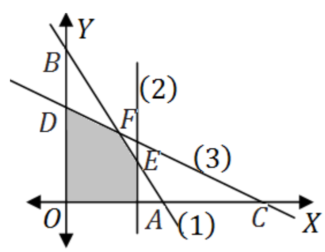
(a) 17 (b) 13 (c) 16 (d) 12

12. The shaded region in the adjacent graph shows the feasible region for the objective function $z = 4x + 3y$. The number of points where the maximum is attained is



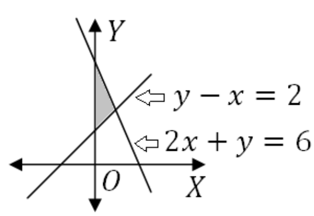
(a) 1 (b) 3 (c) 0 (d) infinite

13. The shaded region in the adjacent graph shows the feasible region for the objective function $z = 7.5x + 5y$ with the corner points $O(0, 0)$, $A(20, 0)$, $E(20, 20)$, $F(15, 30)$ and $D(0, 40)$. The maximum of z is



(a) 213.5 (b) 102.5 (c) 137.5 (d) 262.5

14. The shaded region in the adjacent diagram is the feasible region for a LPP. This is represented by



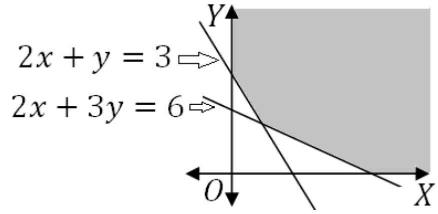
(a) $2x + y \geq 6,\ x - y \geq -2,\ x \geq 0,\ y \geq 0$

(b) $2x + y \geq 6,\ x - y \leq -2,\ x \geq 0,\ y \geq 0$

(c) $2x + y \leq 6,\ x - y \leq -2,\ x \geq 0,\ y \geq 0$

(d) $2x + y \leq 6,\ x - y \geq -2,\ x \geq 0,\ y \geq 0$

15. The shaded region in the adjacent diagram is the feasible region for a LPP. This is represented by



(a) $2x + y \geq 3,\ 2x + 3y\ \geq 6, x \geq 0,\ y \geq 0$

(b) $2x + y \leq 3,\ 2x + 3y\ \geq 6, x \geq 0,\ y \geq 0$

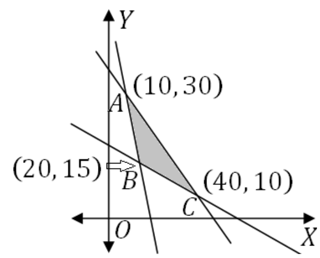
(c) $2x + y \geq 3,\ 2x + 3y\ \leq 6, x \geq 0,\ y \geq 0$

(d) $2x + y \leq 3,\ 2x + 3y\ \leq 6, x \geq 0,\ y \geq 0$

16. The number of corner points of the feasible region of a LPP whose constraints are $2x + y \leq 5,\ x + 2y \leq 4,\ x + y \leq 5,\ x \geq 0,\ y \geq 0$ is

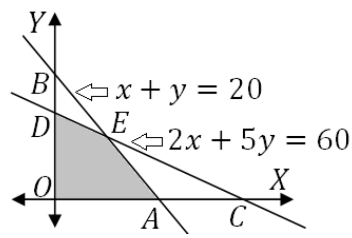
(a) 3 (b) 7 (c) 5 (d) 4

17. The objective function of a LPP is $z = 6x + 3y$ and the feasibility region of the LPP is the shaded region in the adjacent diagram. The feasible maximum value is



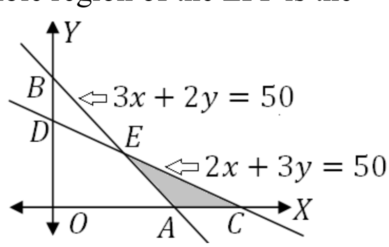
(a) 320 (b) 240 (c) 270 (d) 210

18. The objective function of a LPP is $z = 2x + y$ and the feasible region of the LPP is the shaded region in the adjacent diagram. The feasible non-zero minimum value of z is



(a) $100/3$ (b) 40 (c) 12 (d) 35

19. The objective function of a LPP is $z = 5x + y$ and the feasible region of the LPP is the shaded region in the adjacent diagram. The feasible minimum value of z is



(a) $250/3$ (b) 125 (c) 90 (d) 60

20. A diet program is to contain atleast 60 units of vitamin A and 90 units of vitamin B. Two food products f_1 and f_2 are available in the market. Product f_1 costs ₹100 per unit and product f_2 costs ₹120 per unit. One unit of product f_1 contains 2 units of vitamin A and 5 units of vitamin B while one unit of product f_2 contains 4 units of vitamin A and 3 units of vitamin B. It is required to find minimum cost for the diet program that includes a combination of these foods and also minimum requirements of the vitamins. The linear programing problem can be represented as {Here x is the number of units of food f_1, y is the number of units of food f_2 and C is the cost.}

(a) $C = 100x + 120y,\ 2x + 4y \geq 60,\ 5x + 3y \geq 90,\ x \geq 0,\ y \geq 0$

(b) $C = 60x + 90y,\ 2x + 4y \geq 100,\ 5x + 3y \geq 120,\ x \geq 0,\ y \geq 0$

(c) $C = 100x + 120y,\ 2x + 4y \geq 100,\ 5x + 3y \geq 120,\ x \geq 0,\ y \geq 0$

(d) $C = 60x + 90y,\ 2x + 4y \geq 60,\ 5x + 3y \geq 90,\ x \geq 0,\ y \geq 0$

21. An aero plane can carry a maximum of 200 passengers. A profit of ₹1000 is made on each executive class ticket and a profit of ₹600 is made on each economy class ticket. The airline reserves atleast 20 seats for executive class. However, atleast 4 times as many passengers prefer to travel by economy class than by the executive class. If x and y be the number of executive class and economy class tickets to be sold to get maximum profit z in rupees then $x + y + z =$

(a) 136240 (b) 126200 (c) 136200 (d) 126240

Correct options

1.(b) 2.(b) 3.(d) 4.(d) 5.(a) 6.(a) 7.(d) 8.(c) 9.(a) 10.(a) 11.(b) 12.(a)
13.(d) 14.(c) 15.(a) 16.(d) 17.(c) 18.(c) 19.(d) 20.(a) 21.(c)

Unit test

1. The optimal value of a linear objective function in x and y subject to the linear constraints occurs at

(a) the intersection of the feasible region with the axis of x and y.

(b) the intersection of the boundary of the feasible region with the axis of x and y.

(c) the corner points of the feasible region

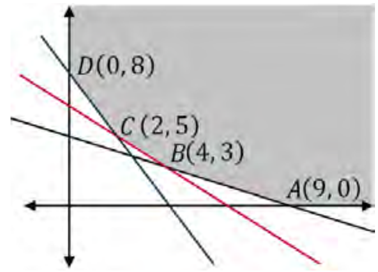
(d) each point of the boundary of the feasible region

2. The maximum value of $z = ax + by,\ a > b > 0$, subject to the constraints $x + y \leq a,\ x \geq 0,\ y \geq 0$ is

(a) a^2 (b) ab (c) b^2 (d) $a + b$

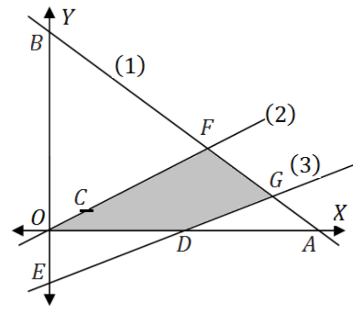
3. The feasible region for an LPP is as shown in the adjacent diagram. The minimum value of $z = 4x + 3y$ is

(a) 27 (b) 23 (c) 26 (d) 32



4. The adjacent diagram shows the feasible region for a LPP with the corner points $O(0,0)$, $D(600,0)$, $G(1050,150)$ and $F(800,400)$. The sum of the maximum and the non-zero minimum value of the objective function $z = 12x + 16y$ is

(a) 23200 (b) 18900 (c) 14500 (d) 25600



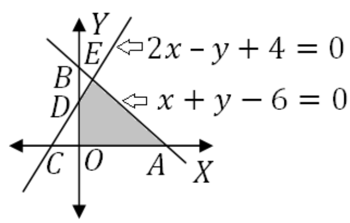
5. The shaded region in the adjacent diagram is the feasible region for a LPP. This is represented by

(a) $2x - y + 4 \geq 0,\ y \geq 6 - x, x \geq 0,\ y \geq 0$

(b) $2x - y + 4 \leq 0,\ y \leq 6 - x, x \geq 0,\ y \geq 0$

(c) $2x - y + 4 \geq 0,\ y \leq 6 - x, x \geq 0,\ y \geq 0$

(d) $2x - y + 4 \leq 0,\ y \geq 6 - x, x \geq 0,\ y \geq 0$



6. The number of corner points of the feasible region of a LPP whose constraints are $x + y \geq 1,\ 2x + y \leq 4,\ x + 2y \leq 5,\ x \geq 0,\ y \geq 0$ is

(a) 3 (b) 6 (c) 5 (d) 4

7. An entrepreneur wants to invest up to an amount of ₹50000 in two types of bonds namely bond A and bond B. Bond A yields 10% return on the invested amount and bond B yields 15% return on the invested amount. The entrepreneur decides to invest atleast ₹15000 on bond A and not more than ₹25000 in bond B. The entrepreneur wants to maximize the profit. The corner points of the feasible region corresponding to the above are $A(5 \times k, 0)$,

$C(2.5 \times k, 0)$, $E(1.5 \times k, 2.5 \times k)$, $F(2.5 \times k, 2.5 \times k)$. The value of k is

(a) 20000 (b) 1000 (c) 10000 (d) 2000

Correct options

1.(c) 2.(a) 3.(b) 4.(a) 5.(c) 6.(c) 7.(c)

13. PROBABILITY

1. If $P(A) = \frac{7}{13}$, $P(B) = \frac{9}{13}$ and $P(A \cap B) = \frac{4}{13}$ then $P(A'|B) =$

(a) $2/9$ (b) $5/9$ (c) $5/13$ (d) $1/5$

2. Three events A, B and C have probabilities $\frac{2}{5}, \frac{1}{3}$ and $\frac{1}{2}$ respectively. If $P(A \cap C) = \frac{1}{5}$ and $P(B \cap C) = \frac{1}{4}$ then which of the following is NOT TRUE?

(a) $P(C|B) = \frac{3}{4}$ (b) $P(A' \cap C') = \frac{3}{10}$ (c) $P(B|C) = \frac{1}{2}$ (d) $P(A' \cup C') = \frac{1}{5}$

3. For two mutually exclusive events A and B, $P(A) = 0.2$ and $P(\bar{A} \cap B) = 0.3$. The value of $P\big(A\big|(A \cup B)\big)$ is

(a) $2/5$ (b) $3/5$ (c) $1/5$ (d) $4/5$

4. Two dice are thrown. If it is known that the sum of the numbers on the dice was less than 6 the probability of getting a sum 3 is

(a) $7/10$ (b) $4/5$ (c) $3/10$ (d) $1/5$

5. A shop keeper sells 3 types of flower seeds, A_1, A_2 and A_3. They are sold as a mixture where the proportions are $4 : 4 : 2$ respectively. The germination rates of the 3 types of seeds are 45%, 60% and 35% respectively. The probability that it will not germinate given that the seed is of type A_3, is

(a) 0.49 (b) 0.65 (c) 0.35 (d) 0.51

6. A committee of 4 students is selected at random from a group consisting 8 boys and 4 girls. Given that there is at least one girl in the committee, the probability that there are exactly 2 girls in the committee is

(a) $13/42$ (b) $211/532$ (c) $18/43$ (d) $168/425$

7. If each element of a second order determinant is either zero or one, the probability that the value of the determinant is positive, is (Assume that the individual entries of the determinant are chosen independently, each value being assumed with probability $1/2$)

(a) $5/16$ (b) $3/16$ (c) $1/16$ (d) $7/16$

8. If $P(A) = \frac{2}{5}$, $P(B) = \frac{3}{10}$ and $P(A \cap B) = \frac{1}{5}$ then $P(A'|B').P(B'|A') =$

(a) $2/35$ (b) $5/21$ (c) $25/42$ (d) $10/21$

9. For a loaded die which is tossed twice, the probabilities of outcomes are given as under.
$P(1) = P(2) = 0.2,\ P(3) = P(5) = P(6) = 0.1$ and $P(4) = 0.3$.
Let A and B be the events 'same number each time' and 'a total score is 10 or more'. Then
(a) A and B are independent (b) A and B are mutually exclusive
(c) A and B are impossible events (d) A and B are exhaustive events

10. If A and B are independent events such that $P(A) = p,\ P(B) = 2p$ and $P(\text{exactly one of } A \text{ or } B) = \frac{5}{9}$, then the sum of the possible values of p is equal to
(a) $3/4$ (b) $3/8$ (c) $5/12$ (d) $1/12$

11. Three persons A, B and C fire at a target in turn, starting with A. Their probabilities of hitting the target are 0.4, 0.3 and 0.2 respectively. The probability of two hits is
(a) 0.704 (b) 0.296 (c) 0.188 (d) 0.812

12. If E_1 and E_2 are two independent events such that $P(E_1) = p_1$ and $P(E_2) = p_2$. Then which of the following statement explains the probability $1 - (1 - p_1)(1 - p_2)$?
(a) probability of simultaneous occurrence of E_1 and E_2
(b) probability of non-occurrence of E_1 and occurrence of E_2
(c) probability of occurrence of atleast one of E_1 and E_2
(d) probability of occurrence of exactly one of E_1 and E_2

13. A salesman of a shop has a 70% chance to sell a product to any customer. The behaviour of successive customers is independent. If two customers A and B enter the shop, the probability that the salesman will sell the product to customer A or B is
(a) 0.92 (b) 0.83 (c) 0.89 (d) 0.91

14. A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement, the probability of getting exactly one red ball, is
(a) $3/8$ (b) $15/56$ (c) $2/7$ (d) $7/56$

15. In an examination there are 3 multiple choice questions and each question has 4 choices of which only one choice is the correct answer. If a student randomly selects an answer for all the three questions, the probability that the answers given by the student are not all correct, is
(a) $1/64$ (b) $63/64$ (c) $1/12$ (d) $11/12$

16. The probability of a shooter hitting a target is $3/4$. The minimum number of times must the shooter fire so that the probability of hitting the target at least once is more than 0.99, is
(a) 2 (b) 4 (c) 5 (d) 6

17. A fair coin is tossed repeatedly. The probability of getting a result in the fifth toss different from those obtained in the first four tosses, is

(a) $1/32$ (b) $1/16$ (c) $1/64$ (d) $1/8$

18. Bag I contains 3 black and 2 white balls, bag II contains 2 black and 4 white balls. A bag and a ball is selected at random. The probability of selecting a black ball is

(a) $11/30$ (b) $13/30$ (c) $6/15$ (d) $7/15$

19. A bag contains $(2n + 1)$ coins. It is known that n of these coins have a head on both sides whereas the rest of the coins are fair. A coin is picked up at random from the bag and is tossed. The probability that the toss results in a head is $\frac{31}{42}$. The value of n is

(a) 12 (b) 21 (c) 10 (d) 24

20. Three groups of children, group one contain 3 girls and one boy, group two contain 2 girls and 2 boys and group three contain one girl and 3 boys. One child is selected at random from each group. The probability that the group of selected children contain one girl and 2 boys, is

(a) $19/32$ (b) $15/32$ (c) $17/32$ (d) $13/32$

21. Suppose that you have two coins which appear identical in your pocket. You know that one is fair and one is fake which is 2 headed. If you take out one coin, toss it and get a head, the probability that it was a fair coin is

(a) $1/2$ (b) $1/5$ (c) $1/4$ (d) $1/3$

22. If a machine is correctly set up, it produces 90% acceptable items. If it is incorrectly set up it produces only 40% acceptable items. Past experience shows that 80% of the set ups are correctly done. If after a certain set up, the machine produces 2 acceptable items then the probability that the machine is correctly set up, is

(a) $81/95$ (b) $81/89$ (c) $81/85$ (d) $72/85$

23. Suppose that 6% of the people with blood group O are left handed and 10% of those with other blood groups are left handed. 30% of the people have blood group O. If a left handed person is selected at random, the probability that he will have blood group O is

(a) $18/87$ (b) $9/44$ (c) $9/88$ (d) $7/44$

24. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probabilities of an accident involving a scooter driver, a car driver and a truck driver are $0.01,\ 0.03$ and 0.15 respectively. One of the insured person meets with an accident. The probability that the person is a scooter driver, is

(a) $1/26$ (b) $1/13$ (c) $1/104$ (d) $1/52$

25. A shop keeper sells 3 types of flower seeds, $A_1,\ A_2$ and A_3. They are sold as a mixture where the proportions are $4 : 4 : 2$ respectively. The germination rates of the 3 types of seeds are $45\%,\ 60\%$ and 35% respectively. The probability that a randomly chosen seed germinates, is

(a) 0.49 (b) 0.78 (c) 0.37 (d) 0.47

26. Suppose that 5% of men and 0.25% of women have grey hair. A grey haired person is selected at random. The probability of this person being male is (Assume that there are equal number of males and females)

(a) $5/21$ (b) $10/21$ (c) $20/21$ (d) $16/21$

27. A discrete random variable X has the following probability distribution. Then the mean of the distribution is

X	0.5	1	1.5	2
$P(X)$	k	k^2	$2k^2$	k

(a) 6 (b) $23/18$

(c) 1 (d) $7/9$

28. In a dice game, a player pays a stake of ₹1 for each throw of a die. He receives ₹5 if the die shows a 3, ₹2 if the die shows a 1 or a 6 and nothing otherwise. The player's expected profit per throw over a long series of throws is

(a) 0.25 (b) 0.75 (c) 0.50 (d4) 1.5

29. Let X be a random variable whose probability distribution is defined as follows.

$$P(X) = \begin{cases} kx^2 & \text{for } x = 1,2,3 \\ 2kx & \text{for } x = 4,5,6. \\ 0 & \text{otherwise} \end{cases}$$ The expectation $E(X)$ is

(a) $95/22$ (b) $95/11$ (c) $190/22$ (d) $190/11$

30. For the following probability distribution of a random variable X, the variance of $X/2$ is (a) 0.543215 (b) 0.361875

(c) 0.257645 (d) 0.156835

X	0	1	2	3	4
$P(X)$	0.1	0.25	0.3	0.2	0.15

31. For the following probability distribution of a random variable X, the standard deviation is (a) 0.71 (b) 0.6 (c) 0.61 (d) 0.7

X	2	3	4
$P(X)$	0.2	0.5	0.3

32. The standard deviation of the number of heads when three coins are tossed simultaneously is

(a) $\sqrt{0.75}$ (b) $5\sqrt{0.3}$ (c) $\sqrt{0.25}$ (d) $0.5\sqrt{0.3}$

33. A die is thrown three times. Let X be the event 'the number of two's show'. The expectation is

(a) 0.25 (b) 0.75 (c) 1 (d) 0.5

34. The probability of guessing correctly at least 8 out of 10 on a true-false type examination is

(a) $7/1024$ (b) $7/128$ (c) $7/512$ (d) $7/256$

35. The probability that a person is not a swimmer is 0.03. The probability that out of 5 persons 4 are swimmers, is

(a) $5.(0.97)^3$ (b) $0.3.(0.97)^4$ (c) $0.15.(0.97)^4$ (d) $0.15.(0.97)^3$

36. The probability of a man hitting a target is 0.25. He shoots 7 times. The probability of his hitting at least twice is

(a) $1-\frac{3^6.5}{2^7}$ (b) $1-\frac{3^6.5}{2^{13}}$ (c) $1-\frac{3^6.5}{4^7}$ (d) $1-\frac{3^6.5}{4^{13}}$

37. There is 25% chance that it rains on any particular day. The probability that there is atleast one rainy day within a period of 7 days, is

(a) $(1/4)^7$ (b) $1-(3/4)^7$ (c) $1-(1/4)^7$ (d) $(3/4)^7$

38. An urn contains 25 balls of which 10 balls bear a mark X and the remaining 15 bear a mark Y. A ball is drawn at random from the urn, its mark is noted down and it is replaced. If 6 balls are drawn in this way, the probability that (i) all will bear X mark is $(1/5)^6$,

(ii) atleast one ball will bear Y mark is $1-\left(\frac{2}{5}\right)^6$. Then

(a) only (i) is true (b) only (ii) is true

(c) both (i) and (ii) are true (d) neither (i) nor (ii) is true

Correct options

1.(b) 2.(d) 3.(a) 4.(d) 5.(b) 6.(d) 7.(b) 8.(c) 9.(a) 10.(a) 11.(c) 12.(c)
13.(d) 14.(b) 15.(b) 16.(b) 17.(b) 18.(d) 19.(c) 20.(d) 21.(d) 22.(c) 23.(b) 24.(d)

25.(a) 26.(c) 27.(b) 28.(c) 29.(a) 30.(b) 31.(d) 32.(a) 33.(d) 34.(b) 35.(c) 36.(b) 37.(b) 38.(c)

Unit test

1. If A and B are two events such that $2P(A) = 3P(B)$, then

(a) $P(A|B) < P(B|A) < P(A \cap B)$ (b) $P(B|A) < P(A|B) < P(A \cap B)$

(c) $P(A \cap B) < P(A|B) < P(B|A)$ (d) $P(A \cap B) < P(B|A) < P(A|B)$

2. In a college 30% students fail in physics, 25% fail in mathematics and 10% fail in both physics and mathematics. One student is selected at random. The probability that he failed in physics if he failed in mathematics is

(a) $1/5$ (b) $4/5$ (c) $1/30$ (d) $2/5$

3. A bag contains 4 white and 2 black balls and another bag contains 3 white and 5 black balls. If one ball is drawn from each bag then the probability that one ball is white and one ball is black is

(a) $15/48$ (b) $11/24$ (c) $13/24$ (d) $17/48$

4. Persons A and B throw a die alternately till one of them gets a 6 and wins the game. If A begins the game, the respective probabilities of winning, are

(a) $7/11,\ 4/11$ (b) $6/11,\ 5/11$ (c) $1/11,\ 10/11$ (d) $8/11,\ 3/11$

5. Let A and B be two independent events such that $P(A) = \frac{1}{5}$, $P(A \cup B) = \frac{7}{10}$. Then $P(\bar{B}) =$

(a) $3/4$ (b) $5/8$ (c) $2/5$ (d) $3/8$

6. Bag I contains 3 red and 4 black balls and bag II contains 4 red and 5 black balls. One ball is transferred from bag I to bag II and then a ball is drawn from bag II. The ball so drawn is found to be red in colour. The probability that the transferred ball is black, is

(a) $15/31$ (b) $14/29$ (c) $16/31$ (d) $15/29$

7. A letter is known to come from either TATANAGAR or from CALCUTTA. On the envelope, just two consecutive letters TA are visible. The probability that the letter came from TATANAGAR is

(a) $3/28$ (b) $7/11$ (c) $4/7$ (d) $8/13$

8. An item is manufactured by 3 machines A, B and C. Out of the total number of items manufactured during a specific period, 50% are manufactured on A, 30% on B and 20% on C. Also 2% of the items produced on A, 2% produced on B and 3% produced on C

are defective. All the items are stored at one godown. One item is drawn at random and is found to be defective. The probability that it was manufactured on machine A is

(a) $6/11$ (b) $5/11$ (c) $7/21$ (d) $11/21$

9. A discrete random variable X has the following probability distribution. The mean of the distribution is

X	1	2	3	4	5	6	7
$P(X)$	C	$2C$	$2C$	$3C$	C^2	$2C^2$	$7C^2 + C$

(a) 4.32 (b) 4.92
(c) 3.96 (d) 3.66

10. The probability distribution of a random variable X is given in the following. Which of the following is TRUE?

X	0	1	2	3
$P(X)$	k	$k/2$	$k/4$	$k/8$

(a) $P(X \leq 2) = 11/15$ (b) $P(X > 2) = 1/15$
(c) $P(X \leq 2) = 8/15$ (d) $P(X > 2) = 4/15$

11. If X follows binomial distribution with parameters $n = 5$ and the probability of success p and if $P(X = 2) = 9P(X = 3)$ then $p =$

(a) $1/10$ (b) $9/10$ (c) $7/10$ (d) $3/10$

12. An experiment succeeds twice as often as it fails. The probability that in the next six trials, there will be atleast 4 successes, is

(a) $238/729$ (b) $248/729$ (c) $496/729$ (d) $476/729$

13. A card is drawn from a pack. The card is replaced and the pack is reshuffled. If this is done six times then the probability that 2 hearts, 2 diamonds and 2 black cards are drawn is

(a) $90\left(\frac{1}{2}\right)^{10}$ (b) $\left(\frac{1}{2}\right)^{10}$ (c) $6\left(\frac{1}{2}\right)^{10}$ (d) $6\left(\frac{1}{4}\right)^{10}$

14. The minimum number of times a man must toss a fair coin so that the probability of having atleast one head is more than 90%, is

(a) 1 (b) 2 (c) 3 (d) 4

Correct options

1.(c) 2.(d) 3.(c) 4.(b) 5.(d) 6.(c) 7.(b) 8.(b) 9.(d) 10.(b) 11.(a) 12.(c) 13.(a) 14.(d)

BIOLOGY

Brief Profile of the Author:

Prof. LAKSHMI MURTHY

A senior biology teacher, teacher trainer and adolescent counsellor with over 27 years' experience. Currently the Academic Head of BASE Educational Services - Mysore branch, and Biology faculty at BASE Educational Services.

Education:

- BSc in Chemistry, Botany & Zoology from RLS Institute, Belgaum
- MSc(Botany) with specialisation in Biotechnology & Tissue Culture from Karnatak University, Dharwad
- BEd in English and Science from ICFAI
- Certificate in Counselling Skills from Prasanna Counseling Centre & NIMHANS.
- Certificate in Genes – Development to Behaviour from University of Maryland.

Work Recognition:

- Received personal commendation letters from Ministry of HRD, Government of India for contribution to education.
- Received the Best Biology Teacher Award from the Indian Brain Bee Organisation
- Received the Reliance Foundation Award for my contributions to Biology teaching
- Secured the 1st Rank for Senior School Biology in the Teacher's Professional Olympiad (TPO) for 2018, 2019, 2020 and 2023 at the All India + UAE level.

Work Experience:

- Have been training NEET-UG aspirants and KCET aspirants at BASE Educational Services since 2016.
- Taught Biology for Secondary School and Senior School as a Senior Faculty at National Public Schools, Indiranagar & Rajajinagar from May 2000 to October 2015.
- Taught Middle School Chemistry and Biology at Phoenix School, Belgaum.

Prof. Lakshmi Murthy
Academic Head of BASE Educational Services - Mysore branch
Mobile : 99006 98091

Biology Syllabus Competitive Exams Topics of 1st and 2nd PUC

SECTION B : 2nd PUC SYLLABUS

1st PU

The Living World

1. Among the following which is the common phenomenon exhibited by living organisms and non-living objects to show the feature of growth?

   (A) Increase in mass (B) Rapid cell division

   (C) Increase in respiration (D) Higher cell differentiation

   Ans (A)

2. True regeneration is found in
   (A) *Amoeba* (B) *Hydra* (C) *Planaria* (D) *Cuscuta*

   Ans (C)

3. Select the correct option from the following statements:

   (A) Mules can reproduce

   (B) Worker bee undergoes reproduction to generate new progeny

   (C) Mule and worker bee reproduce

   (D) Mule and worker bee do not reproduce

   Ans (D)

4. Metabolism can be best defined as

   (A) the process in which a chemical is formed inside a body

   (B) the process in which a chemical is destroyed inside a body

   (C) the sum total of all chemical reactions occurring in a body

   (D) a complex construction process only

   Ans (C)

5. Who wrote the book *Systema Naturae*?

   (A) Ernst Mayr (B) Carolus Linnaeus

   (C) RH Whittaker (D) WM Stanley

   Ans (B)

6. Binomial nomenclature means
   (A) a scientific name, which consist of two words - generic name and specific name
   (B) one name given by two scientists
   (C) two names, one vernacular and one scientific
   (D) two names, one in Latin and the other of a person
   Ans (A)
7. Which is a correctly printed scientific name?
   (A) *Panthera Tigris* (B) *Mangifera indica*
   (C) <u>Panthera Leo</u> (D) <u>TRITICUM aestivum</u>
   Ans (B)
8. Which of the following is in taxonomic hierarchy?
   (A) Kingdom—Order—Species—Genus—Class— Family—Phylum
   (B) Kingdom—Family—Genus—Species—Class— Phylum—Order
   (C) Species—Phylum—Order— Genus—Class—Family—Kingdom
   (D) Species—Genus—Family—Order—Class— Phylum—Kingdom
   Ans (D)
9. ICBN stands for
   (A) Indian Congress of Biological Names
   (B) International Code for Botanical Nomenclature
   (C) International Congress of Biological Names
   (D) Indian Code of Botanical Nomenclature
   Ans (B)
10. A place where dried, pressed and preserved plant specimens are kept is called
   (A) Herbarium (B) Museum
   (C) Botanical garden (D) Both (A) and (C)
   Ans (A)

11. Which taxonomical aid provide all information about a particular taxon like order or family?

(A) Herbarium (B) Catalogue

(C) Taxonomic key (D) Monograph

Ans (D)

12. Match the following columns and choose the correct match:

Column – I		Column – II	
(i)	Herbarium	(P)	Preserved plant and animal specimens
(ii)	Botanical Garden	(Q)	Living wild animals under human protection
(iii)	Zoological Park	(R)	Preserved plant specimens
(iv)	Museum	(S)	Diversity of living plants

(A) (i) → (R), (ii) → (S), (iii) → (Q), (iv) → (P)

(B) (i) → (P), (ii) → (S), (iii) → (Q), (iv) → (R)

(C) (i) → (S), (ii) → (R), (iii) → (P), (iv) → (Q)

(D) (i) → (S), (ii) → (P), (iii) → (Q), (iv) → (R)

Ans (A)

13. Which of the following taxonomic categories includes all the others?

(A) Family (B) Order (C) Genus (D) Species

Ans (B)

14. The housefly belongs to the family

(A) Diptera (B) Muscidae (C) Insecta (D)Arthropoda

Ans (B)

15. Which of the following groups consist of organisms which multiply by fragmentation?

(A) Earthworm, *Amoeba*, fungi (B) Earthworm, fungi, bacteria

(C) Fungi, filamentous algae; protonema of mosses

(D) *Amoeba, Hydra*, bacteria

Ans (C)

16. Which of these is not the aim of systematics?
(A) To identify organisms (B) To classify organisms
(C) To improve organisms (D) To name organisms
Ans (C)

17. The number of species that are described by scientists so far, ranges between
(A) 1.7 – 1.8 thousand. (B) 1.7 – 1.8 million.
(C) 17 – 18 thousand. (D) 17 – 18 million.
Ans (B)

18. Match the following items regarding biological classification of potato species and choose the correct option:

Column I		Column II	
A	Family	(i)	*tuberosum*
B	Kingdom	(ii)	Polemoniales
C	Order	(iii)	*Solanum*
D	Species	(iv)	Plantae
E	Genus	(v)	Solanaceae

(A) A = iv, B = v, C = i, D = iii, E = ii
(B) A = iii, B = i, C = iv, D = ii, E = v
(C) A = i, B = iv, C = iii, D = ii, E = v
(D) A = v, B = iv, C = ii, D = i, E = iii
Ans (D)

19. *Homo* and *Panthera* are names of
(A) genus and species (B) genus and genus
(C) species and species (D) only species
Ans (B)

20. The scientific *name* of banyan is written as *Ficus bengalensis* L. Which of the following statements is correct regarding this?

(A) Letter L signifies Latin language.

(B) The name should be written reverse with *bengalensis* preceding *Ficus*.

(C) Letter L signifies the taxonomist Linnaeus.

(D) *bengalensis* is generic name.

Ans (C)

21. The two lead sentences used together in an identification key are referred to together as

(A) Couplet (B) Sonnet (C) Doublet (D) Diploid

Ans (A)

22. A naturalist has discovered a new species of sharks. Which code does she have to follow to give a biological name to the organism?

(A) International Code of Biological Naming

(B) International Code of Botanical Nomenclature

(C) International Code of Zoological Nomenclature

(D) International Council for Biological Nomenclature.

Ans (C)

23. The primary aim of botanical gardens is
(A) To beautify a dry piece of land
(B) To grow plants for commercial use
(C) To educate the public on plant varieties and their systematics
(D) To calculate the rate of plant growth
Ans (C)

24. **Statement 1:** Plants grow definitely in their life only till they reach reproductive maturity.
Statement 2: Animals grow only upto a certain age and absolutely no cell division occurs in them later.

(A) Both statements 1 and 2 are correct

(B) Both statements 1 and 2 are incorrect

(C) Statement 1 is correct and statement 2 is incorrect.

(D) Statement 1 is incorrect and statement 2 is correct.

Ans (B)

25. Plants respond to external factors like
    (A) Light and water
    (B) Light, water and temperature
    (C) Water, light, temperature, other living organisms, pollutants
    (D) Temperature, water, light and pollutants
    Ans (C)

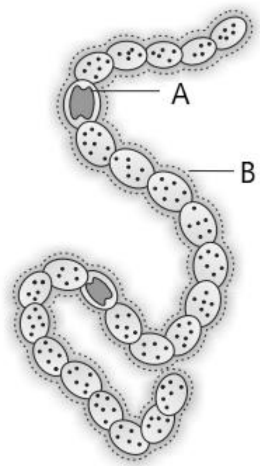
****

1st PU

Biological Classification

1. Given figure is of filamentous blue green alga *Nostoc*. Identify the parts marked as A and B and select the correct option.

	A	B
(A)	Heterocyst	Mucilaginous sheath
(B)	Vegetative cell	Mucilaginous sheath
(C)	Trichomes	Cell wall
(D)	Mucilaginous sheath	Heterocyst



Ans (A)

2. In 5-kingdom classification system, the kingdom that includes the blue-green algae, nitrogen-fixing bacteria and methanogenic archaebacteria is

   (A) Plantae (B) Fungi (C) Protista (D) Monera.

   Ans (D)

3. Chemosynthetic bacteria are those bacteria

   (A) Which carry out photosynthesis

   (B) Which synthesize food without light

   (C) Which are unable to carry out chemical reactions

   (D) Which carry out photosynthesis in absence of light

Ans (B)

4. A bacterial cell undergoes binary fission every twenty minutes. Starting with a single bacterium, how many bacteria will be produced at the end of 3 hours?

(A) 128 (B) 256 (C) 512 (D) 1022

Ans (C)

5. *Nostoc* is known to perform

(A) Only photosynthesis

(B) Photosynthesis and nitrogen fixation simultaneously

(C) Only nitrogen fixation

(D) Either photosynthesis or nitrogen fixation at a time

Ans (B)

6. Under favourable conditions, bacteria prefer which method of reproduction:

(A) Parasexual conjugation (B) Mitosis

(C) Binary fission (D) Gamete fusion

Ans (C)

7. Methanogens can be best described as
(A) Unicellular, eukaryotic, methane producing cyanobcteria
(B) Prokaryotic, methane producing archebacteria
(C) Unicellular, photosynthetic, eukaryotic archebacteria
(D) Methane producing, halophilic eukaryotes.
Ans (B)

8. Which of the following are bacterial diseases?

i) Citrus canker (ii) Cholera (iii) Anthrax
ii) nCOVID 19

(A) i and ii
(B) i, ii and iv
(C) ii, iii and iv
(D) i, ii and iii
Ans (D)

9. Mycoplasmas differ from other Monerans in not having

(A) Genetic material
(B) Cytoplasm
(C) Cell wall
(D) Metabolic activities
Ans (C)

10. Which of these methods of nutrition is not exhibited by Kingdom Monera?

(A) Chemotrophic (B) Holozoic
(C) Saprophytic (D) Parasitic
Ans (B)

11. The cell wall of fungi is made up of
(A) Chitin (B) Cellulose (C) Pectin (D) Suberin

Ans (A)

12. The fungus which grows on dung is called

(A) Humicolous (B) Lignicolous (C) Coprophilous

(D) Fungicolous

Ans (C)

13. Litmus is obtained from a

(A) Lichen (B) Alga (C) Fungus (D) Protozoan

Ans (A)

14. Which is not a locomotory organ seen in Protozoa?

(A) Cilia (B) Flagella (C) Pseudopodia (D) Parapodia

Ans (D)

15. *Amoeba* is a member of Phylum

(A) Porifera (B) Protozoa (C) Annelida (D) Mollusca

Ans (B)

16. Red oceanic tides can be due to

(A) Diatoms (B) Dinoflagellates (C) Red algae

(D)Blue-green algae

Ans (B)

17. Slime moulds belong to

(A) Fungi (B) Protista (C) Monera (D) Plantae

Ans (B)

18. Diatom cell wall is made of

(A) Silica (B) Lime (C) Magnesium carbonate

(D) Any of the above

Ans (A)

19. *Entamoeba* is an example for

(A) Amoeboid Protozoans (B) Flagellated protozoans

(C) Ciliated Protozoans (D) Sporozoans

Ans (A)

20. Potato spindle tuber disease is caused by a

(A) Prion (B) Viroid (C) Virus (D) Bacteria

Ans (B)

21. The fungus used in genetic experiments is

(A) *Rhizopus* (B) *Mucor* (C) *Neurospora*

(D) *Claviceps*

Ans (C)

22. Asexual spores produced by Phycomycetes are

(A) Zygospores (B) Hyphae (C) Sporangiophores

(D) Condiospores

Ans (C)

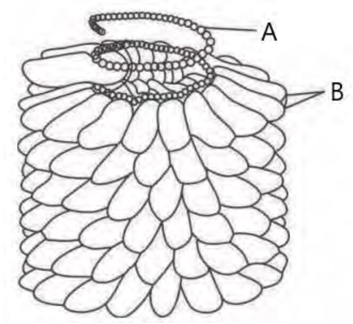
23. Mycelium of *Mucor* or *Rhizopus* is

(A) Aseptate and unicellular (B) Septate and unicellular

(C) Septate and multicellular (D) Coenocytic

Ans (D)

24. Study the given figure of structure of TMV and select the option that correctly identifies the labellings A and B.



	A	**B**
(A)	DNA	Capsomeres
(B)	Protein	Capsomeres

(C) RNA	Capsomeres
(D) RNA	Tail fibres

Ans (C)

25. Which of the following statements is incorrect about the class Deuteromycetes?

(A) They reproduce only by asexual spores (conidia).

(B) Mycelium in these fungi is branched and septate.

(C) They have only parasitic forms.

(D) Examples of these fungi are *Alternaria*, *Colletotrichum* and *Trichoderma*.

Ans (C)

****

1st PU

Plant Kingdom

1. Kingdom-Plantae includes

   (A) algae, bryophytes and pteridophytes

   (B) algae, bryophytes, pteridophytes, gymnosperms and angiosperms

   (C) algae, fungi, pteridophytes, gymnosperms and angiosperms

   (D) algae, pteridophytes, gymnosperms and angiosperms

   Ans (B)

2. Natural system of classification was developed by

   (A) Linnaeus (B) Engler and Prantl

   (C) Bentham and Hooker (D) Aristotle

   Ans (C)

3. Classification on the basis of all observed characters is known as

   (A) obervable taxonomy (B) numerical taxonomy

   (C) retro taxonomy (D) cyber taxonomy

   Ans (B)

4. Algae include unicellular forms like ...A..., filamentous like ...B... and colonial forms like ...C... Here A, B and C refers to

   (A) A-*Chlamydomonas*, B-*Volvox*, C-*Ulothrix*

   (B) A-*Ulothrix*, B-*Volvox*, C-*Chlamydomonas*

   (C) A-*Volvox*, B-*Ulothrix*, C-*Chlamydomonas*

   (D) A-Chlamydomonas, B-*Ulothrix*, C- *Volvox*

   Ans (D)

5. 'Anisogamous' means both gametes are

   (A) similar in size and non-motile (B) dissimilar in size

   (C) similar in size and motile (D) dissimilar in size and non-motile

   Ans (B)

6. The members of brown algae have

   (A) chlorophyll-a, chlorophyll-b, xanthophylls

   (B) chlorophyll-a, chlorophyll-c, xanthophylls and carotenoids

   (C) fucoxanthin and xanthophylls(D) chlorophyll-a and xanthophylls

   Ans (B)

7. Oogamous type of fusion is found in

   (A) *Volvox* and *Fucus* (B) *Chlamydomonas*

   (C) *Spirogyra* (D) All of these

   Ans (A)

8. Which of the following group of marine algae are used as food?

   (A) *Chlamydomonas*, *Volvox* and *Gracilaria*

   (B) *Porphyra*, *Laminaria* and *Sargassum*

   (C) *Laminaria* and *Gracilaria*

   (D) *Porphyra* and *Chlamydomonas*

   Ans (B)

9. Agar-agar is obtained from

   (A) Chlorella (B) *Spirogyra* (C) *Ulothrix* (D) *Gelidium*

   Ans (D)

10. Pyrenoids are made up of

   (A) core of starch surrounded by sheath of protein

   (B) core of protein surrounded by fatty sheath

   (C) proteinaceous centre and starchy sheath

   (D) core of nucleic acid surrounded by protein sheath

   Ans (C)

11. Female reproductive part of bryophytes is called

   (A) antheridium (B) oogonium

   (C) archegonium (D) sporangium

   Ans (C)

12. Which of the following can be regarded as seedless vascular plants?

(A) Angiosperms (B) Gymnosperms

(C) Bryophytes (D) Pteridophytes **Ans** (D)

13. The main plant body in a pteridophyte is

(A) sporophyte (2n) which is differentiated into root, stem and leaf

(B) sporophyte having no root, stem and leaf

(C) gametophyte (n) which is differentiated into root, stem and leaf

(D) gametophyte having no root, stem and leaf

Ans (A)

14. Which of the following pteridophytes is heterosporous in nature?

(A) *Selaginella* and *Salvinia* (B) *Adiantum* and *Equisetum*

(C) *Psilotum* and *Lycopodium* (D) *Adiantum* and *Psilotum*

Ans (A)

15. In which of the following groups, would you place a plant, which produces seeds but lacks fruits?

(A) Fungi (B) Bryophytes (C) Pteridophytes

(D) Gymnosperms **Ans** (D)

16. In which of the following gymnosperms, are coralloid roots associated with N_2 fixing cyanobacteria?

(A) *Pinus* (B) *Cycas* (C) *Cedrus* (D) *Ginkgo*

Ans (B)

17. In gymnosperms, dominant phase is

(A) sporophyte (B) gametophyte (C) haploid (D) diploid

Ans (A)

18. In conifers, ovules are borne on

(A) microsporophyll (B) megasporophyll

(C) all sporophylls (D) Neither (A) nor (B) **Ans** (B)

19. Floridean starch is reserve food in

(A) Phaeophceae (B) Chlorophyceae

(C) Rhodophyceae (D) Cyanophyceae **Ans** (C)

20. Angiosperms are also called

    (A) seedless plants (C) flowering plants

    (B) fruit less plants (D) All of these **Ans** (C)

21. Tallest flowering tree is

    (A) *Pinus* (C) *Sequoia*

    (B) *Cycas* (D) *Eucalyptus* **Ans** (D)

22. Haplo-diplontic life cycle is followed by

    (A) bryophytes and pteridophytes (B) all algae and bryophytes

    (C) angiosperms and gymnosperms (D) bryophytes and gymnosperms

    Ans (A)

23. Which of the following is the 'amphibian of the plant kingdom'?

    (A) Angiosperms (B) Pteridophytes

    (C) Gymnosperm (D) Bryophytes

    Ans (D)

24. Species of *Sphagnum*, a moss, provide

    (A) oil, that can been used as fuel (B) peat (fuel)

    (C) agar-agar (D) antibiotics

    Ans (B)

25. If the chromosome number in the leaf of *Funaria* is 20, what will be the chromosome number in the spores?

    (A) 10 (B) 40 (C) 20 (D) 5

    Ans (C)

****

1st PU

Animal Kingdom

1. Match the following columns and choose the correct option:

Column I		Column II	
(a)	Cellular level of organisation	1.	Cnidaria
(b)	Organ level of organisation	2.	Platyhelminthes
(c)	Organ system level of organisation	3.	Chordata
(d)	Tissue level of organisation	4.	Porifera

Codes

	(a)	(b)	(c)	(d)
(A)	4	2	3	1
(B)	2	1	4	3
(C)	3	2	4	1
(D)	4	2	1	3

Ans (A)

2. Diploblastic animals belong to the phylum

(A) Protista (B) Protozoa

(C) Coelenterata (D) Platyhelminthes

Ans (C)

3. In phylum Porifera, opening through which water leaves the spongocoel is called

(A) ostia (B) ommatidia

(C) osculum (D) osmocytes

Ans (C)

4. Pseudocoelomate animals belong to the phylum

   (A) Platyhelminthes (B) Arthropoda

   (C) Mollusca (D) Aschelminthes

   Ans (D)

5. The notochord is derived from which of the following layers?

   (A) Ectoderm (B) Mesoderm

   (C) Endoderm (D) Placoderm

   Ans (B)

6. Collar cells are characteristic feature of

   (A) earthworm (B) roundworms

   (C) coelenterates (D) sponges

   Ans (D)

7. Metagenesis is seen in

   (A) *Hydra* (B) *Aurelia*

   (C) *Obelia* (D) *Adamsia*

   Ans (C)

8. Which of the following animals is called a 'living fossil'?

   (A) *Carcharodon*

   (B) *Bombyx*

   (C) *Limulus*

   (D) *Balanoglossus*

   Ans (C)

9. Which of the following insects is not of any economic benefit?

   (A) Silkworm (B) Lac insect

   (C) Locust (D) Honey bee

   Ans (C)

10. The phylum Mollusca lacks which one of the following?

(A) Visceral hump (B) Malpighian tubules

(C) Gills (D) Radula

Ans (B)

11. Match the following columns:

Column I		Column II	
(a)	*Loligo*	1.	Cuttle fish
(b)	*Aplysia*	2.	Chiton
(c)	*Sepia*	3.	Pearl oyster
(d)	*Chaetopleura*	4.	Tusk shell
(e)	*Pinctada*	5.	Squid
		6.	Sea hare

Codes

	(a)	(b)	(c)	(d)	(e)
(A)	6	3	1	4	5
(B)	5	4	6	2	3
(C)	4	5	3	1	6
(D)	5	6	1	2	3

Ans (D)

12. Excretory organ in phylum Hemichordata is

(A) proboscis gland (B) gills

(C) collar (D) skin

Ans (A)

13. Phylum Chordata is divided into sub-phyla

(A) Vertebrata, Protochordata and Urochordata

(B) Urochordata, Gnathochordata and Vertebrata

(C) Urochordata, Tunicata and Vertebrata

(D) Urochordata, Cephalochordata and Vertebrata

Ans (D)

14. Which statement is incorrect for animals belonging to Class Chondrichthyes?

(A) Presence of placoid scales

(B) Absence of air bladder

(C) Presence of cartilaginous endoskeleton

(D) Notochord is persistent only at larval stage.

Ans (D)

15. The number of gills present in Osteichthyes is

(A) 2 pairs (B) 6 pairs

(C) 5 pairs (D) 4 pairs

Ans (D)

16. The jawless vertebrate is

(A) crocodile (B) loris

(C) *Hyla* (D) hag fish

Ans (D)

17. Dry skin with scales or scutes without glands is a characteristic of

(A) Pisces (B) Reptilia

(C) Amphibia (D) Aves

Ans (B)

18. The character of birds without exception is

(A) omnivorous (B) flying wings

(C) beak without teeth (D) building nests

Ans (C)

19. Find the odd one.

(A) sea lily

(B) sea fan

(C) sea cucumber

(D) sea urchin

Ans (B)

20. Which statement is incorrect about *Pleurobrachia*?

(A) They are diploblastic (B) They have tissue level organisation

(C) They have comb plates (D) They are triploblastic

Ans (D)

21. Match the following columns.

Column I		**Column II**	
(a)	*Hippocampus*	1.	Fighting fish
(b)	*Betta*	2.	Catla
(c)	*Clarius*	3.	Sea horse
(d)	*Labeo*	4.	Angel fish
		5.	Rohu
		6.	Magur

Codes

	(a)	(b)	(c)	(d)
(A)	3	1	6	5
(B)	6	2	4	1
(C)	3	2	6	4
(D)	4	1	6	5

Ans (A)

22. Roundworms are different from flatworms in which of the following feature/s?

    (A) Roundworms are triploblastic

    (B) Roundworms have a complete digestive system

    (C) Roundworms have flame cells

    (D) All of the above

    Ans (B)

23. Which of the following groups of animals is correctly matched with its characteristics feature without even a single exception?

    (A) Chordata - possess a mouth provided with jaws

    (B) Chondrichthyes - possess cartilaginous endoskeleton

    (C) Mammalia - give birth to young ones

    (D) Reptilia - possess 3-chambered heart

    Ans (B)

24. *Ichthyophis* belongs to Class

    (A) Mammalia (B) Reptilia

    (C) Amphibia (D) Aves

    Ans (C)

25. Which one of the following is not a mammalian character?

    (A) Presence of milk producing glands

    (B) Two pairs of limbs

    (C) Skin has scales

    (D) Presence of external ears called pinnae

    Ans (C)

26. Which of the following animals has a true coelom?

    (A) *Ascaris* (B) *Pheretima* (C) *Sycon* (D) *Taenia*

    Ans (B)

27. Which of the following does not belong to phylum Platyhelminthes?

(A) *Fasciola* (B) *Taenia* (C) *Wuchereria*

(D) *Planaria*

Ans (C)

28. Select the phylum that is the largest of Animalia.

(A) Phylum Mollusca (B) Phylum Arthropoda

(C) Phylum Annelida (D) Phylum Coelenterata

Ans (B)

29. Which of the following statement/s is/are true?

(A) All chordates are vertebrates

(B) All vertebrates are chordates

(C) All invertebrates are non-chordates

(D) All the above

Ans (B)

30. Select the correct set of animals of Mammalia.

(A) Lion, horse, penguin, bat

(B) Lion, bat, whale, ostrich

(C) Horse, penguin, whale, kangaroo

(D) Whale, bat, kangaroo, horse

Ans (D)

****

1st PU

Morphology of Flowering Plants

1. The direct elongation of radicle leads to the formation of

   (A) stem (B) primary root

   (C) secondary root (D) tertiary root

   Ans (B)

2. Match the following columns.

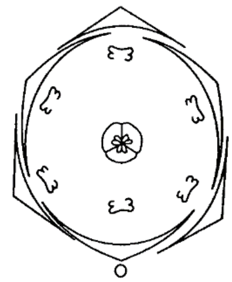
Column I		Column II	
(a)	Food	1.	Tomato
(b)	Spices	2.	Brinjal
(c)	Medicine	3.	Potato
(d)	Fumigatory	4.	Chili
(e)	Ornamental	5.	Belladona
		6.	Ashwagandha
		7.	Tobacco
		8.	Petunia

Codes

	(a)	(b)	(c)	(d)	(e)
(A)	1, 2,	3, 4	5, 6	7	8
(B)	1, 2, 3	4	5, 6	7	8
(C)	1, 2, 3,	4, 5	6	7	8
(D)	1	2	3, 4	5, 6	7, 8

Ans (B)

3. Floral diagram belongs to



   (A) coffee plant (Solanaceae)

   (B) lemon plant (Rutaceae)

   (C) potato plant (Solanaceae)

   (D) onion plant (Liliaceae)

   Ans (D)

4. Regions of root from the root tip to base are

   (A) Region of maturation→Region of elongation→ Region of meristematic activity

   (B) Region of elongation→Region of maturation →Region of meristematic activity

   (C) Region of meristematic activity→Region of elongation→Region of maturation

   (D) Region of division→Region of maturation→Region of elongation

   Ans (C)

5. Swollen leaf base is called

   (A) lemma (B) petiole (C) pulvinus

   (D) leaf blade **Ans** (C)

6. Arrangements of veins and the veinlets in the lamina of leaf is termed as

   (A) phyllotaxy (B) venation (C) inflorescence

   (D) aestivation **Ans** (C)

7. Perianth is the condition in which

   (A) calyx and corolla are fused

   (B) calyx is present but corolla is absent

   (C) corolla is present but calyx is absent

   (D) calyx and corolla are indistinct

   Ans (D)

8. Arrangement of sepals or petals with respect to the other members of same whorl is known as

(A) gamopetalous condition (B) polypetalous condition

(C) aestivation (D) vernation **Ans** (C)

9. Match the following columns:

Column I		Column II	
(a)	Valvate aestivation	1.	*Calotropis*
(b)	Twisted aestivation	2.	China rose
(c)	Imbricate aestivation	3.	Cotton
(d)	Vexillary aestivation	4.	*Cassia*
		5.	Pea
		6.	Bean

Codes

	(a)	(b)	(c)	(d)
(A)	1, 2	3, 4	5	6
(B)	5, 6	2, 3	1	2
(C)	1	2, 3	4	5, 6
(D)	2, 3	1	5, 6	4

Ans (C)

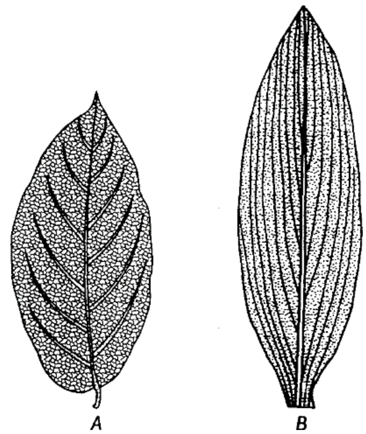
10. Bicarpellary syncarpous ovary with axile placentation is seen in

(A) Solanaceae (B) Liliaceae

(C) Fabaceae (D) Malvaceae

Ans (A)

11. Identify the type of venation and the group where it is commonly seen from the given diagram (A and B)



(A) A-Reticulate (dicots); B-Parallel (monocots)

(B) A-Reticulate (monocots); B-Parallel (dicots)

(C) A-Parallel (dicots); B-Reticulate (monocots)

(D) A-Parallel (monocots); B-Reticulate (dicots)

Ans (A)

12. Staminode is

(A) sterile stamen (B) rudimentary stamen

(C) fertile stamen (D) developed stamen **Ans** (A)

13. Smallest region of the root is

(A) root cap (B) region of elongation

(C) region of meristematic activity (D) region of maturation

Ans (C)

14. Match the following columns:

Column I		**Column II**	
(a)	Marginal	1.	Pea
(b)	Axile	2.	China rose
(c)	Parietal	3.	Tomato
(d)	Free central	4.	Mustard
(e)	Basal	5.	*Dianthus*
		6.	Primrose

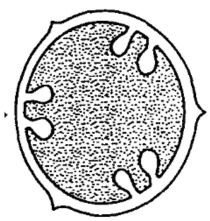
		7.	Sunflower
		8.	Marigold

Codes

	(a)	(b)	(c)	(d)	(e)
(A)	1, 2	3, 4	5,6	7	8
(B)	8	7, 6	5, 4	3, 2	2
(C)	1	2, 3	4	5, 6	7, 8
(D)	7, 8	5, 6	4	2, 3	2

Ans (C)

15. Identify the type of placentation in the given diagram:



(A) Marginal (B) Basal (C) Free central (D) Parietal

Ans (D)

16. I. Epicarp is thin.

II. Mesocarp is fleshy and edible.

III. Endocarp is strong and hard.

These are the probable features of the fruit

(A) coconut (B) mango

(C) almond (D) brinjal

Ans (B)

17. $\underline{G}_{(2)}$ represents

(A) gynoecium, bicarpellary, apocarpous, superior

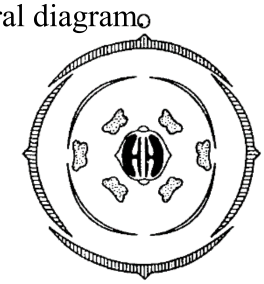
(B) gynoecium, bicarpellary, syncarpous, inferior

(C) gynoecium, bicarpellary, apocarpous, inferior

(D) gynoecium, bicarpellary, syncarpous, superior

Ans (D)

18. Identify the family represented through the given floral diagram



(A) Brassicaceae

(B) Poaceae

(C) Asteracae

(D) Fabaceae

Ans (A)

19. Potato family is called

(A) Cruciferae (B) Brassicaceae

(C) Solanaceae (D) Poaceae

Ans (C)

20. Roots arising from the part of plant other than the radicle are called

(A) adventitious roots (B) stilt roots

(C) nodal roots (D) internodal roots

Ans (A)

21. Insectivorous plants such as pitcher plant, Venus fly trap have insect-catching parts which are

(A) modified leaf (B) modified stem

(C) modified flower (D) All of the above

Ans (A)

22. Match the following columns:

Column I		Column II	
(a)	Ornamental	1.	Tulip
(b)	Medicine	2.	*Gloriosa*

(c)	Vegetable	3.	Aloe
(d)	Colchicine	4.	*Asparagus*
		5.	*Colchicum autumnale*

Codes

	(a)	(b)	(c)	(d)
(A)	1	2, 3	4	5
(B)	1, 2	3	4	5
(C)	1	2	3, 4	5
(D)	1	2	3	4, 5

Ans (B)

23. Match the following columns:

Column I		**Column II**	
(a)	Superior ovary	1.	Hypogynous flower
(b)	Inferior ovary	2.	Perigynous flower
(c)	Half-inferior ovary	3.	Epigynous flower

Codes

	(a)	(b)	(c)
(A)	1	3	2
(B)	1	2	3
(C)	2	1	3
(D)	3	2	1

Ans (A)

24. Match the following columns.

Column I		**Column II**	
(a)	Monoadelophous	1.	Citrus
(b)	Diadelphous	2.	Pea
(c)	Polyadelphous	3.	China rose

Codes

	(a)	(b)	(c)
(A)	1	2	3
(B)	1	3	2
(C)	3	2	1
(D)	3	1	2

Ans (C)

25. Root hair are present on the

(A) root cap (B) region of elongation

(C) region of maturation (D) region of division

Ans (C)

****

1st PU

Anatomy of Flowering Plants

1. Early wood is formed in an older dicot plant during

   (A) spring season (B) winter season

   (C) autumn season (D) summer season **Ans** (A)

2. The meristem which is particularly present in the mature regions of roots and shoots, and produces woody axis and appears later than the primary meristem is

   (A) secondary meristem (B) intercalary meristem

   (C) apical meristem (D) tertiary meristem **Ans** (A)

3. Simple permanent living tissues which are made up of thin-walled isodiametric cells are called

   (A) sclerenchyma tissues (B) parenchyma tissues

   (C) collenchyma tissues (D) meristematic tissues **Ans** (B)

4. Gymnosperms lack which of the following?

   (A) tracheids (B) vessels (C) xylem (D) phloem

   Ans (B)

5. Which of the following would be present in insignificant amount in xylem sap?

   (A) Phosphates (B) Nitrates (C) Sugar (D) Water

   Ans (C)

6. The protoxylem and metaxylem in the stem lies towards

   (A) the pith and root centre, respectively

   (B) the periphery and root centre, respectively

   (C) the root centre and periphery of stem, respectively

   (D) the pith and periphery of stem, respectively

   Ans (D)

7. Conjoint vascular bundles are common in

   (A) roots (B) stems (C) leaves (D) Both (B) and (C) **Ans** (D)

8. The functions of sieve tubes are controlled by

(A) cytoplasm of sieve tube cells (B) nucleus of sieve tube cells

(C) nucleus of companion cells (D) cytoplasm of companion cells

Ans (C)

9. Epidermis is often covered with a waxy thick layer called

(A) cuticle (B) suberin (C) supporting cell (D) All of these

Ans (A)

10. In grasses, the guard cells are

(A) kidney-shaped (B) sphere-shaped

(C) dumb-bell-shaped (D) bean-shaped

Ans (C)

11. The innermost layer of cortex is called

(A) pith (B) casparian strips (C) endodermis (D) pericycle

Ans (C)

12. Grass elongates after cutting (mowing) due to

(A) primary meristem (B) secondary meristem

(C) apical meristem (D) intercalary meristem **Ans** (D)

13. Trichomes are epidermal hairs of

(A) primary root (B) primary stem (C) primary leaves

(D) secondary root **Ans** (B)

14. Ground tissue does not include

I. epidermis II. vascular bundle III. sclerenchyma

IV. collenchyma V. parenchyma

Select the right combination from the above given options.

(A) I and II (B) III and IV (C) I and V

(D) I and IV **Ans** (A)

15. Vascular bundle without cambium is called

(A) closed vascular bundle (B) open vascular bundle

(C) radial vascular bundle (D) conjoint vascular bundle

Ans (A)

16. Bulliform cells are the modification of

(A) abaxial epidermis cell (B) adaxial epidermis cell

(C) mesophyll (D) vascular tissue

Ans (B)

17. In dicotyledonous root, the cortex consists of

(A) sclerenchymatous tissue (B) collenchymatous tissue

(C) parenchymatous tissue (D) endodermis tissue

Ans (C)

18. Water impermeable, waxy material secreted by endodermal cells is called

(A) lignin (B) conjuctive tissue (C) suberin (D) pectin **Ans** (C)

19. The cells arranged in multiple layers between the epidermis and pericycle is called

(A) pith (B) stele (C) medullary rays (D) cortex

Ans (D)

20. In monocotyledonous stem, the vascular bundles are

(A) conjoint and open (B) conjoint and closed

(C) scattered throughout the ground tissue (D) Both (B) and (C)

Ans (D)

21. Palisade parenhyma and spongy parenchyma are found in

(A) mesophyll of leaves (B) vascular system of leaves

(C) epidermis of leaves (D) endodermis of leaves **Ans** (A)

22. I. Dicot leaf is also called isobilateral leaf

II. Monocot leaf is also called dorsoventral leaf.

Select the correct option:

(A) I and II are correct (B) I is correct, but II is incorrect

(C) II is correct, but I is incorrect (D) I and II are incorrect **Ans** (D)

23. Match the following columns:

Column I		Column II	
(a)	Cork	1.	Phellogen
(b)	Secondary cortex	2.	Phellem
(c)	Cork cambium	3.	Phelloderm

Codes

	(a)	(b)	(c)
(A)	1	2	3
(B)	3	2	1
(C)	3	1	2
(D)	2	3	1

Ans (D)

24. Aerating pores are present at places on bark of trees. These are called

(A) pneumatophores (B) hydathodes (C) lenticels

(D) stomata **Ans** (C)

25. In dicot root, the vascular cambium is

(A) completely secondary in origin

(B) completely primary in origin

(C) secondary as well as primary in origin

(D) does not exist **Ans** (A)

****

1^{st} PU

Structural Organisation in Animals

1. The type of cell junction, which facilities cell to cell communication is called the
   (A) tight junction (B) adhering junction
   (C) gap junction (D) desmosmes **Ans** (C)
2. Thin Malpighian tubules in cockroach are present at the junction of
   (A) fore gut and mid gut (B) mid gut and hind gut
   (C) fore gut and hind gut (D) mid gut and gizzard **Ans** (B)
3. Fibroblasts, macrophages and mast cells are present in the
   (A) epithelium tissue (B) connective tissue
   (C) skeletal muscle tissue (D) smooth muscle tissue
   Ans (B)
4. On the basis of structure and functions animal tissues are classified into
   (A) 3 types (B) 2 types (C) 1 type (D) 4 types
   Ans (D)
5. Which of the following tissues provides a covering layer for some of the body parts?
   (A) Connective tissues (B) Muscular tissues
   (C) Epithetical tissues (D) Neural tissues
   Ans (C)
6. The midbrain of the frog is characterised by a pair of
   (A) cerebral hemisphere (B) cerebellum
   (C) optic lobes (D) olfactory lobes
   Ans (C)
7. Which of the following is not a function of epithelium?
   (A) Protection (B) Connection (C) Secretion or excretion
   (D) Adsorption **Ans** (B)
8. The tissue which forms the glands in humans is
   (A) muscular tissue (B) nervous tissue
   (C) epithelium tissue (D) connective tissue
   Ans (C)

9. The endothelium of blood vessels is made up of simple
(A) cuboidal epithelium (B) squamous epithelium
(C) columnar epithelium (D) non-ciliated columnar epithelium
Ans (B)
10. The columnar epithelium in human body is found in
(A) stomach (B) lungs (C) kidney (D) Fallopian tube
Ans (A)
11. The ciliated columnar epithelial cells in humans are known to occur in
(A) bronchioles and fallopian tubes (B) bile duct and oesophagus
(C) fallopian tube and urethra (D) eustachian tube and stomach lining
Ans (A)
12. Goblet cells of alimentary canal are a type of
(A) intercellular gland (B) multicellular gland
(C) unicellular gland (D) none of these **Ans** (C)
13. Earthworm is a
(A) unisexual animal (B) multisexual animal
(C) bisexual animal (D) asexual animal **Ans** (C)
14. Adipose tissue is a type of
(A) loose connective tissue (B) dense connective tissue
(C) specialised connective tissue (D) none of the above **Ans** (A)
15. Which of the following organ regulates the volume and composition of the body fluids of earthworm?
(A) Stomach (B) Nephridia (C) Heart (D) Intestine
Ans (B)
16. Tendons helps in connecting
(A) muscles to bones (B) bone to bone
(C) bone to cartilage (D) cartilage to muscle **Ans** (A)
17. Which of the following type of connective tissue is present at the tip of human nose?
(A) Cartilage (B) Bone (C) Adipose tissue
(D) None of these **Ans** (A)

18. The contractile tissue that is present only in the heart is
(A) Cardiac tissue (B) Areolar tissue
(C) Adipose tissue (D) All of these
Ans (A)
19. Each segment of the cockroach exoskeleton has hardened plates called
(A) sclerites (B) spicules
(C) arthrodial membrane (D) ossicles **Ans** (A)

20. The mouth part of a cockroach are said to be
(A) absorbing type (B) biting and absorbing type
(C) biting and chewing type (D) biting and sucking type
Ans (C)

21. Hypopharynx of the cockroach acts as
(A) mouth (B) lips (C) tongue (D) jaws **Ans** (C)

22. ….. helps in grinding the food particles in cockroach. Fill in the blank.
(A) Crop (B) Bristles (C) Gizzard (D) none of these **Ans** (C)

23. How many pairs of testes are present in earthworm?
(A) Five (B) Two (C) Three (D) Four
Ans (B)

24. The number of spiracles present in cockroaches are
(A) 9 pairs (B) 10 pairs (C) l2 pairs
(D) l4 pairs **Ans** (B)

25. Cockroach is
(A) uriotelic (B) uricotelic (C) ammonotelic (D) ureo-ammonotelic
Ans (B)

26. The frogs have the ability to change its colour to hide them from their enemies. This protective colouration is called
(A) hibernation (B) aestivation (C) mimicry (D) camouflage
Ans (D)

27. The alimentary canal of frog is short because frogs are
(A) herbivores (B) carnivores (C) omnivores
(D) heterotrophs **Ans** (B)

28. The first pair of wings in cockroach arises from …. and the second pair from …. Most suitable option consisting of word pair to fill the blank is
(A) prothorax, mesothorax (B) mesothorax, metathorax
(C) metathorax, mesothorax (D) mesothorax, prothorax **Ans** (B)

29. Match column I with column II about nervous system of frog.

Column I			**Column II**
a.	Brain Box	1.	Unpaired diencephalon
b.	Midbrain	2.	Cerebellum
c.	Hindbrain	3.	Optic lobes

d.	Forebrain	4.	Cranium
e.	Peripheral nervous system	5.	Cranial nerves

Codes
(A) a = 1, b = 2, c = 3, d = 4, e = 5
(B) a = 3, b = 2, c = 1, d = 4, e = 5
(C) a = 4, b = 3, c = 2, d = 1, e = 5
(D) a = 5, b = 4, c = 3, d = 2, e = 1
Ans (C)

30. In earthworms, clitellum is formed of
(A) 14^{th}, 15^{th} and 16^{th} segment (B) 19^{th}, 20^{th} and 22^{th} segment
(C) 15^{th}, 16^{th} and 17^{th} segment (D) 7^{th}, 8^{th} and 9^{th} segment
Ans (A)

****

1st PU

Cell – the Unit of Life

1. Select the incorrect pair.

   (A) Cell wall – Structural support

   (B) Central vacuole – Storage

   (C) Amyloplast – Starch storage

   (D) Plasmodesmata – Protection

   Ans (D)

2. Read the given statements.

   (i) Flat, membranous sacs in chloroplasts

   (ii) Infoldings in mitochondria

   (iii) Disc-shaped sacs in Golgi apparatus

   Select the correct option as per the codes given:

	Cristae	**Cisternae**	**Thylakoids**
(A)	(iii)	(i)	(ii)
(B)	(i)	(ii)	(iii)
(C)	(ii)	(iii)	(i)
(D)	(iii)	(ii)	(i)

   Ans (C)

3. Arrangement of microtubules in a flagellum and a centriole is respectively

   (A) 9 + 2 and 9 + 1 (B) 9 + 1 and 9 + 0

   (C) 9 + 0 and 9 + 2 (D) 9 + 2 and 9 + 0. **Ans** (D)

4. The chromosome in which centromere lies slightly away from the middle of the chromosome, resulting into one shorter arm and one longer arm, is called as

   (A) metacentric (B) submetacentric (C) acrocentric (D) telocentric

   Ans (B)

5. Ribosomes are composed of

(A) RNA only (B) Proteins only (C) RNA and proteins

(D) RNA, proteins arid DNA **Ans** (C)

6. The best material for the study of structure of cell membrane is

(A) RBC of human (B) liver cell

(C) kidney cell (D) muscle cell **Ans** (A)

7. Cell membrane is selective permeable. This means that it

(A) allows all materials to pass through

(B) allows only water to pass through

(C) allows only certain materials to pass through

(D) allows only ions to pass through. **Ans** (C)

8. Which of the following statements is incorrect for centrioles?

(A) Both the centrioles in a centrosome lie perpendicular to each other.

(B) Central proteinaceous hub is missing in a centriole.

(C) Each centriole has an organization like that of a cartwheel.

(D) Centrosome usually contains 2 cylindrical centrioles. **Ans** (B)

9. Select the incorrect statement:

(A) Robert Brown discovered cell

(B) Antony von Leeuwenhoek first saw and described a living cell

(C) Cell is the basic unit of structure and function in 5 kingdoms

(D) Anything less than a complete structure of a cell does not ensure independent living

Ans (A)

10. Part of chromosome after secondary constriction is called

(A) centriole (B) centromere (C) chromomere

(D) satellite **Ans** (D)

11. Match Column-I with Column-II and select the correct option from the codes given below.

	Column-I		**Column-II**

a.	Leeuwenhoek	(i)	First saw and described a living cell
b.	Robert Brown	(ii)	Presence of cell wall is unique to plant cells
c.	Schleiden	(iii)	Discovered the nucleus
d.	Schwann	(iv)	All plants are composed of different kind of cells

(A) a-(i), b-(iii), c-(iv), d-(ii) (B) a-(i), b-(iii), c-(ii), d-(iv)

(C) a-(iii), b-(i), c-(iv), d-(ii) (D) a-(i), b-(iv), c-(ii), d-(iii) **Ans** (A)

12. Which of these are an exception to cell theory?

(A) Bacteria (B) Fungi (C) Viruses (D) Lichens **Ans** (C)

13. Correct sequence of layers of bacterial cell envelope from outward to inward is

(A) Cell wall → Glycocalyx → Cell membrane

(B) Cell membrane → Glycocalyx → Cell wall

(C) Glycocalyx → Cell wall → Cell membrane

(D) Glycocalyx → Cell membrane → Cell wall. **Ans** (C)

14. ________ are self-replicating, extra chromosomal segments of double stranded circular and naked DNA, present in a bacterial cell.

(A) Plasmids (B) Nucleoid (C) Mesosomes

(D) Bacteriophages **Ans** (A)

15. The latest model of cell membrane is the

(A) Unit membrane model (B) Fluid mosaic model

(C) Danielli and Davson's model (D) Robertson's model. **Ans** (B)

16. Mesosomes are the infoldings of cell membrane, which

(i) are present in both prokaryotic and eukaryotic cells.

(ii) help in cell wall formation, DNA replication and respiration.

(iii) increase the surface area of plasma membrane.

(A) (i) and (ii) (B) (ii) and (iii) (C) (i) and (iii)

(D) (i), (ii) and (iii). **Ans** (B)

17. Polyribosomes are aggregation of

(A) ribosomes and rRNA (B) peroxisomes

(C) several ribosomes held together by a string of mRNA

(D) rRNA. **Ans** (C)

18. Longest cells in human body are

(A) Nerve cells (B) Bone cells (C) Leg muscle cells

(D) Heart muscle cells **Ans** (A)

19. Lysosomes are ____________ vesicular structures formed by the process of packaging in the _______. The blanks respectively are

(A) membrane bound, Golgi apparatus

(B) non-membrane bound, Golgi apparatus

(C) membrane bound, ER (D) non-membrane bound, ER **Ans** (A)

20. Plastids differ from mitochondria on the basis of which of the following features?

(A) Presence of two layers of membrane (B) Presence of ribosome

(C) Presence of thylakoids (D) Presence of DNA **Ans** (C)

21. Rough endoplasmic reticulum is well developed in the cells which synthesize

(A) steroids (B) proteins (C) carbohydrates (D) all of these.

Ans (B)

22. *Omnis cellula e cellulae* i.e., new cells arise from pre-existing cells. This statement was given by

(A) Schleiden and Schwann (B) Rudolf Virchow

(C) Robert Brown (D) Robert Hooke. **Ans** (B)

23. The type of ribosomes found in prokaryotes is

(A) 80S type (B) 70S type

(C) 30S type (D) 50S type. **Ans** (B)

24. If you remove the fimbriae from the bacterial cell, which of the following would you expect to happen?

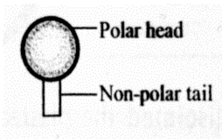
(A) The bacteria could no longer swim

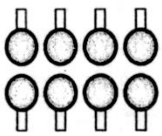
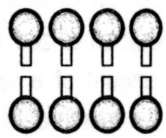
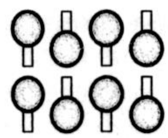
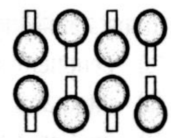
(B) The bacteria would not adhere to the host tissue

(C) Transportation of molecules across the membrane would stop

(D) The shape of bacteria would change **Ans** (B)

25. The lipid molecules present in plasma membrane have polar heads and-non-polar tails (as shown in figure). Which option represents the correct arrangement of lipids in lipid bilayer?



(A)  (B)  (C)  (D) 

Ans (B)

****

1st PU

Biomolecules

1. Choose the element which is negligible in living matter.

   (A) Si (B) Mg (C) Ca (D) S **Ans** (A)

2. Types of amino acids found in proteins are

   (A) 21 (B) 19 (C) 20 (D) 23 **Ans** (C)

3. Arachidonic acid has …. carbon atoms including the carboxyl carbon.

   Complete the given statement by filling the most appropriate option in the blank.

   (A) 20 (B) 22 (C) 21 (D) 23 **Ans** (A)

4. The aggregation of the various kinds of biomolecules in a cell is referred to as the

   (A) acid soluble pool (B) acid insoluble pool

   (C) cellular pool (D) biomolecule fraction **Ans** (C)

5. Which of the following secondary metabolites are used as drugs?

   (A) Vinblastin and curcumin (B) Anthocyanin

   (C) Gums and cellulose (D) Abrin and ricin **Ans** (A)

6. Match the following columns.

Column I Building blocks		**Column II Large molecules**	
a.	Amino acids	1.	Lipids
b.	Fatty acids, Glycerol	2.	Proteins
c.	Nucleotides	3.	Polysaccharides
d.	Simple Sugars	4.	Nucleic acids

   (A) a = 2, b = 1, c = 4, d = 3 (B) a = 1, b = 2, c = 3, d = 4

   (C) a = 3, b = 2, c = 1, d = 4 (D) a = 4, b = 3, c = 2, d = 1 **Ans** (A)

7. Select the correct constituents of proteins:

   (A) Carbon, hydrogen, oxygen and nitrogen

(B) Carbon, hydrogen, nitrogen and sulphur

(C) Carbon, hydrogen, nitrogen, oxygen and sulphur

(D) Carbon, hydrogen and oxygen

Ans (C)

8. The most abundant chemical in living organisms is

   (A) protein (B) water (C) lipids (D) nucleic acids

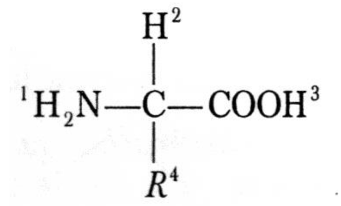
   Ans (B)

9. Name the most abundant protein in animal world.

   (A) RUBISCO (B) Chitin (C) Collagen (D) Cellulose

   Ans (C)

10. Which of the two groups of following formula is involved in peptide bond formation between different amino acids?



   (A) 1 and 3 (B) 2 and 3 (C) 2 and 4 (D) 1 and 4

   Ans (A)

11. Adult human haemoglobin consists of

   (A) 2 subunits (B) 2 subunits (β, β) (C) 4 subunits (2α, 2β)

   (D) 3 subunits (2α, 1β) **Ans** (C)

12. Select the correct pair of purines.

   (A) Cytosine and thymine (B) Adenine and guanine

   (C) Uracil and cytosine (D) Guanine and uracil **Ans** (B)

13. In a polypeptide chain, a β-pleated sheet is an example of

   (A) 2° structure (B) 1° structure (C) 4° structure

   (D) 3° structure **Ans** (A)

14. Acidic amino acids carry two –COOH and one –NH_2 groups per molecule. Keeping this in mind, select the correct pair of acidic amino acid.

(A) Lysine and arginine (B) Aspartic acid and glutamic acid

(C) Glycine and alanine (D) Both (A) and (B) **Ans** (B)

15. In a polysaccharide, the individual monosaccharides are linked by a

(A) glycosidic bond (B) peptide bond

(C) ester bond (D) phosphodiester bond **Ans** (A)

16. One turn of B-DNA contains how many nucleotides?

(A) 8 (B) 20 (C) 6 (D) 10 **Ans** (B)

17. Proteins with catalytic power are called

(A) reactants (B) substrate (C) co-factors (D) enzymes

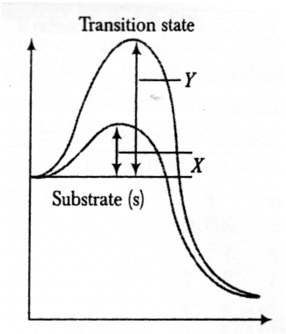
Ans (D)

18. Those nucleic acids which behave like enzymes are known as

(A) ribozymes (B) pepzymes (C) Both (A) and (B)

(D) ribose **Ans** (A)

19. Choose the correct option representing X and Y in the given graph.



(A) X–Activation energy without enzymes, Y–Activation energy with enzyme

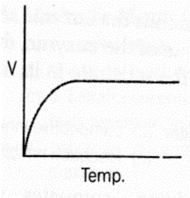
(B) X–Activation energy with enzymes, Y–Activation energy without enzyme

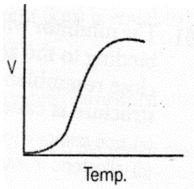
(C) X−Substrate concentration with enzyme, Y−Substrate concentration without enzyme

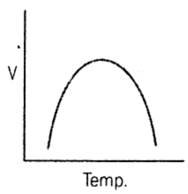
(D) X−Substrate concentration without enzyme, Y−Substrate concentration with enzyme

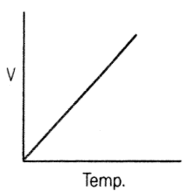
Ans (B)

20. Select the correct graph, which shows the effect of temperature on the velocity of a typical enzymatic reaction.

(A) 

(B) 

(C) 

(D) 

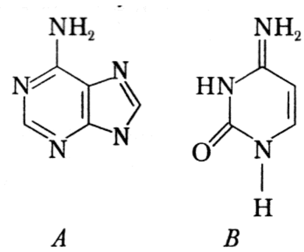
Ans (C)

21. Malonate inhibits succinate dehydrogenase, is an example of

(A) allosteric inhibition (B) negative feedback

(C) competitive inhibition (D) non-competitive inhibition **Ans** (C)

22. Name the structural formulae of the given structures correctly.



(A) A–Adenine; B–Uracil (B) A–Guanine; B–Thymine

(C) A–Adenine; B–Guanine (D) A–Cytosine; B–Thymine

Ans (A)

23. Match the following column.

Column I		Column II	
a.	Prosthetic group	1.	NAD
b.	Cofactor	2.	Haem
c.	Coenzyme	3.	Zn ions

(A) a = 2, b = 3, c = 1 (B) a = 1, b = 2, c = 3

(C) a = 3, b = 1, c = 2 (D) a = 2, b = 1, c = 3

Ans (A)

24. Inulin is a polymer of

(A) amino acids (B) glucose (C) fructose (D) fatty acids

Ans (C)

25. Choose the type of enzyme involved in the following reaction.

$$S{-}G + S' \rightarrow S + S' - G$$

(A) Dehydrogenase (B) Transferase (C) Hydrolase

(D) Lygase **Ans** (B)

****

1^{st} PU

Cell Cycle and Cell Division

1. The cell cycle of yeast takes about

   (A) 24 hrs (B) 60 min (C) 30 min (D) 90 min **Ans** (D)

2. Two basic states of cell cycle are

   (A) Interphase and M-phase/divisional phase

   (B) Karyokinesis and cytokinesis

   (C) Prophase, metaphase, anaphase and telophase

   (D) G_1, S and G_2 phases

   Ans (A)

3. What is the approximate percentage duration of cell cycle that comes under interphase in human cells under lab culture?

   (A) 99% (B) 95 % (C) 25 % (D) 5 % **Ans** (B)

4. Match the following columns

Column – I		Column II	
a.	Separation of daughter chromosomes	1.	Interphase
b.	Division of cytoplasm	2.	Karyokinesis
c.	Phase between two successive M-phases	3.	S-phase
d.	Synthesis phase	4.	Cytokinesis

   (A) a = 2, b = 3, c = 1, d = 4 (B) a = 4, b = 1, c = 3, d = 2

   (C) a = 2, b = 4, c = 1, d = 3 (D) a = 4, b = 2, c = 3, d = 1 **Ans** (C)

5. In which phase of the cell cycle, DNA content gets doubled?

   (A) Interphase (B) Anaphase (C) Prophase

   (D) Telophase **Ans** (A)

6. Which of the following stage of cell cycle is known as quiescent stage?

   (A) G_1-phase (B) S-phase (C) G_0-phase

   (D) G_2-phase **Ans** (C)

7. Select the correct sequence of a cell cycle

(A) $G_2 \rightarrow M \rightarrow G_1 \rightarrow S$ (B) $S \rightarrow G_2 \rightarrow M \rightarrow G_1$

(C) $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$ (D) $M \rightarrow G_1 \rightarrow G_2 \rightarrow M$

Ans (C)

8. Which of the following phases of the cell cycle is not a part of interphase?

(A) S (B) M (C) G_0 (D) G_1 **Ans** (B)

9. Karyokinesis refers to the division of

(A) the cytoplasm (B) the nucleus

(C) cytoplasm and nucleus (D) all constituents of the cell

Ans (B)

10. What would be the change in the chromosome number during S-phase?

(A) No change (B) The number of chromosome doubles

(C) The number of chromosome doubles only in case of diploid cell

(D) The number of chromosome doubles in the case of haploid cell

Ans (A)

11. What is not seen during mitosis in somatic cells?

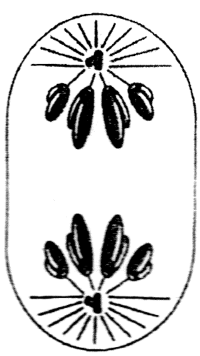
(A) Spindle fibres (B) Chromosome movement

(C) Disappearance of nucleolus (D) Synapsis **Ans** (D)

12. Which type of cell division helps in regeneration of cells?

(A) Mitosis (B) Amitosis (C) Meiosis (D) Karyokinesis **Ans** (A)

13. Given diagram indicates which of the following phase of mitosis? Choose the correct option.



(A) Interphase (B) Prophase (C) Metaphase (D) Anaphase

Ans (D)

14. The morphology of chromosomes can be studied most easily in

(A) prophase (B) metaphase (C) anaphase

(D) telophase **Ans** (B)

15. At the end of meiosis-II, number of haploid cells formed are

(A) two (B) four (C) eight (D) six **Ans** (B)

16. In meiosis, the chromosome number

(A) reduces by half (B) increase by twice

(C) increase by four times (D) reduces by one-fourth

Ans (A)

17. Longest phase of meiosis is

(A) Prophase-I (B) Prophase-II (C) Anaphase-I

(D) Metaphase-II **Ans** (A)

18. When paternal and maternal chromosomes change their material with each other in cell division, this event is called

(A) bivalent forming (B) crossing over

(C) synapsis (D) dyad forming **Ans** (B)

19. In which of the following stages of the cell cycle chromosome number becomes half?

(A) Metaphase-I (B) Anaphase-I

(C) Prophase-I (D) Metaphase-II **Ans** (B)

20. Arrange the following events of meiosis in a correct sequence and choose the correct option.

I. Terminalisation of chaismata   II. Crossing over

III. Synapsis   IV. Disjunction of chromosomes

(A) IV, III, II and I   (B) III, II, I and IV

(C) II, I, IV and III   (D) I, IV, III and II

Ans (B)

21. The stage between two meiotic division is called

(A) interphase   (B) cytokinesis

(C) interkinesis   (D) karyokineis

Ans (C)

22. If the cell has 14 chromosomes at interphase. Than how many chromosomes will the cell have at G_1-phase of cell cycle?

(A) 28   (B) 14   (C) 7   (D) 21

Ans (B)

23. In a cell cycle, replication of centrioles occurs during

(A) interphase   (B) prophase   (C) late prophase

(D) metaphase   **Ans** (A)

24. In which phase of cell cycle, proteins for spindle fibres are synthesised?

(A) G_1-phase   (B) G_2-phases   (C) S-phase

(D) Anaphase   **Ans** (B)

25. What is the number of mitotic cell divisions required to produce 256 cells from a single cell?

(A) 10   (B) 12   (C) 6   (D) 8

Ans (D)

****

1st PU

Transport in Plants

1. Choose the correct option given below

   (A) Diffusion needs ATP

   (B) Diffusion is an active and rapid process

   (C) Diffusion is rapid over short distance but extremely slow over long distance transport

   (D) Diffusion is slow over short distance, but rapid over long distance transport

   Ans (C)

2. Which of the following affects the rate of diffusion?

   (A) Concentration gradient (B) Permeability of the membrane

   (C) Temperature and pressure (D) All of the above

   Ans (D)

3. Water channels are possessed by a membrane to facilitate the movement of hydrophilic substances. These channels are made up of

   (A) eight similar type of aquaporin

   (B) eight different type of aquaporin

   (C) eight similar and eight different aquaporin

   (D) do not possess any water channel

   Ans (B)

4. Which of the following pairs is selective and specific mode of transport?

   (A) Passive transport and active transport

   (B) Passive transport and facilitated diffusion

   (C) Facilitated diffusion and active transport

   (D) Simple diffusion and facilitated diffusion

   Ans (C)

5. Carrier protein, which allows the diffusion of two type of molecules in the same direction is

(A) symport (B) antiport (C) actiport (D) uniport

Ans (A)

6. If solute particles are added to pure water, its diffusion pressure will be

   (A) increased (B) decreased (C) remain constant

   (D) become less than zero **Ans** (B)

7. Osmosis involves

   (A) flow of water through a semipermeable membrane

   (B) flow of water without a membrane

   (C) flow of solute through a semipermeable membrane

   (D) flow of solute without a membrane

   Ans (A)

8. A special type, which occurs when water is absorbed by solids causing them to increase in volume is called

   (A) osmosis (B) translocation (C) Imbibition (D) transpiration

   Ans (C)

9. A plant cell becomes turgid due to

   (A) plasmolysis (B) electrolysis (C) exosmosis

   (D) endosmosis **Ans** (D)

10. Two cells (A and B) have osmotic potential and pressure potential –18 bars and 8 bars, and –14 bars and 2 bars respectively. What will be the direction of water flow?

    (A) From cell A to cell B (B) Flow of water does not takes place

    (C) In both direction (D) From cell B to cell A **Ans** (A)

11. Match the following columns.

Column I (surrounding medium)		**Column II (Cell)**	
(a)	Hypotonic	1.	No net flow of water
(b)	Hypertonic	2.	Water moves into the cell
(c)	Isotonic	3.	Water moves out of the cell

	a	b	c
(A)	2	3	1
(B)	3	2	1
(C)	1	2	3
(D)	2	1	3

Ans (A)

12. In which of the following paths, flow of water occurs from cell to cell through their protoplasm?

    (A) Apoplast pathway (B) Symplast pathway

    (C) Both (A) and (B) (D) Active pathway **Ans** (B)

13. Which one of the following acts as a barrier in an apoplastic pathway?

    (A) Epidermis (B) Plasmodesmata (C) Casparian strips

    (D) Metaxylem **Ans** (C)

14. Pathway of water conduction from soil to xylem is

    (A) soil → root hair → cortex → pericycle → endodermis → metaxylem → protoxylem

    (B) soil → root hair → cortex → endodermis → pericycle → protoxylem → metaxylem

    (C) soil → root hair → epidermis → endodermis → phloem → xylem

    (D) soil → root hair → epidermis → cortex → phloern → xylem

    Ans (B)

15. Regarding root pressure, which is not correct?

    (A) It is sufficient to rise water above ground level

    (B) It is positive in all except the tallest trees

    (C) It do not act as driving force for the mass flow of sugar

    (D) It is not able to push water up to small height in the stem

Ans (D)

16. No rupture and fraction occur in water column of vessels and tracheids during ascent of sap. It is because

    (A) they have lignified thick waits

    (B) they have weak gravitational pull

    (C) of cohesion and adhesion

    (D) transpiration pull **Ans** (C)

17. The concentration of minerals on the soil is usually ——— than / to the concentration of minerals in the roots. Fill in the above blank.

    (A) greater (B) equal (C) Both (A) and (B) (D) lower **Ans** (D)

18. Loss of water in liquid phase (in form of droplets) from the margin of leaves in many herbaceous plants is

    (A) guttation (B) root pressure (C) transpiration

    (D) transpiration pull **Ans** (A)

19. Which of the following ion helps in the opening and closing of stomata?

    (A) K^+ (B) Mn^+ (C) Mg^{2+} (D) Ca^{2+} **Ans** (A)

20. Which is not the function of transpiration?

    (A) Cooling leaf surface

    (B) Maintaining shape and structure of plant

    (C) Helping in translocation of sugars from source to sink

    (D) Providing water for photosynthesis

    Ans (C)

21. Xylem sap is made up of

    (A) water alone (B) water and minerals (C) minerals alone

    (D) sugar and water **Ans** (B)

22. Water in the vessel of xylem in tall plant is

    (A) pushed (B) pulled (C) pulled and pushed

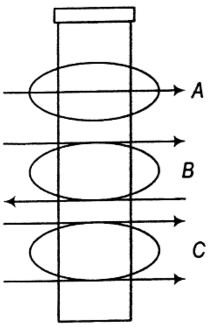
    (D) first pushed and it is pulled slowly **Ans** (B)

23. In plants; which of the following are/is translocated through phloem?

(A) Hormones (B) Amino acids

(C) Sugars (D) All of these **Ans** (D)

24. The given diagram shows cotransport method of two molecules. Labelled it correctly and choose the correct option accordingly.



(A) A – Uniport, B – Symport, C – Antiport

(B) A – Uniport, B – Antiport, C – Symport

(C) A – Symport, B – Uniport, C – Antiport

(D) A – Antiport, B – Uniport, C – Uniport

Ans (B)

25. Water potential of pure water can be increased due to

(A) addition of solute

(B) evaporation

(C) addition of inorganic substances

(D) increase in pressure

Ans (D)

****

1^{st} PU

Mineral Nutrition

1. The technique of growing plants in a nutrient solution is known as

   (A) hydroponics. (B) tissue culture. (C) aeroponics.

   (D) sand culture. **Ans** (A)

2. Which among the following includes only micronutrients?

   (A) Magnesium, iron and manganese.

   (B) Manganese, copper and zinc.

   (C) Boron, sulphur and phosphorus.

   (D) Chlorine, nickel and calcium. **Ans** (B)

3. Which among the following sets of elements is not included among the seventeen essential elements required by plants?

   (A) Nickel, boron and cobalt. (B) Silicon, zinc and boron.

   (C) Sodium, chlorine and boron. (D) Sodium, silicon and cobalt.
   Ans (D)

4. Which among the following is a macronutrient of plants?

   (A) Magnesium. (B) Manganese. (C) Copper.

   (D) Iron. **Ans** (A)

5. Which of the following is a component of nitrogenase and nitrate reductase enzymes?

   (A) Molybdenum. (B) Boron. (C) Copper. (D) Zinc. **Ans** (A)

6. The elements involved in water-splitting reactions of photosynthesis are

   (A) manganese and copper. (B) chlorine and manganese.

   (C) boron and chlorine. (D) zinc and copper. **Ans** (B)

7. The micronutrient needed for synthesis of auxin is

   (A) manganese. (B) zinc. (C) boron. (D) chlorine.

   Ans (B)

8. In plant metabolism, excess manganese inhibits the

(A) absorption of iron. (B) absorption of magnesium.

(C) translocation of calcium. (D) all of (A), (B) and (C) **Ans** (D)

9. Chlorosis is caused by the deficiency of elements

(A) N, K, Mg, S, Fe, Mn, Zn and Mo.

(B) Ca, Mg, Cu, K, S, Cl, Na and Co.

(C) N, K and S. (D) N, S and Mu. **Ans** (A)

10. Which of the following is caused in plants due to the deficiency of Ca, Mg, Cu and K?

(A) Chlorosis. (B) Necrosis. (C) Inhibition of cell division.

(D) Delay in flowing. **Ans** (B)

11. Which of the following statements are correct?

a. Deficiency of any element can cause multiple symptoms.

b. Same symptoms may be caused by the deficiency of one of several different elements.

c. The deficiency symptoms of nitrogen, potassium and magnesium are visible first in the younger leaves.

d. The deficiency symptoms of sulphur and calcium are visible first in senescent leaves.

(A) a and b are correct. (B) c and d are correct.

(C) All are correct. (D) All are incorrect. **Ans** (A)

12. Match the items listed under Column I with those listed under Column II. Select the correct option.

Column I (Processes)		**Column II (Micronutrient)**	
A.	Pollen germination	P.	Molybdenum
B.	Activation of carboxylase	Q.	Copper
C.	Nitrogen metabolism	R.	Chlorine
D.	Redox reactions	S.	Zinc
		T.	Boron

(A) A = S, B = T, C = Q, D = P (B) A = R, B = S, C = P, D = Q

(C) A = T, B = R, C = P, D = S (D) A = T, B = S, C = P, D = Q

Ans (D)

13. Identify (A) and (B) in the following equation and select the correct option.

$$\text{Ammonia} \xrightarrow{(A)} \text{Nitrite} \xrightarrow{(B)} \text{Nitrate}$$

(A) A = *Nitrobacter*, B = *Nitrosomones.*

(B) A = *Nitrosomonas*, B = *Pseudomonas.*

(C) A = *Nitrosomonas*, B = *Nitrobacter.*

(D) A = *Pseudomonas*, B = *Thiobacillus*.

Ans (C)

14. Which of the following is/are denitrifying bacteria?

(A) *Pseudomonas.* (B) *Thiobacillus*.

(C) *Nitrococcus*. (D) *Pseudomonas* and *Thiobacillus.* **Ans** (D)

15. In *Alnus* nitrogen fixing nodules are produced by

(A) *Beijernickia.* (B) *Frankia*. (C) *Rhodospirillum*.

(D) *Nostoc*. **Ans** (B)

16. The leg haemoglobin in root nodule of leguminous plants

(A) catalyses the conversion of atmospheric nitrogen to ammonia.

(B) catalyses the conversion of ammonia to nitrates.

(C) functions as an oxygen scavenger.

(D) helps to establish aerobic conditions.

Ans (C)

17. Which among the following fix atmospheric nitrogen?

(A) Only certain eukaryotic organisms.

(B) All prokaryotic organisms.

(C) Only certain prokaryotic organisms.

(D) Certain prokaryotic and certain eukaryotic organisms.

Ans (C)

18. Which of the following statements is correct?

(A) *Rhizobium* live as aerobes under free living condition and become anaerobic during nitrogen fixing events.

(B) *Rhizobium* live as anaerobes under free living conditions and become aerobic during nitrogen fixing events.

(C) *Rhizobium* is anaerobic in both free living and nitrogen fixing conditions.

(D) *Rhizobium* is aerobic in both free living and nitrogen fixing conditions.

Ans (A)

19. The number of ATP molecules required for the formation of each NH_3 molecule during nitrogen fixation process is

(A) one. (B) two. (C) four. (D) eight. **Ans** (D)

20. The technique of growing plants in a nutrient solution was first demonstrated by

(A) F.W. went (B) Julius von Sachs (C) Francis Darwin

(D) Liebig **Ans** (B)

21. Macronutrients of plants are those generally occurring

(A) less than 10 g/kg dry ht.

(B) in excess of 10 m mol/kg dry wt.

(C) more than 100 gm/kg dry wt.

(D) in excess of 1 m mol/kg fresh wt. **Ans** (B)

22. Match the items listed under column I with those listed under column II. Select the correct option.

Column I (Micronutrients)		Column II (Importance)	
A.	Potassium	P.	Structure of chlorophyll
B.	Magnesium	Q.	Opening and closing of stomata.
C.	Sulphur	R.	Structure of cytochromes.
D.	Iron	S.	Structure of methionine.

(A) A = Q, B = P, C = S, D = R.

(B) A = P, B = Q, C = S, D = R.

(C) A = Q, B = P, C = R, D = S

(D) A = S, B = R, C = Q, D = P. **Ans** (A)

23. Translocation of mineral salts in plants is through
    (A) xylem. (B) phloem. (C) cortex. (D) pith. **Ans** (A)

24. Which among the following is/are a chemoautotroph/s?
    (A) *Nitrobacter*. (B) *Escherichia*. (C) *Lactobacillus*.

    (D) *Escherichia* and *Lactobacillus*. **Ans** (A)

25. Which of the following is/are example/s for free living nitrogen fixing cyanobacteria?
    (A) *Anabaena*. (B) *Nostoc*. (C) *Frankia*. (D) Both (A) and (B)
    Ans (D)

****

1st PU

Photosynthesis

1. Who discovered that light is essential for releasing oxygen in plants?

   (A) Stephen Hales (B) Lavoisier

   (C) Jan lngenhousz (D) von Helmont **Ans** (C)

2. If green plants are incubated with O_{18} labelled water, which molecule (photosynthesis product) will become radioactive?

   (A) O_2 (B) CO_2 (C) Glucose (D) ATP **Ans** (A)

3. Which is the correct reaction of photosynthesis?

   (A) $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} 6O_2 + C_6H_{12}O_6$

   (B) $6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

   (C) $C_6H_{12}O_6 + 6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} 6CO_2 + 12H_2O + \text{Energy}$

   (D) $C_6H_{12}O_6 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} 6CO_2 + 6H_2O + \text{Energy}$

   Ans (B)

4. Which of the following statements are correct?

   I. Light reaction occurs in stroma.

   II. Light reaction occurs in grana.

   III. Dark reaction occurs in stroma.

   IV. Dark reaction occurs in grana.

   Choose the correct option.

   (A) I and II (B) II and IV

   (C) III and IV (D) II and III **Ans** (D)

5. The movement of electrons in ETC in light reaction is?

   (A) up hill in terms of redox reaction

   (B) downhill in terms of redox reaction

   (C) Either (A) or (B)

   (D) Both (A) and (B) **Ans** (B)

6. The Z scheme of electron transport is

(A) Cyclic photophosphorylation

(B) Non-cyclic photophosphorylation

(C) Both (A) and (B)

(D) Only photosystem pigment-I is involved

Ans (B)

7. Electrons which gets excited in PS-I must be replaced. These replacement ultimately come from

(A) ATP (B) H_2O

(C) PS-II (D) NAD **Ans** (B)

8. The water splitting complex is associated with

(A) PS-I (B) PS-II

(C) carotenoid (D) xanthophyll **Ans** (B)

9. Cyclic photophosphorylation occurs in

(A) stroma lamellae (B) thylakoid

(C) stroma cell wall (D) grana cell wall **Ans** (A)

10. Joseph Priestley observed that when mouse alone was placed in a closed bell jar with burning candle, it was suffocated and candle burning extinguished but when mouse was placed with a mint plant in the same bell jar that mouse stayed alive and candle continued to burn. What did he conclude from this experiment?

(A) Burning candle remove the air

(B) Mint plant restore the air

(C) Both (A) and (B)

(D) CO_2 is required for burning of candle **Ans** (C)

11. Which hypothesis best explains the synthesis of ATP in chloroplast?

(A) Chemosynthetic hypothesis

(B) Chemiosmotic hypothesis

(C) Potential gradient hypothesis

(D) Redox gradient hypothesis **Ans** (B)

12. ATP synthesis is linked to

(A) development of pressure gradient across membrane

(B) development of osmotic gradient across membrane

(C) development of proton gradient across membrane

(D) development of electron gradient across membrane **Ans** (C)

13. If the light becomes unavailable during photosynthesis, then

(A) immediately biosynthetic process stops

(B) biosynthetic phase does not stop indefinitely

(C) biosynthetic phase stops forever

(D) biosynthetic phase continues for some time and then stops

Ans (D)

14. In C_4-pathway, the first product identified was

(A) 3-PGA (B) C4 acid like OAA

(C) 2-PGA (D) 1-3DPGA **Ans** (B)

15. Who provided the evidence for the production of glucose when plant grows?

(A) Julius von Sachs (B) Stephen Hales

(C) Lavoisier (D) Von Helmont **Ans** (A)

16. Match the following columns.

Column I		Column II	
(a)	Chlorophyll-a	1.	Blue green
(b)	Chlorophyll-b	2.	Yellow green
(c)	Xanthophyll	3.	Yellow
(d)	Carotenoid	4.	Yellow to yellow orange

	a	**b**	**c**	**d**
(A)	1	2	3	4
(B)	1	3	2	4

(C)	4	3	1	2
(D)	4	3	2	1

Ans (A)

17. In which region, most of the photosynthesis takes place?

    (A) red and green region (B) violet and indigo region

    (C) blue and red region (D) blue and black region

    Ans (C)

18. Light Harvesting Complex (LHC) is

    (A) one molecule of chlorophyll-a

    (B) very few molecules of chlorophyll-a

    (C) hundreds of pigment molecules bound to proteins

    (D) chlorophyll-a + chlorophyll-c + protein + DNA

    Ans (C)

19. During light reaction of photosynthesis

    (A) ADP is phosphorylated and NADPH oxidised

    (B) ADP is phosphorylated and NADP reduced

    (C) ADP is phosphorylated and NADPH reduced

    (D) ATP is phosphorylated and NADPH reduced

    Ans (B)

20. During the dark reaction, the acceptor of CO_2 is

    (A) $NADPH_2$ (B) RuBP

    (C) H_2O (D) CO_2 **Ans** (B)

21. Fixation of six molecules of CO_2 needs

    (A) 5 turns of Calvin cycle (B) 6 turns of Calvin cycle

    (C) 3 turns of Calvin cycle (D) 2 turns of Calvin cycle

    Ans (B)

22. In dark reaction, regeneration of RUBP needs

(A) 2 molecule of ATP (B) 1 molecule of ATP

(C) 3 molecule of ATP (D) 4 molecule of ATP **Ans** (B)

23. RuBisCO is found in

(A) cytoplasm (B) nucleus (C) mitochondria

(D) chloroplast **Ans** (D)

24. Primary acceptor of CO_2 in C_4-cycle is

(A) PGA (B) PEP (C) RuBP (D) OAA **Ans** (B)

25. In C_3 plant, when O_2 concentration is more, the O_2 binds to RuBisCO and RuBP gets changed to

(A) 2 molecules of PGA

(B) 2 molecules of phosphoglycerate

(C) 2 molecules of phosphoglycolate

(D) one molecule each of phosphoglycerate and phosphoglycolate

Ans (D)

26. During the light reaction, the water splits into

(A) H^+, O_2 electrons (B) H_2, O_2 electrons

(C) $2H^+, \frac{1}{2}O_2$ 2 electrons (D) $\frac{1}{2}H_2, \frac{1}{2}O_2$ electrons **Ans** (C)

27. Law of limiting factor in relation to photosynthesis was proposed by

(A) Blackman (B) Weisman (C) Calvin (D) Emerson

Ans (A)

28. Under normal condition, which one of the following is a major limiting factor?

(A) Light (B) CO_2 (C) Temperature (D) Chlorophyll

Ans (B)

29. In sugar cane plant, CO_2 is fixed as a C4 acid. The enzyme that fixes carbon dioxide is

(A) Ribulose phosphate kinase (B) Fructose phosphate

(C) Ribulose biphosphate carboxylase

(D) Phosphoenol pyruvic acid carboxylase **Ans** (D)

30. C_3-plant show optimum photosynthesis at

(A) high O_2 (B) high CO_2

(C) low O_2 (D) high temperature = 45°C **Ans** (B)

****

1st PU

Respiration in Plants

1. The compounds which are oxidised during respiration are known as

   (A) respiratory substrates (B) sugars

   (C) hexoses (D) combustible substances

   Ans (A)

2. Plant does not need specialised respiratory organ because

   (A) each plant part takes care of its own gas exchange needs

   (B) plants do not need great demands for gas exchange

   (C) both (A) and (B) (D) plants do not respire

   Ans (C)

3. The cellular respiration first takes place in the

   (A) Cytoplasm (B) Golgi bodies

   (C) Endoplasmic reticulum (D) Lysosomes **Ans** (A)

4. How many times is ATP utilised in glycolysis?

   (A) 2 (B) 3 (C) 4 (D) 5 **Ans** (A)

5. Phase common to aerobic and anaerobic respiration is

   (A) Krebs' cycle (B) glycolysis (C) glycogenolysis

   (D) ETS **Ans** (B)

6. Glycolysis is also known as

   (A) EMP pathway (B) PMC pathway

   (C) CMI pathway (D) TMC pathway **Ans** (A)

7. Among the following, identify the substrate required for the only oxidative reaction that occurs in the process of glycolysis:

   (A) 3-phosphoglyceric acid (B) Glyceraldehyde 3-phosphate

   (C) Fructose-6-phosphate (D) Glucose-6-phosphate

   Ans (B)

8. The end product of glycolysis is

(A) pyruvic acid (B) acetyl coenzyme

(C) citric acid (D) oxalo acetic acid **Ans** (A)

9. Net gain of ATP from one molecule of glucose in glycolysis is

(A) 3 (B) 4 (C) 5 (D) 2 **Ans** (D)

10. Pyruvate $\rightarrow C_2H_5OH + CO_2$

The above reaction needs two enzymes named as

(A) pyruvate decarboxylase and alcohol dehydrogenase

(B) pyruvate decarboxylase and enolase

(C) pyruvate decarboxylase and pyruvate kinase

(D) pyruvate carboxylase and aldolase

Ans (A)

11. During intense exercise, pyruvic acid is reduced to

(A) lactic acid (B) fumaric acid

(C) glutamic acid (D) oxaloacetic acid **Ans** (A)

12. In oxidative decarboxylation, what converts PA into Acetyl-CoA

(A) pyruvate decarboxylase (B) pyruvate dehydrogenase

(C) pyruvate hydrogeneticase (D) pyruvate dehydrogeneticase

Ans (B)

13. Which is/are product of aerobic respiration?

(A) CO_2 and H_2O (B) Ethyl alcohol

(C) Lactic acid (D) Pyruvic acid **Ans** (A)

14. Connecting link between glycolysis and Krebs' cycle is

(A) Acetyl Co-A (B) pyruvic acid

(C) CO_2 (D) OAA **Ans** (A)

15. Most of the TCA cycle enzymes are present in

(A) cytoplasm (B) inter membrane space of mitochondria

(C) mitochondrial matrix (D) inner membrane of mitochondria

Ans (C)

16. In citric acid cycle first step is

    (A) Acetyl Co-A combines with oxalo acetic acid

    (B) Acetyl Co-A combines with citric acid

    (C) Citric acid combines with oxaloacetic acid

    (D) Citric acid combines with malic acid

    Ans (A)

17. Acetyl Co-A binds to oxaloacetic acid to form

    (A) formaldehyde (B) citrate

    (C) acetate (D) isocitrate **Ans** (B)

18. Decarboxylation is involved in

    (A) electron transport system (B) glycolysis

    (C) Krebs' cycle (D) lactic acid fermentation **Ans** (C)

19. In Krebs' cycle

    (A) ATP is converted into ADP

    (B) pyruvic acid is converted into CO_2 and H_2O

    (C) glucose is converted into CO_2

    (D) pyruvic acid is converted into ATP **Ans** (B)

20. In the electron transport system present in the inner mitochondrial membrane, Complex I and IV are respectively.

    (A) NADH dehydrogenase and $FADH_2$

    (B) $NADH_2$ and NADH dehydrogenase

    (C) NADH dehydrogenase and cytochrome C oxidase complex

    (D) NADH dehydrogenase and ATP synthetase **Ans** (C)

21. α-ketoglutarate acid, an intermediary compound of Krebs' cycle is a

    (A) 5-carbon compound

    (B) 6-carbon compound

    (C) 4-carbon compound

    (D) 3- carbon compound **Ans** (A)

22. In Krebs' cycle, GTP in formed by

(A) oxidative phosphorylation

(B) substrate level phosphorylation

(C) photophosphorylation

(D) decarboxylation

Ans (B)

23. Last electron acceptor during ETS is

(A) O_2 (B) cyt-*a* (C) cyt-a_2 (D) cyt-a_3

Ans (A)

24. How many ATP is released respectively when NADH and $FADH_2$ molecules get oxidised?

(A) 3 ATP, 2 ATP (B) 2 ATP, 3 ATP

(C) 5 ATP, 4 ATP (D) 3ATP, 5ATP **Ans** (A)

25. The Respiratory Quotient (RQ) or respiratory ratio is

(A) $RQ = \frac{\text{Volume of } O_2 \text{evolved}}{\text{Volume of } CO_2 \text{consumed}}$

(B) $RQ = \frac{\text{Volume of } O_2 \text{consumed}}{\text{Volume of } CO_2 \text{evolved}}$

(C) $RQ = \frac{\text{Volume of } CO_2 \text{consumed}}{\text{Volume of } O_2 \text{evolved}}$

(D) $RQ = \frac{\text{Volume of } CO_2 \text{evolved}}{\text{Volume of } O_2 \text{consumed}}$

Ans (D)

****

1st PU

Plant Growth and Development

1. Study the following statements of plants growth.

   I. One single maize root apical meristem can give rise to more than 17500 new cells per hour.

   II. A cell in watermelon can increase its size up to 3,50,000 limes.

   III. Growth of pollen tube is measured in the terms of its weight.

   IV. Growth in dorsiventral leaf is measured in terms of an increase in its number of cells produced.

   Choose the correct option.

   (A) I and II (B) II and III

   (C) III and IV (D) I, II and IV **Ans** (A)

2. I. Increased vacuolation.

   II. Cell enlargement. III. New cell wall deposition.

   Which of the above are the characteristics of phase of elongation?

   (A) I and II (B) II and III (C) I and III

   (D) I hand III **Ans** (D)

3. In ...A... growth, following mitotic cell division, only one daughter cell continues to divide, while other ...B... and matures. Fill A and B with appropriate option.

   (A) A-arithmetic; B-divide (B) A-geometrical; B-differentiate

   (C) A-arithmetic; B-differentiate (D) A-geometrical; B-divide

   Ans (C)

4. I. Lag phase. II. Stationary phase. III. Exponential phase.

   Arrange the above steps of geometrical growth (from beginning to last) in a correct sequence of their occurrence and choose the correct option accordingly.

   (A) I $\rightarrow$ II $\rightarrow$ III (B) I $\rightarrow$ III $\rightarrow$ II (C) III $\rightarrow$ II $\rightarrow$ I

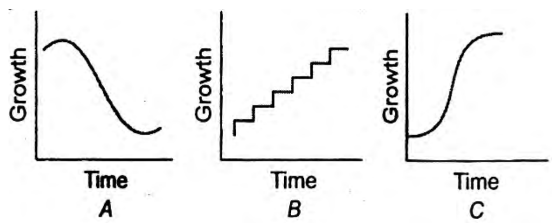
   (D) III $\rightarrow$ II $\rightarrow$ II **Ans** (B)

5. In the expression, $W_1 = W_0 e^{rt}$ (geometrical growth), W_1, W_0, r, t represents

	W_0	**W_1**	**r**	**t**
(A)	Initial size	Final size	Growth rate	Time of growth
(B)	Final size	Initial size	Growth rate	Time of growth
(C)	Final size	Initial size	Growth rate	Time of dividing
(D)	Initial size	Final size	Growth rate	Time of dividing

Ans (A)

6. Which of the following graphs shows the sigmoid growth curve?



(A) A and B (B) C (C) A (D) B **Ans** (B)

7. Which tissue was formed by redifferentiation?

(A) Cork cambium (B) Secondary cortex

(C) Meristems (D) Interfasicular cambium **Ans** (B)

8. Match the following columns.

Column I		**Column II**	
a	Plant growth promoters	1.	Auxin
b	Plant growth inhibitor	2.	Gibberellin
		3.	Abscisic acid
		4.	Cytokinin

Codes

	a	b
(A)	1, 2, 3	4
(B)	4	1, 2, 3
(C)	3	1, 2, 4
(D)	1, 2, 4	3

Ans (D)

9. Auxin was first isolated by

   (A) Charles Darwin (B) Francis Darwin

   (C) F W Went (D) de Vries **Ans** (C)

10. 'Bakane' (foolish seedling) disease of rice seedlings, was caused by

    (A) fungi (B) Protozoa (C) bacteria

    (D) virus **Ans** (A)

11. Canary grass experiment for phototropism was first conducted by

    (A) Went (B) Darwin (C) Cousins

    (D) Kurosawa **Ans** (B)

12. Match the following columns.

Column I		**Column II**	
a	Natural auxin	1.	IAA
b	Synthetic auxin	2.	NAA
		3.	IBA
		4.	2-4-D

Codes

	a	b

(A)	1, 2	3, 4
(B)	3, 4	1, 2
(C)	1, 3	2, 4
(D)	2, 4	1, 3

Ans (C)

13. Member of auxin, which is widely used to kill the dicotyledonous weed is

    (A) lAA (B) IBA (C) NAA (D) 2-4-D **Ans** (D)

14. Which one of the following is not an effect of gibberellin?

    (A) Increase grapes stalk (B) Delay senescence of fruit

    (C) Induce dormancy (D) Increase sugarcane stem

    Ans (C)

15. Which plant hormone is found in gaseous form?

    (A) Auxin (B) Cytokinin (C) Ethylene

    (D) ABA **Ans** (C)

16. Which one is not an ethylene effect?

    (A) Swelling of axis

    (B) Apical hook formation in dicot seedlings

    (C) Horizontal growth of seedling

    (D) Apical dominance **Ans** (D)

17. Most widely used compound as a source of ethylene is

    (A) nepthol (B) acetol (C) ethephon (D) ethen

    Ans (C)

18. Which hormone is called the dormancy hormone?

    (A) IAA (B) NAA (C) ABA (D) GA **Ans** (C)

19. I. Leaf abscission is ...A... by auxin in younger leaves and fruits.

    II. Apical dominance is ...B... by auxin.

Complete the given statement by choosing appropriate options for the given blanks.

(A) A-inhibited; B-promoted (B) A-promoted; B-inhibited

(C) A-inhibited; B-inhibited (D) A-promoted; B-promoted

Ans (A)

20. Which PGR counteracts the apical dominance induced by auxin?

(A) IAA (B) Cytokinin (C) C_2H_4

(D) NAA **Ans** (B)

21. Internodal elongation just prior to flowering in beet, cabbage and in many plants with rosette habit is called

(A) pruning (B) bolting (C) grafting

(D) cutting **Ans** (B)

22. Apple's elongation and improvement of its shape is performed by

(A) auxin (B) ethylene (C) C_2H_4

(D) GA **Ans** (D)

23. The site of perception of light for photoperiodism is

(A) root (B) shoot (C) leaves (D) meristem

Ans (C)

24. Flowering of plants by exposure to low temperature is called

(A) vernalisation (B) cryobiology (C) photoperiodism

(D) micrografting **Ans** (A)

25. 'Bakane' disease is related to which hormone and in which plant?

	Hormone	**Plant**
(A)	Auxin	Wheat
(B)	Cytokinin	Corn
(C)	Gibberellin	Rice
(D)	Ethylene	Tomato

Ans (C)

****

1st PU

Digestion and Absorption of Food

1. Which is the correct sequence of the four layers of alimentary canal from periphery to centre?

   (A) Muscularis → Serosa → Mucosa → Submucosa

   (B) Serosa → Mucosa → Muscularis → Submucosa

   (C) Serosa → Muscularis → Submucosa → Mucosa

   (D) Serosa → Mucosa → Submucosa → Muscularis

   Ans (C)

2. The type of dentition found in human beings is

   (A) polyphyodont, thecodont (B) diphyodont and thecodont

   (C) diphyodont and acrodont (D) diphyodont and homodont

   Ans (B)

3. Which of the following is not a cause of indigestion?

   (A) Overeating (B) Anxiety (C) Oversleeping (D) Infection

   Ans (C)

4. What is frenulum?

   (A) It is the fold by which tongue is attached to the floor of oral cavity

   (B) It is an adenoid which is present on pharyngeal wall

   (C) It is a tonsil like structure on the lateral walls of palate

   (D) It is a V-shaped furrow which divides the surface of tongue

   Ans (A)

5. Which one serves as a passage for both food and air?

   (A) Larynx (B) Pharynx (C) Gullet (D) Glottis **Ans** (B)

6. Opening of oesophagus into 'J'-shaped, bag-like structure is regulated by

   (A) pyloric sphincter (B) sphincter of Oddi

   (C) ileocaceal sphincter (D) gastro oesophageal sphincter

   Ans (D)

7. Which is not part of large intestine?

(A) Rectum (B) Caecum (C) Ileum (D) Colon

Ans (C)

8. Out of four layers of alimentary canal, which one forms villi?

(A) Serosa (B) Mucosa (C) Submucosa (D) Muscularis

Ans (B)

9. Common bile duct is formed by the fusion of

(A) pancreatic duct and cystic duct

(B) pancrealic duct and hepatic duct

(C) pancreatic duct, hepatic duct and cystic duct

(D) hepatic duct and cystic duct **Ans** (D)

10. Sphincter of Oddi guards

(A) Opening of hepatopancreatic duct into duodenum

(B) Opening of hepatic ducts before joining the cystic duct

(C) Opening of stomach into duodenum

(D) Opening of cystic duct into pancreatic duct **Ans** (A)

11. Which component of gastric juices inactivates salivary amylase?

(A) Mucus (B) Rennin (C) HCl (D) Pepsin **Ans** (C)

12. What is the dental formula of human being?

(A) $\frac{2123}{2123}$ (B) $\frac{2123}{2213}$ (C) $\frac{2114}{2114}$ (D) $\frac{2122}{2122}$

Ans (A)

13. Pepsinogen is converted into pepsin with the help of

(A) Proenzyme (B) Hydrochloric acid

(C) Electrolyte (D) Bicarbonates **Ans** (B)

14. Which enzyme is responsible for the digestion of milk in infants?

(A) Pepsin (B) Trypsin (C) Rennin

(D) Any proteolytic enzyme **Ans** (C)

15. Succus entericus is secreted by

(A) Goblets cell (B) Crypt of Lieberkuhn glands

(C) Islets of Langerhans (D) Paneth cells **Ans** (B)

16. Bile salts activate which enzyme?

(A) Lipase (B) Pancreatic amylase (C) Pepsinogen

(D) Trypsinogen **Ans** (A)

17. In which part of the small intestine, starch is digested?

(A) Duodenum (B) Jejunum (C) Ileum (D) All of these

Ans (A)

18. Name the cells that produce hydrochloric acid in stomach

(A) Chief cells (B) Goblet cells (C) Parietal cells

(D) Endocrine cells **Ans** (C)

19. The form in which the synthesised fats are liberated from the intestinal wall into the lymph present in the lymphatic capillaries is

(A) Micelles (B) Chylomicrons (C) Fatty acids

(D) Both (A) and (B) **Ans** (B)

20. Which is not a disorder of the digestive system?

(A) Jaundice (B) Diarrhoea (C) Emphysema

(D) Constipation **Ans** (C)

21. Lipids, which are present in oil-based dressing and ice-creams, during digestion are hydrolysed into

(A) glucose and amino acids (B) glucose and fatty acids

(C) glycerol and amino acids (D) glycerol and fatty acids

Ans (D)

22. Match the following columns.

Column I		**Column II**	
a.	Salivary amylase	1.	Proteins
b.	Bile salts	2.	Milk proteins

c.	Rennin	3.	Starch
d.	Pepsin	4.	Lipids
e.	Lipase	5.	Emulsification of fats

Codes

	a	**b**	**c**	**d**	**e**
(A)	5	4	1	2	3
(B)	2	3	4	5	1
(C)	2	4	3	1	5
(D)	3	5	2	1	4

Ans (D)

23. Which is the hardest material of the human body?

    (A) Dentine (B) Enamel (C) Teeth (D) Bone

    Ans (B)

24. Which is the largest gland of human body?

    (A) Gastric gland (B) Pancreas (C) Liver (D) Salivary gland

    Ans (C)

25. Name that part of small intestine in which the pyloric region of stomach opens.

    (A) Duodenum (B) Ileum (C) Jejunum (D) Caecum

    Ans (A)

****

1st PU

Breathing and Exchange of Gases

1. One of the major causes of emphysema is

   (A) Pollution (B) Bacterial infection

   (C) Cigarette smoking (D) Unsanitary conditions **Ans** (C)

2. Match the following columns.

Column I Organism		Column II Respiratory structure	
a.	Earthworms	1.	Network of tubes
b.	Aquatic arthropods	2.	Lungs
c.	Insects	3.	Gills
d.	Snakes	4.	Moist cuticle
e.	Molluscs		

Codes

	a	**b**	**c**	**d**	**e**
(A)	1	2	3	4	3
(B)	4	3	1	2	3
(C)	4	2	1	3	3
(D)	4	2	3	1	3

Ans (B)

3. Correct partial sequence of the air passage in humans is

   (A) Nose → Larynx →Pharynx → Bronchioles → Alveoli

   (B) Nose → Pharynx → Larynx → Bronchioles → Bronchi

   (C) Nose → Pharynx → Larynx → Bronchioles → Trachea

   (D) Nose → Pharynx → Larynx → Bronchioles → Alveoli

   Ans (D)

4. Match the following columns.

Column I		Column II	
a.	Tidal Volume (TV)	1.	1100 to 1200 mL
b.	Inspiratory Reserve Volume (IRV)	2.	1000 to 1100 mL
c.	Expiratory Reserve Volume (ERV)	3.	2500 to 3000 ml
d.	Residual Volume (RV)	4.	500 m L

Codes

	a	b	c	d
(A)	1	2	3	4
(B)	4	1	2	3
(C)	4	3	1	2
(D)	4	3	2	1

Ans (D)

5. Which of the following statements is incorrect about pharynx?

(A) Internal nostrils opens into nasopharynx

(B) It is the passage for air only

(C) It leads into the windpipe and food pipe

(D) It is a common passage for respiratory and digestive tracts

Ans (B)

6. Friction on the lungs is surface reduced by

(A) double layered pleura (B) single layered pleura

(C) ribs covering lungs (D) mucous membrane surrounding the lungs

Ans (A)

7. Conducting part of the respiratory system comprises

   (A) external nostrils upto the terminal bronchioles

   (B) internal nostrils upto trachea (C) epiglottis upto trachea

   (D) larynx upto bronchi **Ans** (A)

8. At which thoracic vertebra does trachea divide into right and left primary bronchi?

   (A) 5 (B) 6 (C) 9 (D) 4 **Ans** (A)

9. Actual site of exchange of gases in the lungs is

   (A) alveoli (B) pleura (C) bronchioles (D) tracheoles **Ans** (A)

10. Which of the following structure is present inside the larynx?

    (A) Glottis (B) Epiglottis (C) Vocal cords (D) Gullet **Ans** (C)

11. During expiration, the diaphragm becomes

    (A) normal (B) flattened (C) dome-shaped (D) oblique

    Ans (C)

12. Additional muscles that impact the ability of humans to increase the strength of inspiration and expiration are present in

    (A) chest (B) diaphragm (C) abdomen (D) lungs **Ans** (C)

13. Tidal volume is

    (A) volume of air inspired or expired during effortless breathing

    (B) additional volume of air a person can inspire forcibly

    (C) additional volume of air, a person can expire forcibly

    (D) volume of air in the lungs remaining after forcible expiration

    Ans (A)

14. How many layers are present in the diffusion membrane of alveoli?

    (A) 5 (B) 3 (C) 2 (D) 4 **Ans** (B)

15. Match the following columns.

Column I		**Column II**	
a.	IC	1.	TV and IRV

b.	EC	2.	TV and ERV
c.	FRC	3.	ERV and RV
d.	VC	4.	ERV, TV and RV

Codes

	a	**b**	**c**	**d**
(A)	1	2	3	4
(B)	1	4	3	2
(C)	1	4	2	3
(D)	4	3	2	1

Ans (A)

16. Factors affecting the rate of diffusion is/are

(A) Pressure gradient (B) Solubility of gases

(C) Thickness of membranes (D) All of these **Ans** (D)

17. The partial pressure of O_2 is the highest in

(A) alveoli (B) oxygenated blood

(C) deoxygenated blood (D) tissues **Ans** (A)

18. The total thickness of the diffusion membrane of alveolus capillary is

(A) less than 1cm (B) less than 2 cm (C) less than 1 mm

(D) more than 1 mm **Ans** (C)

19. Almost same pCO_2 in humans is found in

(A) oxygenated blood and tissues

(B) deoxygenated blood and oxygenated blood

(C) deoxygenated blood and tissues

(D) All of the above

Ans (C)

20. Each haemoglobin molecule can carry maximum of

(A) two molecules of O_2 (B) three molecules of O_2

(C) four molecules of O_2 (D) one molecule of O_2 **Ans** (C)

21. Under which condition, dissociation of oxygen from oxyhaemoglobin in tissues occurs?

(A) Low pO_2 (B) High pCO_2 (C) High H

(D) All of these **Ans** (D)

22. Under normal conditions, what amount of O_2 is delivered by 100 mL of the oxygenated blood?

(A) 5 mL (B) 4 mL (C) 3 mL (D) 2 mL

Ans (A)

23. Which part of the brain contains respiratory rhythm centre?

(A) Cerebellum region (B) Brain stem region

(C) Medulla region (D) Temporal region **Ans** (C)

24. Emphysema is a chronic disorder which is characterized by

(A) damaged trachea (B) damaged nostrils

(C) damaged alveolar walls (D) damaged windpipe **Ans** (C)

25. Which part of the respiratory system has the smallest diameter?

(A) Right primary bronchus (B) Left primary bronchus

(C) Tertiary bronchi (D) Respiratory bronchiole **Ans** (D)

****

1st PU

Body Fluids and Circulation

1. To obtain a standard ECG, the patient is connected to the machine with three electrical leads. These three electrical lead are connected as one each to the

   (A) biceps and third one at the ankles

   (B) triceps and third one at the ankle

   (C) wrists and third one at the right ankle

   (D) wrists and third one at the left ankle

   Ans (D)

2. Match the following columns.

Column I		Column II	
a.	Fibrinogen	1.	Clotting or coagulation of blood
b.	Globulins	2.	Defence mechanism of body
c.	Albumins	3.	Osmotic balance

   Codes

	a	b	c
(A)	3	2	1
(B)	3	1	2
(C)	2	1	3
(D)	1	2	3

   Ans (D)

3. Universal donors and universal recipients are

   (A) A, B and O blood groups, respectively

   (B) O and AB blood groups, respectively

   (C) O and A blood groups, respectively

   (D) AB and O blood groups, respectively

   Ans (B)

4. How many double circulations are normally completed by the human heart in one minute?

(A) 8 (B) 10 (C) 36 (D) 72 **Ans** (D)

5. Most abundant cells in the human blood are

(A) WBC (B) Plasma cells (C) RBC (D) Platelets

Ans (C)

6. Match the following columns.

Column I		**Column II**	
a.	Basophils	1.	Phagocytes
b.	Neutrophils	2.	Secrete histamine, serotonin and heparin
c.	Monocytes	3.	Allergic reaction
d.	Eosinophils	4.	Immunity
e.	Lymphocytes	5.	

Codes

	a	**b**	**c**	**d**	**e**
(A)	1	2	3	4	1
(B)	2	1	1	3	4
(C)	1	1	2	3	4
(D)	4	1	2	3	3

Ans (B)

7. Properties of human RBCs are

I. devoid of nucleus at maturity II. formed in bone marrow

III. possess defence properties IV. biconcave in shape

V. help in blood clotting.

Choose the option with correct properties.

(A) I, II and III (B) I, II and IV

(C) III, IV and V (D) II, III and IV

Ans (B)

8. A healthy individual has . . .A... grams of haemoglobin in every . . .B... mL of blood. Choose the correct option for A and B.

(A) A-12-16, B-100 (B) A-6-8, B-100

(C) A-7-10, B-100 (D) A-16-20, B-1000 **Ans** (A)

9. The graveyard of RBC is

(A) liver (B) stomach (C) spleen (D) bone marrow **Ans** (C)

10. I. Neutrophils II. Eosinophils

III. Basophils IV. Lymphocytes

V. Monocytes

Identify whether the given cell types are granulocytes (A) or agranulocytes (B) and choose the correct option accordingly.

	A	**B**
(A)	I, II, III	IV, V
(B)	I, III, IV	II, V
(C)	IV, V	I, II, III
(D)	II, V	I, III, IV

Ans (A)

11. Example of Rh incompatibility during pregnancy is

(A) mother Rh –ve and father Rh +ve

(B) father Rh –ve and mother Rh +ve

(C) Both Rh –ve

(D) Both Rh +ve

Ans (A)

12. Source of thromboplastin in the human blood is

(A) WBC (B) RBC (C) Blood platelets (D) Both (B) and (C)

Ans (C)

13. Blood coagulation occurs in the presence of

(A) Ca^{2+} (B) Mg^{2+} (C) Fe^{2+} (D) Fe^{3+} **Ans** (A)

14. Which among the following is the principal cation in the human blood?

(A) Potassium (B) Sodium (C) Calcium (D) Manganese

Ans (B)

15. Match the following columns.

Column I		Column II	
a.	Neutrophils	1.	20-25% of WBC
b.	Basophils	2.	2-3% of WBC
c.	Monocytes	3.	6-8% of WBC
d.	Eosinophils	4.	0.5-1% of WBC
e.	Lymphocytes	5.	60-65% of WBC

Codes

	a	b	c	d	e
(A)	5	4	3	2	1
(B)	5	4	2	3	1
(C)	1	2	3	4	5
(D)	5	2	4	3	1

Ans (A)

16. Tricuspid valve is present in between

(A) right atrium and right ventricle

(B) right atrium and left ventricle

(C) left atrium and left ventricle

(D) left atrium and right ventricle **Ans** (A)

17. The valves in the heart allows the blood flow in which direction?

I. From atria to ventricles.

II. From ventricles to pulmonary artery.

III. From pulmonary artery to aorta.

Choose the correct option.

(A) I and II (B) II and III (C) III and I

(D) All of these **Ans** (A)

18. The wall of the ventricles are much thicker than that of atria because

(A) It has to pump the blood over a longer distance

(B) It has to receive the blood at high pressure from atria

(C) It is present below the atria (D) It has to store the blood

Ans (A)

19. SAN can generate impulses

(A) 70-75 min^{-1} (B) 50-55 min^{-1} (C) 100-150 min^{-1}

(D) 35-40 min^{-1} **Ans** (A)

20. In the ventricular diastole, the ...A... valve closes. This causes the heart sound ...B.... Choose the correct option for A and B.

(A) A-Semilunar; B-Dub (B) A-Mitral; B-Dub

(C) A-Bicuspid; B-Dub (D) A-Tricuspid; B-Dub **Ans** (A)

21. Cardiac output is

(A) volume of the blood pumped out by each ventricle per minute

(B) volume of the blood contained in the entire heart

(C) volume of the total blood pumped by heart

(D) volume of the blood received by the heart

Ans (A)

22. Match the following columns.

Column I		**Column II**	
a.	P	1.	Electrical excitation of atria

b.	QRS	2.	Repolarisation of ventricles
c.	T	3.	Depolarisation of ventricles

Codes

	a	**b**	**c**
(A)	1	2	3
(B)	1	3	2
(C)	3	2	1
(D)	3	1	2

Ans (B)

23. Match the following columns.

Column I		**Column II**	
a.	Superior vena cava	1.	Carries oxygenated blood
b.	Inferior vena cava	2.	Carries deoxygenated blood
c.	Pulmonary artery	3.	Brings deoxygenated blood from lower part of body to right atrium
d.	Pulmonary vein	4.	Bring deoxygenated blood from upper part of body to right atrium

Codes

	a	**b**	**c**	**d**
(A)	1	2	3	4
(B)	4	3	2	1
(C)	4	2	3	1
(D)	1	4	3	2

Ans (B)

24. SA node is located in

(A) upper lateral wall of left atrium

(B) lower lateral wall of left atrium

(C) lower lateral wall of right atrium

(D) upper lateral wall of right atrium **Ans** (D)

25. Purkinje fibres are present in

(A) left auricle (B) right auricle

(C) ventricular myocardium (D) SAN **Ans** (C)

26. Cardiac output is

(A) Stroke volume × Heart rate = 72 mL/m

(B) Stroke volume × Heart rate = 5 L/m

(C) Stroke volume × Heart rate = 500 m

(D) Stroke volume × Heart rate = 3 mL/m **Ans** (B)

27. Match the following columns.

Column I		**Column II**	
a.	Fishes	1.	One atrium one ventricle
b.	Amphibians	2.	Two atria two ventricles
c.	Most reptiles	3.	Two atria one ventricle
d.	Mammals		

Codes

	a	**b**	**c**	**d**
(A)	1	2	2	3
(B)	3	2	2	1
(C)	1	3	3	2
(D)	3	3	2	1

Ans (C)

28. Pulmonary circulation is

(A) Left auricle $\xrightarrow[\text{blood}]{\text{oxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{deoxygenated}}$ Right ventricle

(B) Left auricle $\xrightarrow[\text{blood}]{\text{deoxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{oxygenated}}$ Right ventricle

(C) Right ventricle $\xrightarrow[\text{blood}]{\text{Deoxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{Oxygenated}}$ Left atrium

(D) Right ventricle $\xrightarrow[\text{blood}]{\text{oxygenated}}$ Lungs $\xrightarrow[\text{blood}]{\text{deOxygenated}}$ Left atrium

Ans (C)

29. Diastolic pressure of a normal human is

(A) 120 mm of Hg (B) 70 mm of Hg

(C) 80 mm of Hg (D) 70 mm of Hg **Ans** (C)

30. Match the following columns.

Column I		**Column II**	
a.	Heart failure	1.	Heart muscle is suddenly damaged by an inadequate blood supply.
b.	Cardiac arrest	2.	Chest pain due to inadequate reaching the heart muscles.
c.	Heart attack	3.	Atherosclerosis
d.	Coronary Artery Disease (CAD)	4.	Heart not pumping blood effectively enough to meet the needs of the body.
e.	Angina pectoris	5.	Heart stops beating.

Codes

	a	**b**	**c**	**d**	**e**
(A)	4	5	1	3	2
(B)	5	4	1	3	2
(C)	4	5	1	2	3
(D)	5	4	2	3	1

Ans (A)

****

1st PU

Excretory Products and Elimination

1. Order of toxicity among ammonia, urea and uric acid (from lower to higher) is

   (A) uric acid < urea < ammonia (B) uric acid < ammonia < urea

   (C) urea < uric acid < ammonia (D) ammonia < urea < uric acid

   Ans (A)

2. In the glomerulus of the nephron, the afferent arteriole is

   (A) narrower than efferent arteriole

   (B) wider than efferent arteriole

   (C) of some diameter as efferent arteriole

   (D) of same diameter as vasa-recta **Ans** (B)

3. Podocytes are present on the

   (A) endothelial cells of the glomerulus

   (B) endothelial cells of the Bowman's capsule

   (C) epithelium cells of the Bowman's capsule

   (D) epithelium cells of the glomerulus **Ans** (C)

4. A fall in the GFR rate activates the

   (A) JG cells to release rennin

   (B) JG cells to release aldosterone

   (C) JG cells to release epinephrine

   (D) JG cells to release nor-epinephrine **Ans** (A)

5. Animals accumulate waste like urea, uric acid, CO_2, H_2O, ions like Na, K, C1, phosphate, sulphate, etc., by

   (A) metabolic activities (B) excess ingestion

   (C) Either (A) or (B) (D) excretion

   Ans (C)

6. Match the following columns.

Column I		Column II	
a.	Ammonotelic	1.	Aquatic invertebrates
b.	Ureotelic	2.	Reptiles
c.	Uricotelic	3.	Birds
		4.	Amphibians
		5.	Mammals

Codes

	a	b	c
(A)	4, 5	3	1, 2
(B)	1, 2	3	4, 5
(C)	1	4, 5	2, 3
(D)	2, 3	1	4, 5

Ans (C)

7. Part of the kidney through which the ureter, blood vessels and nerves enters into it is

(A) renal cortex (B) renal medulla (C) hilum

(D) urethra **Ans** (C)

8. Structural and functional unit of the kidney is

(A) medulla (B) nephridia (C) nephron

(D) hilum **Ans** (C)

9. Each nephron has two parts, which are

(A) Bowman's capsule and PCT (B) Glomerulus and renal tubule

(C) Glomerulus and Bowman's capsule

(D) Bowman's capsule and renal tubule **Ans** (B)

10. In juxtamedullary nephrons,

(A) vasa recta is prominent (B) loop of Henle is long

(C) loop of Henle runs deep into the medulla

(D) All of the above **Ans** (D)

11. Select the correct pathway for the passage of urine in humans.

(A) Renal vein $\rightarrow$ Renal ureter $\rightarrow$ Bladder $\rightarrow$ Urethra

(B) Collecting tubule → Ureter → Bladder → Urethra

(C) Pelvis → Medulla → Bladder → Urethra

(D) Cortex → Medulla → Bladder → Ureter **Ans** (B)

12. Match the following columns.

Column I		Column II	
a.	Delivers blood to glomerulus	1.	Ascending and descending limb
b.	Carries urine to pelvis	2.	Renal artery
c.	Collects filtrate from Bowman's capsule	3.	Collecting duct
d.	Loop of Henle.	4.	Proximal convoluted tubule

Codes

	a	**b**	**c**	**d**
(A)	4	3	2	1
(B)	1	2	3	4
(C)	2	3	4	1
(D)	2	3	1	4

Ans (C)

13. GFR in a healthy individual is

(A) 125 mL/min (B) 150 L/day (C) 125 mL/sec

(D) 135 L/day **Ans** (A)

14. Percentage of electrolytes and water reabsorbed by PCT is ____ %

(A) 60-70 (B) 70-80 (C) 80-90 (D) 90-95

Ans (B)

15. An organism which does not have loop of Henle will excrete

(A) No urine (B) Dilute urine (C) Concentrated urine

(D) No change in urine **Ans** (B)

16. Main function of DCT of nephron is to maintain the

(A) pH in blood (B) Na-K balance of blood

(C) Both (A) and (B) (D) temperature of blood **Ans** (C)

17. Angiotensin-II activates the A to release B.

Choose the correct option for A and B to complete the given statement.

(A) A-adrenal cortex; B-aldosterone

(B) A-adrenal medulla; B-aldosterone

(C) A-adrenal capsule; B-aldosterone

(D) A-adrenal medulla; B-oxytocin **Ans** (A)

18. The process of release of urine is called

(A) defecation (B) sweetening

(C) micturition (D) perspiring **Ans** (C)

19. On an average the amount of urea in gram excreted out per day is

(A) 25-30 gm (B) 30-35 gm (C) 20-25 gm (D) 35-40 gm

Ans (A)

20. Which of the following is the first formed nitrogenous waste in vertebrates?

(A) Uric acid (B) Urea (C) NH_3 (D) NH_4 **Ans** (C)

21. Uremia is accumulation of urea in

(A) Liver (B) Blood (C) Kidney (D) Bone joints **Ans** (B)

22. Renal calculi is

(A) soluble mass of crystallised salts in kidney

(B) soluble mass of protein in kidney

(C) insoluble mass of proteins in kidney

(D) insoluble mass of crystallised salts in kidney

Ans (D)

23. Glomerulonephritis is

(A) bleeding of glomeruli of kidney

(B) absence of glomeruli of kidney

(C) inflammation of glomeruli of kidney

(D) inflammation of PCT of kidney

Ans (C)

24. Match the following columns.

Column I		Column II	
a.	Nephridia	1.	Shark
b.	Malpighian tubules	2.	Flatworm
c.	Protonephridia	3.	Cockroach
d.	Kidneys	4.	Leech
		5.	Bird

Codes

	a	**b**	**c**	**d**
(A)	1	2	3, 4	5
(B)	4	3	2	1, 5
(C)	4	3	1, 5	2
(D)	4	1, 5	3	2

Ans (B)

25. Juxta glomerular apparatus is modification in the

(A) afferent arteriole and PCT

(B) afferent arteriole and DCT

(C) efferent arteriole and DCT

(D) efferent arteriole and PCT

Ans (B)

****

1st PU

Locomotion and Movement

1. Macrophages and leucocytes in blood exhibits

   (A) amoeboid movement (B) ciliary movement

   (C) muscular movement (D) flagellar movement **Ans** (A)

2. Which of the following statements is true with reference to the structure of a muscle fibre?

   (A) H-zone is present in the middle of A-band

   (B) A-band is present in the middle of sarcomere

   (C) M-line is present in the middle of H-zone

   (D) All of the above **Ans** (D)

3. The store house of calcium ions in the muscle fibre is

   (A) mitochondria (B) Golgi body (C) sarcoplasmic reticulum

   (D) lysosomes **Ans** (C)

4. Striated appearance of the myofibrils is due to

   (A) actin proteins (B) myosin proteins

   (C) Both (A) and (B) (D) mesosomes **Ans** (C)

5. In the centre of each I band, there is an elastic fibre called

   (A) I-line (B) Z-line (C) A-line (D) H-zone

   Ans (B)

6. Z-lines divides the myofibrils into

   (A) sarcomere (B) sarcolemma (C) sarcosome

   (D) sarcoplasm **Ans** (A)

7. F-actin is a polymer of

   (A) G myosin (B) G actin (C) M actin (D) All of these

   Ans (B)

8. Mechanism of muscle contraction is best explained by

   (A) physical filament theory (B) chemical filament theory

(C) sliding filament theory (D) jumping filament theory

Ans (C)

9. Neuromuscular junction is a junction between

   (A) two neurons and muscles

   (B) sensory neurons and muscles

   (C) motor neurons and sarcolemma of muscles

   (D) sensory neurons and sarcolemma of muscles

   Ans (C)

10. Which ion binds with troponin during muscle contraction?

    (A) HCO_3^- (B) Ca^{2+} (C) Cl^- (D) Na^+

    Ans (B)

11. During muscles contraction

    (A) Thick filaments slide over thin filaments

    (B) I-band gets reduced (C) Both (A) and (B)

    (D) A band gets narrower

    Ans (B)

12. In which of the following muscle components, actin binding sites are present?

    (A) troponin (B) tropomyosin (C) meromyosin

    (D) actin **Ans** (C)

13. Which muscle band remains unchanged during the contraction and relaxation of the skeletal muscle?

    (A) I (B) H (C) A (D) Z **Ans** (C)

14. Muscle contains a red coloured oxygen containing pigment called

    (A) haemoglobin (B) myoglobin (C) haemocyanin

    (D) Both (A) and (B) **Ans** (B)

15. Monomer of the myosin (thick) filament is

    (A) troponin (B) tropomyosin

    (C) meromyosin (D) F-actin **Ans** (C)

16. Cartilage has slightly pliable matrix due to

(A) chondroitin salts (B) osteoblast

(C) chondroclast (D) osteoclast **Ans** (A)

17. Human skeletal system consists of

(A) 200 bones (B) 300 bones (C) 206 bones

(D) 250 bones **Ans** (C)

18. Tick the wrong option regarding human beings.

(A) Cranial bones-12 (B) Facial bones-14

(C) Mandible -1 (D) Zygomatic bones-2 **Ans** (A)

19. First vertebrae in humans is called

(A) axis (B) atlas (C) lumbar (D) cervical

Ans (B)

20. Flat bone on the ventral midline of thorax is called

(A) coccyx (B) sternum (C) sacrum (D) ribs

Ans (B)

21. Match the following columns.

Column I		**Column II**	
a.	True ribs	1.	11, 12 pairs
b.	False ribs	2.	8, 9, 10 pairs
c.	Floating ribs	3.	First 7 pairs

Codes

	a	**b**	**c**
(A)	1	2	3
(B)	1	3	2
(C)	3	2	1

(D)	3	1	2

Ans (C)

22. Each human limb is made of

    (A) 60 bones (B) 50 bones (C) 40 bones

    (D) 30 bones **Ans** (D)

23. Which of the following is a part of pectoral girdle?

    (A) Ilium (B) Ischium (C) Acetabulum

    (D) Glenoid cavity **Ans** (D)

24. Which one is longest bone in human?

    (A) Femur (B) Clavicle (C) Tibia (D) Ulna

    Ans (A)

25. Where the saddle joints are presents in humans?

    (A) Between carpals and metacarpal of thumb

    (B) Atlas and axis (C) Radius and ulna

    (D) Carpals and phalanges **Ans** (A)

****

1^{st} PU

Neural Control and Coordination

1. Bipolar neurons are found in the

   (A) embryonic stage (B) cerebral cortex

   (C) cerebellum (D) retina of eye **Ans** (D)

2. Nissl's granules are not found in

   (A) cell body (B) dendrites

   (C) Both (A) and (B) (D) axon **Ans** (D)

3. Which pair of systems jointly coordinate and integrate all the activities of the organs, so that they function in a synchronised fashion?

   (A) Neural and respiratory (B) Neural and digestive system

   (C) Neural and endocrine system (D) Neural and circulatory system

   Ans (C)

4. In *Hydra*, neural organisation comprises of

   (A) Network of neurons (B) CNS and PNS

   (C) CNS (D) PNS

   Ans (A)

5. Brain and spinal cord combine to form the

   (A) CNS (B) PNS (C) Both (A) and (B)

   (D) Neural system **Ans** (A)

6. The efferent nerve fibres transmit impulses

   (A) from tissues to the CNS

   (B) from the CNS to the concerned peripheral tissues/organs

   (C) from the CNS to skeletal muscles

   (D) from the CNS to the involuntary organs **Ans** (B)

7. The system that transmits impulse from the CNS to the involuntary organs and smooth muscles of the body.

   (A) Sympathetic neural system

   (B) Parasympathetic neural system

(C) Somatic neural system

(D) Autonomic neural system **Ans** (D)

8. The highly specialised cells called neurons can

(A) detect stimuli (B) receive stimuli

(C) transmit stimuli (D) All of the above

Ans (D)

9. The function of Na and K pump is to move

(A) Na^+ in and K^+ out (B) Na^+ out and K^+ in

(C) Na out and Cl^- in (D) Cl^- out and Na^+ in **Ans** (B)

10. The cell body of neuron contains certain granular bodies called

(A) cell granules (B) neuro cells (C) Nissl's granules

(D) neurogranules **Ans** (C)

11. Synaptic vesicles contains chemicals called

(A) synaptic fluid (B) neurotransmitters

(C) vesicular fluid (D) All of these **Ans** (B)

12. On postsynaptic membrane,, the new potential developed is

(A) always inhibitory (B) always excitatory

(C) may be excitatory or inhibitory

(D) neither excitatory nor inhibitory **Ans** (C)

13. Multipolar neurons are found in the

(A) retina of eye (B) cerebral cortex (C) embryonic stage

(D) sponges **Ans** (B)

14. Schwann cells, form a myelin sheath around the

(A) dendrite (B) cell body (C) nucleus (D) axon

Ans (D)

15. In resting stage, the axonal membrane is comparatively more permeable to A ions and nearly impermeable to B ions. Identify A and B:

(A) A-sodium; B-potassium (B) A-sodium; B-calcium

(C) A-potassium; B-sodium (D) A-potassium; B-calcium

Ans (C)

16. In the resting stage of a neuron, concentration gradient generates due to

(A) high concentration of K^+ and low concentration of Na^+ inside the axon

(B) high concentration of Na^+ and low concentration of K^+ inside the axon

(C) low concentration of Na^+ outside the axon

(D) high concentration of K^+ outside the axon

Ans (A)

17. The electrical potential difference across the plasma membrane at the site of stimulus is called

(A) reaction potential (B) spike potential

(C) action potential (D) resting potential **Ans** (C)

18. Scala vestibuli, scala media and scala tympani of human ear contains

(A) perilymph, endolymph and perilymph respectively

(B) endolymph, perilymph and endolymph respectively

(C) perilymph, endolymph and endolymph respectively

(D) perilymph, haemolymph and endolymph respectively

Ans (A)

19. Select the correct sequence of meninges from inner to outer side.

(A) Duramater $\rightarrow$ Arachnoid $\rightarrow$ Piamater

(B) Arachnoid $\rightarrow$ Duramater $\rightarrow$ Piamater

(C) Piamater $\rightarrow$ Duramater $\rightarrow$ Arachnoid

(D) Piamater $\rightarrow$ Arachnoid $\rightarrow$ Duramater

Ans (D)

20. Brain stem is formed by

(A) midbrain and forebrain plus cerebellum

(B) forebrain and hindbrain

(C) midbrain and hindbrain minus cerebellum

(D) forebrain, midbrain and hindbrain plus spinal cord

Ans (C)

21. Association areas of the brain are

(A) always sensory areas (B) always motor areas

(C) neither sensory nor motor areas

(D) absent in human brain **Ans** (C)

22. The inner parts of cerebral hemispheres and a group of associated deep structures like amygdala, hippocampus, etc. form a complex structure called

(A) arbor vitae (B) limbic system (C) corpora quadrigemina

(D) reticular system **Ans** (B)

23. Which of these is not involved in knee-jerk reflex?

(A) Muscle spindle (B) Motor neuron

(C) Brain (D) Dorsal root ganglion **Ans** (B)

24. The anterior portion of sclera is called

(A) iris (B) cornea (C) ciliary body (D) pupil

Ans (B)

25. Arrange the layers of cells in retina of human eye from inside to outside.

(A) Photoreceptor cells $\rightarrow$ ganglion cells $\rightarrow$ bipolar cells

(B) Ganglion cells $\rightarrow$ photoreceptor cells $\rightarrow$ bipolar cells

(C) Ganglion cells $\rightarrow$ bipolar cells $\rightarrow$ photoreceptor cells

(D) Bipolar cells $\rightarrow$ photoreceptor cells $\rightarrow$ gang lion cells

Ans (C)

26. The PNS includes

(A) central neural system and sympathetic neural system

(B) somatic neural system and autonomic neural system

(C) only sympathetic neural system

(D) only somatic neural system

Ans (B)

27. Which of the following is not correct for rods?

I. Twilight vision is the function of the rods.

II. It is responsible for daylight vision always.

III. The rods contain a protein called rhodopsin.

IV. Rods are photoreceptor cells.

(A) Only I (B) Only II (C) I and III

(D) II and III **Ans** (B)

28. At the posterior pole of the eye lateral to the blind spot, there is a yellowish pigmented spot called

(A) corpus luteum (B) fovea (C) macula quadrigemina
(D) macula lutea

Ans (D)

29. Coiled portion of the inner ear is called

(A) cochlea

(B) vestibule

(C) pinna

(D) ear canal

Ans (A)

30. The sympathetic and parasympathetic neural system combines to form

(A) somatic neural system (B) autonomic neural system

(C) central neural system (D) peripheral neural system

Ans (B)

31. A structure of neuron comprises of

(A) cell body, synaptic knob, ganglia

(B) synaptic vesicles, ganglia, dendrites

(C) cell body, dendrites, ganglia

(D) cell body, dendrites, axon

Ans (D)

32. Which is the visible coloured portion of the eye?

(A) Pupil (B) Lens (C) Iris (D) Ciliary body

Ans (C)

33. The medulla contains centres which control

(A) respiration (B) cardiovascular reflexes

(C) gastric secretions (D) All of the above **Ans** (D)

34. The pressure on either sides of the ear drum gets equalised by

(A) pinna (B) Eustachian tube

(C) cochlea (D) labyrinth **Ans** (D)

35. When different cones of human eye are stimulated equally, a sensation of ___________ light is produced.

(A) red (B) white (C) green (D) blue **Ans** (B)

****

1^{st} PU

Chemical Control and Coordination

1. Diurnal rhythm of our body is maintained by

   (A) Thyroid gland (B) Pineal gland

   (C) Pituitary gland (D) Hypothalamus **Ans** (B)

2. GnRH (Gonadotropin Releasing Hormone) stimulates the

   (A) posterior pituitary to release the gonadotropins

   (B) pituitary for synthesis and release of gonadotropins

   (C) testis to release the gonadotropins

   (D) hypothalamus to release the gonadotropins

   Ans (B)

3. Somatostatin from hypothalamus gland

   (A) activates the release of growth hormone

   (B) inhibits the release of growth hormone

   (C) inhibits the release of enzymes in the digestive tract

   (D) activates the release of hormones from pineal gland

   Ans (B)

4. Which hormone acts on the exocrine part of pancreas and stimulates secretion of water and bicarbonate ions?

   (A) Gastric (B) Secretin

   (C) CCK (D) GIP **Ans** (B)

5. Significant role of calcium balance in the body is maintained by

   (A) PTH and FSH (B) PTH and TCT

   (C) TCT and FSH (D) TCT and GH **Ans** (B)

6. The posterior pituitary is under the

   (A) direct neural regulation of the adenohypophysis

   (B) direct neural regulation of the hypothalamus

   (C) direct axonal regulation of the adenohypophysis

(D) direct axonal regulation of the neurohypophysis

Ans (B)

7. Cretinism, mental retardation, low intelligence quotient, abnormal skin, deaf-mutism, etc. are the results of

   (A) hyperthyroidism in foetus (B) goitre in embryo

   (C) hypothyroidism in pregnant woman

   (D) Both (B) and (C) **Ans** (C)

8. Gigantism and dwarfism are the disease related to

   (A) prolactin hormone of mammary gland

   (B) growth hormone of adenohypophysis

   (C) luteinising hormone of pituitary gland

   (D) thyroid stimulating hormone of thyroid

   Ans (B)

9. Match the following columns.

Column I Hormone		**Column II Target organ**	
a.	PRL	1.	Gonads
b.	TSH	2.	Adrenal cortex
c.	ACTH	3.	Thyroid gland
d.	LH and FSH	4.	Mammary glands
		5.	Adrenal medulla

Codes

	a	**b**	**c**	**d**
(A)	1	2	3	4
(B)	2	1	3	5

(C)	4	3	5	1
(D)	4	3	2	1

Ans (D)

10. Hypothalamus is in the

(A) anterior part of diencephalon

(B) posterior part of diencephalon

(C) interior part of diencephalon

(D) basal part of diencephalon

Ans (D)

11. Secretion of PTH is regulated by the circulating levels of which ion in blood?

(A) Na^{+} (B) I^{-2} (C) Ca^{2+} (D) Fe^{2+} **Ans** (C)

12. Immune response of old age person becomes weak due to the degeneration of

(A) thyroid (B) parathyroid (C) thymus

(D) hypothalamus **Ans** (C)

13. I. Increased alertness

II. Pupillary dilation

III. Raising of hairs

IV. Sweating

All of the above written physiological processes are regulated by

(A) adrenaline (B) norepinephrine

(C) Both (A) and (B) (D) Thymosin **Ans** (C)

14. Corticoids are the hormones, which are secreted by

(A) kidney (B) adrenal cortex (C) adrenal medulla

(D) hypothalamus **Ans** (B)

15. Pituitary gland is divided into

(A) adenohypophysis and neurohypophysis

(B) adenohypophysis and pars distalis

(C) adenohypophysis and pars intermedia

(D) adenohypophysis and anterior pituitary

Ans (A)

16. I. Increase of heart beat.

II. Increase of respiration rate.

III. Stimulate breakdown of glycogen.

IV. Stimulate breakdown of lipid and protein.

Statements written above are the features of which hormone?

(A) PTH (B) TCT

(C) Thymosin (D) Catecholamine **Ans** (D)

17. Insulin

(A) is a hypoglycemic hormone (B) decreases the blood sugar

(C) act on adipose tissue and hepatocytes

(D) All of the above **Ans** (D)

18. Estrogen

(A) stimulates the regeneration of endometrium

(B) stimulates the appearance of secondary sex characters

(C) stimulates the growth of mammary gland

(D) All of the above

Ans (D)

19. I. Insulin

II. Epinephrine

III. Oestradiol

IV. Norepinephrine

V. Testosterone

VI. Glucagon

Which of the above hormones are amino acid derivatives?

(A) I and II (B) III and IV (C) V and VI

(D) II and IV **Ans** (D)

20. Injury to adrenal cortex is not likely to affect the secretion of which one of the following hormones?

(A) Aldosterone (B) Both aldosterone and androgens

(C) Adrenaline (D) Cortisol **Ans** (C)

21. Match the following columns:

Column I		**Column II**	
a.	Zona reticularis	1.	Outer layer (adrenal cortex)
b.	Zona fasciculata	2.	Inner layer (adrenal cortex)
c.	Zona glomerulosa	3.	Middle layer (adrenal cortex)

Codes

	a	**b**	**c**
(A)	3	2	1
(B)	1	2	3
(C)	2	3	1
(D)	2	1	3

Ans (C)

22. Match the following columns.

Column I Hormone		**Column II Function**	
a.	Glucagon	1.	Glucogenolysis
b.	Insulin	2.	Hypoglycemic hormone

		3.	Hyperglycemic hormone
		4.	Glycogenesis

Codes

	a	b
(A)	1, 2	3, 4
(B)	1, 3	2, 4
(C)	1, 2, 3	4
(D)	4	1, 2, 3

Ans (B)

23. 'ANF' is

(A) steroidal in nature (B) a peptide hormone

(C) glucocorticoid hormone (D) mineralocorticoid hormone

Ans (B)

24. Erythropoietin

(A) stimulates erythropoiesis (B) inhibits erythropoiesis

(C) inhibits platelets formation (D) stimulates platelets formation

Ans (A)

25. Which of these are the second messengers?

I. Cyclic AMP II. IP_3 III. Ca^{2+}

The correct option is

(A) I and II (B) II and III (C) I and III

(D) I, II and III **Ans** (D)

****

2nd PU

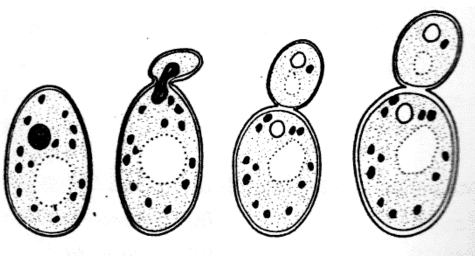
Reproduction in Organisms

1. Division in a bacterial cell is carried out through

   (A) multiple fission (B) binary fission

   (C) budding (D) mitosis

   Ans (B)

2. 

   The above figure depicts.

   (A) Budding in yeast (B) Binary fission in bacteria

   (C) Fission in sporozoans (D) Zoospores in fungi

   Ans (A)

3. Common mode of reproduction in *Penicillium* is by formation of

   (A) conidia (B) buds

   (C) gemmules (D) zoospores

   Ans (A)

4. Asexual reproduction in plants is called

   (A) vegetative reproduction (B) syngamy

   (C) parthenocarpy (D) parthenogenesis

   Ans (A)

5. *Strobilanthus kunthiana* is also called

   (A) Neela Kuranji (B) Peela Kuranji

(C) Hara Kuranji (D) Manjal Kuranji

Ans (A)

6. Menstrual cycle is

(A) seasonal hormonal ovarian change

(B) conditional hormonal ovarian change

(C) periodic hormonal ovarian change

(D) habitual hormonal ovarian change

Ans (C)

7. Events in sexual reproduction:

I. Pre-fertilisation

II. Fertilisation

III. Post-fertilisation

The sequential order of their occurrence is

(A) I $\rightarrow$ III $\rightarrow$ II (B) II $\rightarrow$ I $\rightarrow$ III

(C) III $\rightarrow$ II $\rightarrow$ I (D) I $\rightarrow$ II$\rightarrow$ III

Ans (D)

8. 'Unisexual female flower is called staminate'. The above statement is

(A) True (B) False

(C) Sometimes (A) and sometimes (B)

(D) Neither (A) nor (B)

Ans (B)

9. If the parent body is haploid then the gametes are

(A) haploid (B) diploid

(C) never produced (D) produced by meiosis

Ans (A)

10. Parthenogenesis is the process in which new organism is formed

(A) with fertilisation (B) without fertilisation

(C) through mitosis (D) through meiosis **Ans** (B)

11. During embryogenesis the zygote undergoes

(A) cell division (mitosis) (B) cell division (meiosis)

(C) cell differentiation (D) (A) followed by (C)

Ans (D)

12. Zoospores are

(A) motile gametes (B) female gametes

(C) sessile gametes (D) male gametes **Ans** (A)

13. Which of the following is hermaphrodite?

(A) Roundworm (B) Jelly fish

(C) Earthworm (D) Cockroach **Ans** (C)

14. Off-spring formed by sexual reproduction exhibit more variation than those formed by asexual reproduction because

(A) sexual reproduction is a lengthy process

(B) gametes of parents have superior genes always

(C) genetic material comes from two different parents

(D) greater amount of DNA is involved in sexual reproduction

Ans (C)

15. Why is water hyacinth called 'Terror of Bengal'?

(A) It is being used as food for fish

(B) It consumes oxygen from cultivated plants and destroy them

(C) It is an alien species

(D) It is a problematic weed that spreads at an alarming rate

Ans (D)

****

2^{nd} PU

Sexual Reproduction in Flowering Plants

1. 60% of the angiosperms shed their pollen at the

   (A) 2-celled stage (B) 3-celled stage

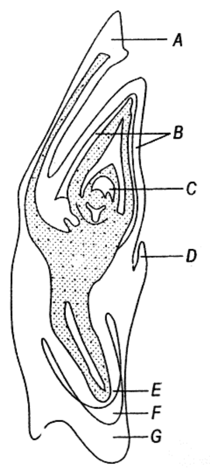
   (C) 4-celled stage (D) 1-celled stage **Ans** (A)

2. Individual part or segment of calyx is called

   (A) sepal (B) petal

   (C) tepal (D) corolla **Ans** (A)

3. In the given figure, find out coleoptile, scutellum and epiblast respectively



   (A) A, B and C (B) B, A and D

   (C) D, F and G (D) E, F and G

   Ans (B)

4. Continued self-pollination results in

   (A) Inbreeding depression

   (B) Out-breeding depression

   (C) Hybrid vigour (D) Better result in off-springs

   Ans (A)

5. A typical angiosperm anther is

   (A) bilobed (B) dithecous (C) Both (A) and (B)

   (D) monothecous **Ans** (D)

6. Number of microsporangia in an angiospermic anther is

   (A) 1 (B) 2 (C) 3 (D) 4

   Ans (D)

7. The inner most layer of microsporangium is

   (A) tapetum (B) endothecium (C) middle layer

   (D) epidermis **Ans** (A)

8. Identify the type of ovary in diagram.

(A) Monocarpellary syncarpous

(B) Monocarpellary apocarpous

(C) Multicarpellary syncarpous

(D) Multicarpellary apocarpous

Ans (D)

9. The stalk which joins ovule and placenta is called

(A) funicle (B) hilum (C) chalaza (D) micropyle

Ans (A)

10. Embryo sac is also called

(A) female gamete (B) synergids

(C) female gametophyte (D) egg of angiosperm **Ans** (C)

11. In a typical embryo sac, the number of synergid, egg cell, central cell, antipodal cell is respectively

(A) 1–l–2–3 (B) 2–1–1–3 (C) 2–1–2–3

(D) 3–2–1–2 **Ans** (B)

12. What does the filiform apparatus do?

(A) It brings about opening of the pollen tube

(B) It guides pollen tube into synergid

(C) It stops the entry of pollen tube into a synergid

(D) It prevents entry of more than one pollen tube into embryo sac

Ans (B)

13. Center of each microsporangium is occupied by

(A) sporogenous tissue (B) spongy tissue

(C) central tissue (D) megaspore mother cells **Ans** (A)

14. Approximate diameter of pollen grain is

(A) 25-50 micrometer (B) 50-75 micrometer

(C) 75-100 micrometer (D) 25-35 micrometer **Ans** (A)

15. Exine of pollen is made up of

(A) sporopollenin (B) sporogenous tissue

(C) spongiform tissue (D) inorganic material **Ans** (A)

16. Which cell is bigger and has abundant food reserve material in a pollen?

(A) Generative cell (B) Vegetative cell

(C) Vacuole (D) Spore mother cell **Ans** (B)

17. If stem has 2n = 10 number of chromosomes than find out

a – number of chromosomes in endosperm.

b – number of chromosomes in egg cell.

c – number of chromosomes in MMC.

(A) 15, 15, 20 (B) 10, 15, 20 (C) 15, 5, 10

(D) 10, 5, 15 **Ans** (C)

18. Double fertilisation involves

(A) fertilisation of egg by two male gametes

(B) fertilisation of two egg in same embryo sac by two gametes brought by one pollen tube

(C) fertilisation of the egg and the central cell by two gametes brought by different pollen tubes

(D) fertilisation of the egg and central cell by two gametes brought by same pollen

Ans (D)

19. Long, ribbon-like pollen grains are seen in some

(A) aquatic plants (B) wind-pollinated grasses

(C) gymnosperms (D) bird-pollinated flowers **Ans** (A)

20. Perisperm is

(A) remnants of nucellus (B) remnants of embryo

(C) remnants of endosperm (D) remnants of cotyledon

Ans (A)

21. False fruit is a fruit in which

(A) only ovary take part in fruit development

(B) only embryo take part in fruit development

(C) only chalazal cells take part in fruit development

(D) ovary and other floral parts are included in fruit

Ans (D)

22. Most oldest viable seed is of

(A) Arctic lupine (B) *Ficus*

(C) Date palm (D) *Phoenix* **Ans** (A)

23. Which is most crucial for seed storage?

(A) Dehydration and dormancy

(B) Endosperm and water

(C) Least amount of development

(D) Endosperm in large quantity

Ans (A)

24. Maximum viability of rice and wheat pollen is

(A) 60 min (B) 50 min

(C) 40 min (D) 30 min **Ans** (D)

25. Among the sets of terms given below, identify those that are associated with gynoecium

(A) pistil, style, ovule, pollen

(B) ovule, ovary, tapetum, embryo sac

(C) egg, embryo sac, nucellus, pollen

(D) stigma, ovule, embryo sac, placenta

Ans (D)

26. Transfer of pollen grains from the anther to stigma of a flower of a different plant is called

(A) geitonogamy (B) chasmogamy

(C) xenogamy (D) cleistogamy **Ans** (C)

27. Long silky hairs on cob of maize are

(A) anthers (B) style

(C) stigma (D) Both (B) and (C) **Ans** (D)

28. Unisexual condition/dioecy prevents

(A) autogamy, geitonogamy (B) geitonogamy, xenogamy

(C) self-fertilisation, geitonogamy, xenogamy

(D) autogamy, xenogamy **Ans** (A)

29. In artificial hybridisation the steps involved are

I. bagging
II. emasculation
III. re-bagging
IV. pollination

Their right arrangement is

(A) I → II → III → IV (B) II → IV → III → I

(C) III → II → I → I (D) II → I → IV → III

Ans (D)

30. Largest cell of ovule is

(A) MMC (B) antipodal cell

(C) central cell (D) chalazal cell **Ans** (C)

****

2nd PU

Human Reproduction

1. Cleavage is

   (A) meiosis of zygote into blastomeres

   (B) mitosis of zygote into blastomeres

   (C) reductional division of zygote

   (D) reductional division of embryo

   Ans (B)

2. Several mammary ducts joins to form a wider mammary ampulla which is connected to

   (A) lactiferous duct (B) seminiferous duct

   (C) seminiferous tubules (D) lactiferous canal

   Ans (A)

3. Which one of the following human cells have 23 chromosomes?

   (A) Primary spermatocytes (B) Secondary spermatocytes

   (C) Leydig cells (D) Primary oocyte

   Ans (B)

4. Human foetus develops limbs and digits in its ____ of development.

   (A) 2^{nd} month (B) 3^{rd} month (C) 4^{th} month

   (D) 5^{th} month **Ans** (A)

5. Releasing of sperms from seminiferous tubules is called

   (A) spermiogenesis (B) spermiation (C) spermatogenesis

   (D) spermatidiogenisis **Ans** (B)

6. Which part of the sperm contains hydrolytic enzymes?

   (A) Head region (B) Neck region

   (C) Middle piece region (D) Tail region **Ans** (A)

7. Second meiotic division in ovum leads to the formation of

(A) haploid ovum (B) second polar body

(C) tertiary polar body (D) Both (A) and (B) **Ans** (D)

8. Graafian follicle after releasing ovum forms

(A) corpus luteum (B) polar body

(C) nuclear body (D) ootid **Ans** (A)

9. The first menstruation begins at puberty and is called

(A) menopause (B) ovulation

(C) gametogenesis (D) menarche **Ans** (D)

10. In which phase, both LH and FSH attain a peak level?

(A) Menstrual phase (B) Follicular phase

(C) Ovulatory phase (D) Luteal phase **Ans** (C)

11. Immediate cause of menstruation is the withdrawal of

(A) oestrogen (B) FSH

(C) FSH-LH (D) progesterone **Ans** (D)

12. Primary sex organ in man is

(A) scrotum (B) accessory gland

(C) testis (D) urinary bladder **Ans** (C)

13. Pouch in which is the testes are suspended outside the abdominal cavity is

(A) tunica albuginea (B) inguinal canal

(C) epididymis (D) scrotum **Ans** (D)

14. How many compartments (approx.) are there in each human testis?

(A) 250 (B) 300

(C) 350 (D) 400 **Ans** (A)

15. Embryo at 8 to 16 cell stage is called

(A) blastula (B) morula

(C) trophoblast (D) All of these **Ans** (B)

16. Inner mass of cell in a blastocyst gives rise to

(A) foetal part (B) embryo

(C) notochord (D) nourishment cell **Ans** (B)

17. Attachment of blastocyst of uterine wall is called

(A) fertilisation (B) implantation

(C) insemination (D) All of these **Ans** (B)

18. Leydig cells secrete

(A) testosterone (B) inhibin

(C) oxytocin (D) FSH **Ans** (A)

19. Chorionic villi and uterine tissue become interdigitated with each other and jointly form

(A) trophoblast (B) inner cell mass

(C) placenta (D) implantation **Ans** (C)

20. Relaxin (a hormone) is secreted by

(A) placenta (B) ovary

(C) anterior lobe of pituitary (D) posterior lobe of pituitary

Ans (B)

21. hCG and hPL are released

(A) before pregnancy (B) during pregnancy

(C) at parturition (D) during lactating stage

Ans (B)

22. Heart is formed in embryo during ________ of development.

(A) 15 days (B) 1^{st} month

(C) 1.5 months (D) 2^{nd} month **Ans** (B)

23. The signals for parturition originates from the fully developed foetus and placenta causing the mild contractions called

(A) foetal ejection reflex (B) embryo ejection reflex

(C) blastocoel ejaculation reflex (D) still birth

Ans (A)

24. Chemicals involved in human parturition is/are

(A) oestrogen (B) oxytocin

(C) prostaglandin (D) All of these **Ans** (D)

25. First milk produced after child birth is called

(A) sebum (B) cerumen

(C) true milk (D) colostrum **Ans** (D)

26. Function of bulbourethral glands is to

(A) lubricate the penis (B) increase the motility of sperms

(C) enhance the sperm count (D) All of the above

Ans (A)

27. Body covered with fine hair, eyelids separate and eye lashes are formed during ____ of development.

(A) 3^{rd} month (B) 4^{th} month

(C) 5^{th} month (D) 6^{th} month **Ans** (D)

28. Which of the following cells present in the mammalian testis nourishes the sperms?

(A) Leydig cells (B) Oxyntic cells

(C) Interstitial cell (D) Sertoli cell **Ans** (D)

29. Funnel-shaped part of oviduct closer to the ovary is called

(A) fimbriae (B) infundibulum

(C) ampulla (D) isthmus **Ans** (B)

30. Match the following columns.

Column I		Column II	
a.	Perimetrium	1.	Inner glandular layer of uterus
b.	Endometrium	2.	External thin membrane of uterus
c.	Myometrium	3.	Middle thick membrane of uterus

Codes

	a	b	c
(A)	2	1	3
(B)	1	2	1
(C)	1	2	3
(D)	3	1	2

Ans (A)

31. Cushion of fatty tissue covered by skin and pubic hair in the human female is called

(A) mons pubis (B) labia majora

(C) labia minora (D) clitoris **Ans** (A)

32. The dominant hormone controlling the proliferative phase of the uterine endometrium is

(A) oestrogen (B) FSH

(C) LH (D) progesterone **Ans** (A)

33. The polar body of human ovum is formed

(A) before birth (B) after birth

(C) during birth (D) Both (A) and (B) **Ans** (D)

34. An antrum is the characteristic of which follicles?

(A) secondary (B) Graafian

(C) primary (D) tertiary and Graafian **Ans** (D)

35. The target of LH in the human male is

(A) prostate gland (B) seminiferous tubules

(C) interstitial cells (D) seminal vesicles **Ans** (C)

****

2^{nd} PU

Reproductive Health

1. Family planning program was initiated in

   (A) 1941 (B) 1951 (C) 1961 (D) 1981

   Ans (B)

2. RCH stands for

   (A) Reproductive and Child Healthcare

   (B) Reproductive Cum Hygiene

   (C) Routine Check-up of Health

   (D) Reproduction of Child Health and Care **Ans** (A)

3. Amniocentesis is the detection of

   (A) chromosomal pattern by taking amniotic fluid

   (B) chorionic fluid from developing embryo

   (C) chromosomal pattern after child birth

   (D) chromosomal pattern before fertilization

   Ans (A)

4. Full form of CDRI is

   (A) Central Development Research Institute

   (B) Child Development Research Institute

   (C) Central Drug Research Institute

   (D) Common Development Research Institute **Ans** (C)

5. Population of India was approximately _______ million at the time of independence.

   (A) 350 million (B) 400 million

   (C) 500 million (D) 600 million **Ans** (A)

6. Day of periodic abstinence is

   (A) 10-11 days of menstrual phase

   (B) 10-17 days of menstrual phase

(C) 17-20 days of menstrual phase

(D) 20-28 days of menstrual phase **Ans** (B)

7. Lactational amenorrhoea is

(A) Absence of menses in adult age

(B) Absence of menses in elderly age

(C) Absence of menses during lactation

(D) No menses during pregnancy **Ans** (C)

8. Example of the non-medicated IUD is

(A) Cu-T (B) Cu-7 (C) multiload-375

(D) Lippes' loop **Ans** (D)

9. Oral contraceptives have hormonal preparation of

(A) progesterone (B) oestrogen

(C) Both (A) and (B) (D) FSH and LH **Ans** (C)

10. Cu^{2+} ions released from copper releasing Intra Uterine Devices (IUDs)

(A) prevent ovulation

(B) makes uterus unsuitable for implantation

(C) increases phagocytosis of the sperms

(D) suppress sperm motility **Ans** (D)

11. What is true about 'Saheli'?

I. Developed at CDRI, Lucknow.

II. Contains a steroidal preparation.

III. 'Once-a-week' pill.

IV. Many side effects.

V. High contraceptive value.

VI. Very few side effects.

VII. Low contraceptive value.

(A) I, II, III, V and VI (B) I, III, V and VI

(C) I, II, III, IV and V (D) I, III, IV and V **Ans** (B)

12. When was MTP legalised in India?

(A) 1951 (B) 1971 (C) 1981

(D) 1924 **Ans** (B)

13. Which of the following diseases is incurable and transmitted only by coitus?

I. Hepatitis-B

II. HIV

III. Genital herpes

(A) I, II and III (B) I and II (C) II (D) III

Ans (D)

14. Incidents of STD are very high among persons in the age group of

(A) 15 to 35 years (B) 15 to 30 years

(C) 15 to 24 years (D) 15 to 45 years

Ans (C)

15. The technique called Gamete Intra Fallopian Transfer (GIFT) is recommended for the females

(A) who can't retain the foetus inside the uterus

(B) who can't produce an ovum

(C) whose cervical canal is too narrow to allow the passage for the sperms

(D) who can't provide suitable environment for fertilization

Ans (B)

16. In delaying pregnancy or spacing among children, the popular contraceptive in India is

(A) IUD (B) natural method

(C) oral contraceptive (D) surgical methods **Ans** (A)

17. Find out the natural contraception method/s among the list

Implantation

I. Lactational amenorrhoea
II. Condoms

IV. Vasectomy

V. Tubectomy

VI. Sterilisation

(A) I and II (B) III and IV

(C) V and VI (D) Only II **Ans** (D)

18. Which of the following methods is used when male partner is unable to inseminate the female partner due to the low sperm count?

(A) AI (B) IUI

(C) Both (A) and (B) (D) GIFT **Ans** (C)

19. Find out the true statements for IUD.

I. They are self-inserted.

II. They are inserted by expert nurses.

III. They may be non-medicated IUDs, copper releasing IUDs or hormone releasing IUDs.

IV. They are inter-uterine devices.

V. Widely accepted in India.

(A) II, III, IV and V (B) I, II, III and V

(C) I, II, IV and V (D) II, III and V **Ans** (A)

20. During which phase of the pregnancy, MTP is safe?

(A) 1st trimester (B) 2nd trimester

(C) 3rd trimester (D) 4th trimester **Ans** (A)

****

2^{nd} PU

Principles of Inheritance and Variation

1. The tendency of offspring to differ from their parents is called

   (A) variation (B) heredity

   (C) inheritance (D) resemblance **Ans** (A)

2. Mendel's experimental material was

   (A) *Pisum sativum* (B) *Lathyrus odoratus*

   (C) *Oryza sativa* (D) *Mirabilis jalapa* **Ans** (A)

3. The physical expression or appearance of a character is called as

   (A) morphology (B) genotype

   (C) phenotype (D) ecotype **Ans** (C)

4. The alternate forms of a gene is called

   (A) recessive character (B) dominant character

   (C) alleles (D) alternative gene **Ans** (C)

5. Mendel conducted experiments for

   (A) 7 years (B) 6 years (C) 5 years

   (D) 4 years **Ans** (A)

6. Which is correct about traits chosen by Mendel for his experiment on pea plant?

   (A) Terminal pod was dominant (B) Constricted pod was dominant

   (C) Green coloured pod was dominant

   (D) Tall plants were recessive **Ans** (C)

7. The proportion of plants that were dwarf and tall in F_2–generation of Mendel experiment.

   (A) $\frac{1}{4}$th and $\frac{3}{4}$th (B) $\frac{3}{4}$th and $\frac{1}{4}$th

   (C) $\frac{2}{3}$rd and $\frac{1}{3}$rd (D) $\frac{1}{3}$rd and $\frac{4}{3}$rd **Ans** (A)

8. When alleles of two contrasting characters are present together, one of the character expresses itself during the cross while the other remains hidden. This is the

(A) law of purity of gametes (B) law of segregation

(C) law of dominance (D) law of independent assortment

Ans (C)

9. If male is TT and female is tt, then they contribute pollen and egg respectively with

(A) T and T gametes (B) t and T gametes

(C) TT and tt gametes (D) T and t gametes **Ans** (D)

10. How many different kinds of gametes will be produced by a plant having genotype AABbcc?

(A) Three (B) Four (C) Nine (D) Two

Ans (D)

11. In cross between yellow round seeds (YYRR) and pure breeding pea plants having green wrinkled seeds (yyrr), find out the total plants having yellow seed colour in F_2 generation out of 16 plants:

(A) 12 (B) 10 (C) 14 (D) 11

Ans (A)

12. In which year was Mendel's work rediscovered?

(A) 1900 (B) 1901 (C) 1902 (D) 1903

Ans (A)

13. Who proposed the 'chromosomal theory of inheritance'?

(A) Sutton and Mendel (B) Boveri and Morgan

(C) Morgan and Mendel (D) Sutton and Boveri

Ans (D)

14. Strength of the linkage between two genes is

(A) proportionate to the distance between them

(B) inversely proportionate to the distance between them

(C) dependant on the chromosomes

(D) dependant upon the size of chromosomes **Ans** (B)

15. In haplodiploidy determination of sex, male is

(A) haploid (B) diploid

(C) haplodiploid (D) diplohaploid **Ans** (A)

16. A couple has 6 children, 5 of which are girls and 1 is a boy. The percentage of having a girl child in the next pregnancy is

(A) 10% (B) 20% (C) 50%

(D) 100% **Ans** (C)

17. XO type of sex determination is seen in

(A) man (B) grasshopper (C) fruitfly (D) birds

Ans (B)

18. Chromosomal aberrations are commonly found in the

(A) cancer cells (B) normal cells

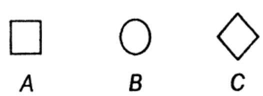
(C) healthy cells (D) spore cells **Ans** (A)

19. Classical example of point mutation is

(A) sickle-cell anaemia (B) thalassaemia

(C) cancer (D) All of the above **Ans** (A)

20. Identify the symbols given below and the correct option with respect of *A, B* and *C*



(A) A–Male, B–Female, C–Sex unspecified

(B) A–Male, B–Female, C–Sterile

(C) A–Male, B–Female, C–Fertile

(D) A–Female, B–Male, C–Sex unspecified

Ans (A)

21. Phenylketonuria disease is a/an ____________ disease.

(A) autosomal dominant (B) autosomal recessive

(C) sex linked recessive (D) sex linked dominant

Ans (B)

22. The possibility, of A becoming a haemophilic is extremely rare because mother of such a female has to be at least B and the father should be C.

Choose the correct option for A, B and C.

(A) A−female, B−carrier, C−haemophilic

(B) A−male, B−carrier, C−carrier

(C) A−female, B−haemophilic, C−carrier

(D) A−male, B−haemophilic, C−-haemophilic

Ans (A)

23. Genetic or chromosomal symbol used for the person who has sickle-cell anaemia is

(A) $Hb^s\ Hb^s$ (B) Hb^aHb^a

(C) $Hb^g\ Hb^g$ (D) Hb^mHb^m **Ans** (A)

24. In sickle-cell anaemia, glutamic acid (glu) is replaced by

(A) valine (B) leucine

(C) isolucine (D) methionine **Ans** (A)

25. The enzyme missing in phenylketonuria is

(A) phenylalanine hydroxylase (B) phenylalanine reductase

(C) phenylalanine oxidase (D) phenylalanine oxidoreductase

Ans (A)

26. In α-thalassaemia, the affected chromosome is

(A) 16th (B) 17^{th} (C) 18th (D) 19^{th}

Ans (A)

27. Colour blindness is a failure to discriminate between

(A) red and blue (B) red and green (C) red and black

(D) red and white **Ans** (B)

28. Trisomy 21 in humans causes

(A) Klinefelter's syndrome (B) Down's syndrome

(C) Turner's syndrome (D) Patau's syndrome

Ans (B)

29. Turner's syndrome is caused due to the absence of

(A) one X-chromosome (44 with XO = 45)

(B) two Y-chromosome (45 with XX = 46)

(C) one X-and Y-chromosome (44 with OO = 44)

(D) two X-chromosomes (44 with YY = 46)

Ans (A)

30. Gynaecomastia is common feature seen in

(A) Down's syndrome (B) Turner's syndrome

(C) PKU (D) Klinefelter's syndrome **Ans** (D)

31. Which of the following is not a hereditary disease?

(A) Thalassemia (B) Haemophilia

(C) Cystic fibrosis (D) Cretinism **Ans** (D)

32. Genes for colour blindness is carried by

I. all embryos

II. father

III. mother

IV. either father or mother

(A) I and II (B) II (C) III (D) I and IV

Ans (C)

33. In a family, the father has blood group A and mother has blood group B. Blood group of their children may be

(A) only A (B) A or B or AB or O

(C) only O (D) only B **Ans** (B)

34. From which cross will you get most pink flowered offspring?

(A) Red × red (B) Red × pink

(C) Pink × pink (D) Red × white

Ans (D)

35. Mother = A blood group

Father = AB blood group

The child cannot have

(A) A blood group

(B) O blood group

(C) B blood group

(D) A blood group

Ans (B)

****

2^{nd} PU

Molecular Basis of Inheritance

1. Nucleic acids were first isolated by

   (A) Miescher (B) Altman

   (C) Kornberg (D) Mendel **Ans** (A)

2. RNA acts as genetic material in

   (A) bacteria (B) virus

   (C) fungi (D) All of these **Ans** (B)

3. Haploid content of human DNA has

   (A) 3.3×10^7 bp (B) 3.3×10^8 bp

   (C) 3.3×10^9 bp (D) 3.3×10^{10} bp **Ans** (C)

4. Name the pyrimidine which is present only in RNA.

   (A) Adenine (B) Guanine

   (C) Thymine (D) Uracil **Ans** (D)

5. Nucleoside is formed when the nitrogenous bases are linked to

   (A) sugar (B) phosphate

   (C) proteins (D) fats **Ans** (A)

6. Which additional group is present at the 2′ position of the ribose sugar in RNA?

   (A) –H (B) –CHO

   (C) –OH (D) –COOH **Ans** (C)

7. Thymine is also called

   (A) 2 methyl uracil (B) 3 methyl uracil

   (C) 4 methyl uracil (D) 5 methyl uracil **Ans** (D)

8. X-ray data diffraction of DNA was produced by

   (A) Watson and Crick (B) Wilkins and Franklin

   (C) Bateson and Punnett (D) Both (A) and (B)

   Ans (B)

9. Central dogma of molecular biology states that genetic information flows from

(A) DNA $\rightarrow$ RNA $\rightarrow$ Fat (B) DNA $\rightarrow$ RNA$\rightarrow$ Protein

(C) RNA $\rightarrow$ DNA $\rightarrow$ Protein (D) RNA $\rightarrow$ DNA $\rightarrow$ Amino acid

Ans (B)

10. In a DNA molecule, if cytosine is 18%, the percentage of adenine would be

(A) 18% (B) 32% (C) 36% (D) 64%

Ans (B)

11. Why both the strands of DNA are not copied during transcription?

(A) Because RNA molecule with different sequences will be formed

(B) Because RNA molecule with same sequences will be formed

(C) Because RNA molecule with identical sequences will be formed

(D) Because DNA molecule with different sequences will be formed

Ans (A)

12. Monocistronic transcriptional units are found in

(A) prokaryotes (B) eukaryotes (C) Both (A) and (B)

(D) bacteria **Ans** (B)

13. Splicing is the removal of

(A) exons and joining of introns

(B) introns and joining of exons (C) exons only

(D) introns only **Ans** (B)

14. If the coding strand has the sequence $5' - AGGCCT - 3'$, then find out the sequence in the strand of mRNA transcribed

(A) $3' - AGGCCU - 5'$ (B) $3' - UGGCCA - 5'$

(C) $3' - UCCGGA - 5'$ (D) $5' - ACCGGU - 3'$ **Ans** (C)

15. RNA polymerase II transcribes

(A) hnRNA (heterogenous nuclear RNA) (B) 50S rRNA

(C) 30S rRNA (D) 40S rRNA **Ans** (A)

16. Number of adenylate residues added at 3′ end of hnRNA

(A) 300 – 400 (B) 200 – 300 (C) 400 – 500

(D) 100 – 200 **Ans** (B)

17. Who used cell free system for protein synthesis?

(A) Marshall Nirenberg (B) Ochoa (C) Khorana

(D) Gamow **Ans** (A)

18. 'Codons are degenerate' means some amino acids are coded by

(A) more than one codon (B) only one codon

(C) two codons (D) more than 8 codons

Ans (A)

19. The distance between the two consecutive base pairs of DNA is

(A) 3.4 nm (B) 0.34 nm

(C) 0.34 Å (D) both (B) and (C) **Ans** (B)

20. Lightly stained part of chromatin which remains loosely packed is

(A) euchromatin (B) heterochromatin

(C) chromatosome (D) chromonemata **Ans** (A)

21. Identify the stop codons in given options.

(A) UAA, UAG, UGA (B) UCA, UCC, UCA

(C) UGC, UCG, UCC (D) UUU, UAT, UTA **Ans** (A)

22. Ribosome that acts as a catalyst or ribozyme is

(A) 40S rRNA (B) 50S rRNA

(C) 70S RNA (D) 23S rRNA **Ans** (D)

23. Match the following columns.

Column I		**Column II**	
a.	z-gene	1.	Transacetylase
b.	y-gene	2.	Permease
c.	a-gene	3.	β-galactosidase

Codes

	A	b	c
(A)	1	2	3
(B)	3	2	1
(C)	1	3	2
(D)	3	1	2

Ans (B)

24. In lac operon model, lactose acts as

(A) repressor (B) terminator

(C) regulator (D) inducer **Ans** (D)

25. *Caenorhabditis elegans* is a

(A) parasitic pathogenic nematode

(B) free living pathogenic nematode

(C) free living non-pathogenic nematode

(D) parasitic non-pathogenic nematode **Ans** (C)

26. ESTs stands for

(A) Expressed Sequence Tags (B) Exit Sequence Tags

(C) Exon Sequence Tags (D) Expressed Satellite Tags

Ans (A)

27. Total percentage of genes, which codes for proteins is

(A) 4 % (B) 2 % (C) 4 %

(D) 5 % **Ans** (B)

28. Chromosome number __________ has most genes (2968) while _______ has fewest genes (231). The blanks are

(A) 10 and Y (B) X and Y

(C) 1 and Y (D) Y and 1 **Ans** (C)

29. SNP-Single Nucleotide Polymorphisms is

(A) location on RNA where the single base differs

(B) location on proteins where the single base differs

(C) location on genome where the single base of DNA differs

(D) location on genome where many bases of DNA differs

Ans (C)

30. VNTR belongs to the class of satellite DNA referred to as

(A) microsatellite DNA (B) minisatellite DNA

(C) megasatellite DNA (D) repetitive DNA **Ans** (B)

31. HGP was closely associated with the rapid development of a new area in biology called

(A) biotechnology (B) bioengineering

(C) bioinformatics (D) biogeography **Ans** (C)

32. How many base pairs of DNA helix are contained in a typical nucleosome?

(A) 400 (B) 300 (C) 200 (D) 100

Ans (C)

33. In Griffith's experiment, what would be the effect of following conditions on mice?

Form of *Streptococcus* injected	**Effect on Mice**
I. Live rough non-capsulated	A
II. Live smooth capsulated	B
III. Heat-killed smooth	C
IV. Heat-killed smooth + live rough	D

Choose the correct option for effect on mice.

(A) A–Survived, B–Died, C–Died, D–Survived

(B) A–Survived, B–Died, C–Survived, D–Died

(C) A–Died, B–Survived, C–Survived, D–Died

(D) A–Died, B-Survived, C–Died, D–Died

Ans (B)

34. Who gave an unequivocal proof that DNA is the genetic material?

(A) Griffith (B) Avery, MacLeod and McCarty

(C) Alfred Hershey and Martha Chase (D) Mendel and Watson

Ans (C)

35. The first genetic material was

(A) RNA (B) DNA (C) Both (A) and (B)

(D) Proteins **Ans** (A)

36. Name the heavy isotope used by Meselson and Stahl for proving the semiconservative mode of DNA.

(A) $^{15}NH_4Cl$ (B) $^{14}NH_3Cl_2$ (C) $^{13}NH_2Cl_3$

(D) $^{18}NH_2Cl_3$ **Ans** (A)

37. The main enzyme which uses a DNA template to catalyse the polymerisation of deoxynucleotides is

(A) DNA ligase (B) DNA polymerase

(C) DNA helicase (D) DNA gyrase **Ans** (B)

38. DNA dependent DNA polymerases catalyses polymerisation in which direction?

(A) $3' - 5'$ (B) $5' - 2'$

(C) $5' - 3'$ (D) $2' - 5'$ **Ans** (C)

39. Which of the following statements is correct?

(A) A forms 2 hydrogen bonds with G; T forms 3 hydrogen bonds with C

(B) A forms 3 hydrogen bonds with T; G forms 2 hydrogen bonds with C

(C) A forms 2 covalent bonds with T; G forms 3 covalent bonds with C

(D) A forms 2 hydrogen bonds with T; G forms 3 hydrogen bonds with C

Ans (D)

40. Which of the following factors is not needed for transcription?
(A) Ribosomes

(B) Nucleotides

(C) DNA

(D) Enzymes

Ans (A)

****

2nd PU

Evolution

1. Eyes of octopus and mammals appear quite similar. They are

   (A) homologous organs (B) analogous organs

   (C) vestigial organs (D) non-functional organs **Ans** (B)

2. Saltation stands for

   (A) single step large mutation (B) single step small mutation

   (C) double step small mutation (D) double step large mutation

   Ans (A)

3. Australian marsupials are the example of

   (A) extinct animals (B) manmade evolution

   (C) adaptive radiation (D) convergent radiation **Ans** (C)

4. Big-Bang theory attempts to explain the origin of

   (A) earth (B) solar-system

   (C) universe (D) continents **Ans** (C)

5. First evidence of ceremonial burial of dead body and belief in religion have been found with the fossils of

   (A) Neanderthal man (B) Cro-magnon man

   (C) *Homo erectus* (D) *Homo habilis* **Ans** (A)

6. For a long time it was believed that life came out of decaying and rotting matter like straw, mud, etc.

   This was the theory of

   (A) catastrophism (B) spontaneous generation

   (C) panspermia (D) chemogeny **Ans** (B)

7. Which of the following gases was absent in the atmosphere at the time of origin of life?

   (A) NH_3 (B) H_2

   (C) O_2 (D) CH_4 **Ans** (C)

8. Miller synthesised simple amino acids from which one of the following mixtures in his experiment?

(A) CH_4, NH_3, H_2 and water vapour

(B) H_2, O_2, N_2 and water vapour

(C) H_2, O_2, C_2 and water vapour

(D) CH_4, NH_3, O_2 and water vapour **Ans** (A)

9. The first non-cellular forms of life is believed to have originated

(A) 3 billion years back

(B) 2 billion years back

(C) 4 billion years back

(D) 1 billion years back **Ans** (A)

10. Theory of Natural Selection was given by

(A) Lamarck (B) Darwin (C) Alfred Wallace

(D) JBS Haldane **Ans** (B)

11. How old is our universe?

(A) 10 billion years old (B) 20 billion years old

(C) 15 billion years old (D) 5 billion years old

Ans (B)

12. Divergent evolution gives rise to

(A) homologous organs (B) analogous organs

(C) Both (A) and (B) (D) vestigial organs

Ans (A)

13. Who discarded the theory of spontaneous generation forever?

(A) Louis Pasteur (B) Francisco Redi

(C) Spallanzani (D) Aristotle **Ans** (A)

14. Separate the following into homologous and analogous organs.

I. Sweet potato and potato

II. Flippers of penguins and dolphins.

III. Hearts of different vertebrate.

IV. Brains of different vertebrate.

V. Forelimbs of whales, bat and cheetah.

The correct option is

	Homologous organs	Analogous organs
(A)	I, II, III	IV, V
(B)	III, IV, V	I, II
(C)	I, II	III, IV, V
(D)	I, II, V	IV, III

Ans (B)

15. Two key concepts of Darwinian theory of evolution are

I. branching descent. II. use and disuse of organs.

III. natural selection. IV. somatic variance.

The correct combination is

(A) I and II (B) III and IV

(C) I and III (D) II and IV **Ans** (C)

16. Organs which are anatomically different, but performs similar functions are called

(A) analogous organs (B) homologous organ

(C) vestigial organs (D) heterologous organs **Ans** (A)

17. Evolution for Darwin was gradual, while de Vries believed that mutations caused speciation. The belief of de Vries supports the concept of

(A) saltation (B) evolution

(C) genetic equilibrium (D) variance **Ans** (A)

18. First human like hominid is known as

(A) Neanderthal man (B) *Homo habilis*

(C) Dryopithecus (D) *Homo erectus* **Ans** (B)

19. Identify the phenomenon in which a new population is formed from the set of existing population due to the excessive change in the allele frequency.

(A) Founder effect (B) Evolutionary effect

(C) Bottle-neck effect (D) Gene flow **Ans** (A)

20. Match the following columns.

Column I		Column II	
a.	500 million years ago	1.	Sea weeds and few plants
b.	350 million years ago	2.	Jawless fishes
c.	320 million years ago	3.	Invertebrates

Codes

	a	b	c
(A)	1	2	3
(B)	1	3	2
(C)	2	3	1
(D)	3	2	1

Ans (D)

21. If frequency of 'A' allele is 0.4 then find out the frequencies of 'a' allele and heterozygous genotype in a random mating population at equilibria.

(A) 0.6 and 0.24 (B) 0.6 and 0.96

(C) 0.6 and 0.48 (D) 0.6 and 0.50 **Ans** (C)

22. Fossils of *Homo erectus* was found in

(A) Java in 1891 (B) India in 1921

(C) Africa in 1927 (D) Australia in 1945 **Ans** (A)

23. Which of the given pairs are correct?

I. Wings of insects and birds are homologous organ.

II. Wings of bats and bird are homologous organ.

III. Wings of insect and bats are analogous.

IV. Wings of insect and bird are analogous.

Choose the correct option.

(A) I and II (B) I and III

(C) I and IV (D) II, III and IV **Ans** (D)

24. Tendrils of *Cucurbita* and thorns of *Bougainvillea* are

(A) vestigial organs (B) analogous organs

(C) homologous organs (D) heterologous organs **Ans** (C)

25. Scientist who also came to the similar conclusions of evolution by natural selection around the same time of Charles Darwin was

(A) Alfred Wallace

(B) Hugo de Vries

(C) TH Morgan

(D) Oparin and Haldane

Ans (A)

****

2nd PU

Human Health and Disease

1. The type of antibody present in colostrum is

   (A) IgM (B) IgA (C) IgG (D) IgE **Ans** (B)

2. Which non-infectious disease is the major cause of death in humans?

   (A) Cancer (B) AIDS (C) Asthma

   (D) Typhoid **Ans** (A)

3. Malignant malaria is caused by

   (A) *Plasmodium falciparum* (B) *Plasmodium ovale*

   (C) *Plasmodium vivax* (D) *Plasmodium malariae*

   Ans (A)

4. If a certain patient is suspected to be suffering from typhoid, which diagnostic technique will you recommend for its detection?

   (A) ELISA (B) WIDAL

   (C) MRI (D) CT scan **Ans** (B)

5. Which one of the following is not the property of cancerous cells?

   (A) They do not require nutrition

   (B) They do not remain confined in the area of formation

   (C) They show contact inhibition

   (D) They divide in an uncontrolled manner

   Ans (C)

6. Interferons protect healthy cells in human from

   (A) fungal infection (B) bacterial infection

   (C) viral infection (D) protozoan infection **Ans** (C)

7. Rhinovirus causes

   (A) common cold (B) malaria

   (C) AIDS (D) pneumonia **Ans** (A)

8. Which of the following toxic substances is responsible for the high malarial fever?

(A) Haemoglobin (B) Haemocyanin

(C) Haemozoin (D) Haemoriden **Ans** (C)

9. *Entamoeba histolytica* causes

(A) malaria (B) amoebiasis

(C) typhoid (D) filariasis **Ans** (B)

10. Which is not a symptom of disease caused by *E. histolytica*?

(A) Stools with excess mucus (B) Constipation

(C) Abdominal pain (D) Nasal discharge **Ans** (D)

11. Blood circulation was discovered by

(A) William Harvey (B) Hippocrates

(C) Karl Landsteiner (D) Paul Ehrlich **Ans** (A)

12. The name of Mary Mallon is related with the disease

(A) typhoid (B) pneumonia

(C) dengue (D) AIDS **Ans** (A)

13. The pathogen *Microsporum* responsible for ringworm disease in humans belongs to

(A) viruses (B) bacteria

(C) fungi (D) protozoa **Ans** (C)

14. Which of the following diseases caused internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage?

(A) Ascariasis (B) Filariasis

(C) Amoebiasis (D) Trpanosoiasis **Ans** (A)

15. The carnivorous fish used for eradication of mosquito larva in stagnated water is

(A) *Gambusia* (B) *Anabas* (C) Rohu

(D) *Catla catla* **Ans** (A)

16. Infective stage of *Plasmodium* for humans is

(A) merozoites (B) ookinetes

(C) sporozoites (D) amoebocytes **Ans** (C)

17. Stomach clear out pathogens with the help of

(A) pepsin (B) HCI

(C) bile (D) lysozyme **Ans** (B)

18. Cannabinoids are the group of chemicals which interact with cannabinoid receptors present principally in

(A) brain (B) neuron

(C) nephron (D) Dendron **Ans** (A)

19. Full form of PMNL is

(A) Poly Morpho-Nuclear Leukocytes

(B) Para Morpho-Nuclear Lymphocytes

(C) Penta Morpho-Nuclear Leukocytes

(D) Poly Morpho-Nuclear Lymphocytes **Ans** (A)

20. Antibody molecule has

(A) four polypeptide chains (B) five polypeptide chains

(C) six polypeptide chains (D) seven polypeptide chains

Ans (A)

21. Cell-mediated immunity is mainly a function of

(A) B-cells (B) T-cells (C) macrophages

(D) interferons **Ans** (B)

22. Humoral immunity is also called as

(A) antibody mediated immunity

(B) non-specific immune response

(C) antigen mediated immunity

(D) innate immunity **Ans** (A)

23. How many variable segments are present in the basic structure of an antibody molecule?

(A) One (B) Two (C) Three (D) Four

Ans (D)

24. Hepatitis-B vaccine is produced from

(A) yeast (B) bacteriophage (C) bacteria

(D) All of these **Ans** (A)

25. The Ig that mediates allergic reaction is

(A) IgM (B) IgG (C) IgE (D) IgA

Ans (C)

26. Which among the following is an autoimmune disease?

(A) Rheumatoid arthritis (B) AIDS

(C) Hepatitis-B (D) Swine flu **Ans** (A)

27. What is the main lymphoid organ where all blood cells including lymphocytes are produced?

(A) Spleen (B) Tonsils

(C) Liver (D) Bone marrow **Ans** (D)

28. Full form of MALT is

(A) Mucosal Associated Lymphoid Tissue

(B) Memory Associated Lymphoid Tissue

(C) Memory Associated Lymphocyte Tissue

(D) Mucosa Associated Lymphocyte Tissue **Ans** (A)

29. A new born baby who receives IgA form its mother's milk develops

(A) naturally acquired active immunity

(B) artificially acquired active immunity

(C) naturally acquired passive immunity

(D) artificially acquired passive immunity **Ans** (C)

30. The AIDS virus spreads by decreasing

(A) killer T-cells (B) helper T-cells

(C) suppressor T-cells (D) cytotoxic T-cells **Ans** (B)

31. The invasion of cancerous cells from one part of the body to another of body is called

(A) contact inhibition (B) metastasis

(C) benign tumour (D) tumour **Ans** (B)

32. A disease which can easily transmit from one person to another is called

(A) non-infectious disease (B) infectious disease

(C) viral disease (D) bacterial disease **Ans** (B)

33. The confirmatory test used to diagnose AIDS is

(A) ELISA (B) MRI (C) WIDAL (D) X-RAY

Ans (A)

34. Health is affected by

I. genetic disorders

IL infections

III. life style

Which of the key words given above are correct?

(A) I and II (B) I and III (C) II and III

(D) I, II and III **Ans** (D)

35. The protein α - 1 antitrypsin is used to treat

(A) cancer (B) rheumatoid arthritis

(C) Alzheimer's disease (D) emphysema **Ans** (D)

36. Which form of tumour remains confined to their original location and do not spread to other parts of the body?

(A) Malignant tumour (B) Benign tumour

(C) Both (A) and (B) (D) Leukaemia **Ans** (B)

37. A drug called morphine is obtained from

(A) *Rauwolfia serpentina* (B) *Cannabis sativa*

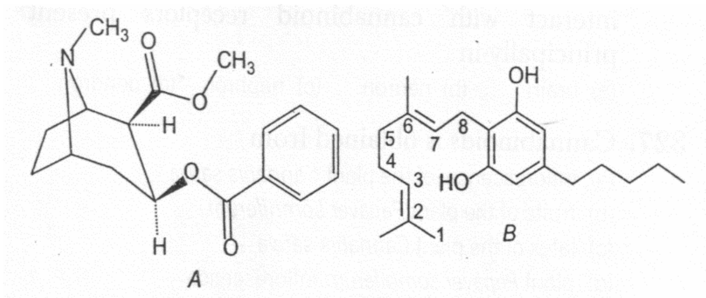
(C) *Cajanus cajan* (D) *Papaver somniferum* **Ans** (D)

38. Smoking causes many types of cancer including cancer of

(A) lungs (B) urinary bladder

(C) throat (D) All of these **Ans** (D)

39. The given below figures show



(A) A - Cannabinoid; B – Morphine

(B) A - Morphine; B - Cannabinoid

(C) A - Morphine; B – Quinine

(D) A - Quinine; B – Cannabinoid **Ans** (B)

40. Which of the following diseases is caused by *Salmonella typhi*?

(A) Typhoid (B) Pneumonia

(C) Malaria (D) Cold **Ans** (A)

41. Cirrhosis is

(A) alcohol related disease (B) smoke related disease

(C) junk food related disease (D) polluted air related disease

Ans (A)

****

2^{nd} PU

Strategies in Enhancement of Food Production

1. Jaya and Ratna are varieties of

   (A) maize (B) wheat (C) rice

   (D) millet **Ans** (C)

2. Most common honey bee species in India

   (A) *Apis indica* (B) *Apis florae* (C) *Apis mellifera*

   (D) *Apis dorsata* **Ans** (A)

3. The entire collection having all the diverse alleles for-all genes in a given crop is called

   (A) gene collection (B) germ collection

   (C) germplasm collection (D) plasma collection

   Ans (C)

4. More than 70% of livestock population is found in

   (A) Denmark (B) India

   (C) China (D) Both (B) and (C) **Ans** (D)

5. The most common egg-type variety of chicken used for commercial production throughout the world is

   (A) leghorn (B) plymoth rock

   (C) cornish (D) new Hampshire **Ans** (A)

6. Choose the flowers of a plant that are pollinated by honey bees

   (A) sunflower (B) apple and pear

   (C) *Brassica* (D) All of these **Ans** (D)

7. A group of animals which are related by descent and share many similarities are referred to as

   (A) breed (B) race

   (C) variety (D) species **Ans** (A)

8. Pomato is a somatic hybrid of

   (A) potato and onion (B) potato and tomato

(C) potato and brinjal (D) potato and garlic **Ans** (B)

9. Close inbreeding usually results in reduction of fertility and productivity. This is called

   (A) homozygosity (B) outbreeding

   (C) inbreeding depression (D) outbreeding depression **Ans** (C)

10. MOET stands for

    (A) Multiple Ovulation Embryo Transfer technology

    (B) More Ovulation Embryo Transfer technology

    (C) Multiple Ovulation Embryo Test technology

    (D) Mature Ovulation Embryo Transfer technology

    Ans (A)

11. Mule is produced by

    (A) inbreeding (B) outcrossing

    (C) interspecific hybridisation (D) intraspecific hybridization

    Ans (C)

12. Apiculture means

    (A) rearing of honey bees (B) rearing of silkworm

    (C) rearing of lac insect (D) rearing of butterflies

    Ans (A)

13. Sonalika and Kalyan Sona are the varieties of

    (A) wheat (B) rice (C) millet (D) tobacco

    Ans (A)

14. Semi-dwarf varieties of rice were developed from

    (A) IR - 8 (B) Taichung Native-1 (C) Both (A) and (B)

    (D) Jaya and Ratna **Ans** (C)

15. *Saccharum barberi* was/is grown in

    (A) East India (B) West India

    (C) North India (D) South India **Ans** (C)

16. Resistance to yellow mosaic virus in bhindi was transferred from a wild species and resulted in new variety of *A. escutentus* called

(A) Golden kranti (B) Sonalika

(C) IR-8 (D) Parbhani kranti **Ans** (D)

17. In maize, presence of high aspartic acid, low nitrogen and sugar content protect them from

(A) aphids (B) fruit borer

(C) jassids (D) stem borer **Ans** (D)

18. Hidden hunger can be defined as:

(A) majority people are unable to buy enough fruits, vegetables, legumes, fish and meat and thus suffer from deficiency

(B) people hide their hunger to remain slim

(C) people are healthy but hungry

(D) All of the above **Ans** (A)

19. The scientific process by which crop plants are enriched with certain desirable nutrients is called

(A) crop protection (B) plant breeding

(C) biofortification (D) bioremediation **Ans** (C)

20. Which is correct about Atlas 66?

(A) It has high protein content

(B) It has been used as a donor for improving cultivated wheat

(C) Both (A) and (B) (D) It is a GMO **Ans** (C)

21. Some released crop varieties bred by hybridisation and selection, for insect pest resistance are given. Fill up the blanks.

Crop	Variety	Resistance to diseases
Brassica	A	Aphids
B	Pusa Sem 2, Pusa Sem 3	Jassids, aphids and fruit borer

C	Pusa A-4	Shoot and fruit borer

(A) A - Pusa Karan, B - Flat bean, C - Bhindi

(B) A - Pusa Gaurav, B - Flat bean, C - Okra

(C) A - Pusa Shubhra, B - Wrinkled bean, C - Pea

(D) A - Pusa Komal, B - Smooth bean, C - Bhindi

Ans (B)

22. Choose the scientific name of a microorganism which produces high quantity of protein.

(A) *Spirulina* (B) *Chara*

(C) Yeast (D) *Ephedra* **Ans** (A)

23. The capacity of a cell explant to grow into a whole plant is called

(A) plant culture (B) tissue culture

(C) cellular totipotency (D) All of these **Ans** (C)

24. In order to obtained disease free plants through tissue culture methods the best techniques is

(A) embryo culture (B) protoplast culture

(C) meristem culture (D) anther culture **Ans** (C)

25. Pisciculture is rearing and production of

(A) fishes (B) birds

(C) reptiles (D) cattle

Ans (A)

****

2nd PU

Microbes in Human Welfare

1. Which of the following bacteria convert milk into curd?

   (A) *Propionibacterium sharmanii*

   (B) *Saccharomyces cerevisiae*

   (C) *Lactobacillus* (D) Thermophilic *bacteria* Ans (C)

2. Biogas is a mixture of inflammable gases like

   (A) Methane, CO_2, H_2 and H_2S (B) Methane, CO, H_2 and N_2

   (C) CO_2, H_2 and H_2S (D) CO, Methane and N_2

   Ans (A)

3. Toddy is a traditional drink of

   (A) South India (B) North India

   (C) West India (D) East India **Ans** (A)

4. Physical removal of large and small stable solid particles from the sewage through filtration and sedimentation is called

   (A) primary treatment (B) secondary treatment

   (C) tertiary treatment (D) quaternary treatment **Ans** (A)

5. Swiss cheese is formed by the bacterium

   (A) *Aspergillus niger* (B) *Lactobacillus*

   (C) *Propionibacterium sharmanii*

   (D) *Penicillium roqueforti* **Ans** (C)

6. Ethanol is commercially produced through a particular species of

   (A) *Aspergillus* (B) *Saccharomyces*

   (C) *Clostridium* (D) *Trichcjderma*

   Ans (B)

7. Which one of the following antibiotis was extensively used to treat American soldiers wounded in World War-II?

   (A) Streptomycin (B) Penicillin

   (C) Clavulin (D) Neomycin **Ans** (B)

8. *Monascus purpureus* is a yeast commercially used in the production of

(A) acetic acid (B) ethanol

(C) blood cholesterol lowering statins

(D) streptokinase **Ans** (C)

9. Which of the following are main the benefits of LAB?

I. Increase Vit B_{12} amount, thus increasing nutrient quality of milk.

II. Checks disease causing microbes in stomach.

Choose the correct option.

(A) Only I (B) Only II

(C) I and II (D) Neither I nor II **Ans** (C)

10. Which one of these microbes is used in the commercial production of butyric acid?

(A) *Clostridium butylicum* (B) *Streptococcus butylicum*

(C) *Trichoderma polysporum* (D) *Saccharomyces cerevisiae*

Ans (A)

11. Cyclosporin-A, an immunosuppressive drug is produced by the fungus

(A) *Aspergillus niger* (B) *Monascus purpureus*

(C) *Penicillium notatum* (D) *Trichoderma polysporum*

Ans (D)

12. Statins used as blood cholesterol lowering agents are extracted from

(A) algae (B) yeast (C) virus (D) bacteria

Ans (B)

13. Name the group of microbes used in biogas production

(A) lactic acid bacteria (B) yeasts

(C) cyanobacteria (D) methanogens **Ans** (D)

14. The technology of biogas production from cow dung was developed in India largely by the efforts of

(A) Oil and Natural Gas Commission (B) Gas Authority of India

(C) Indian Agricultural Research Institute, and Khadi and Village Industries Commission

(D) Indian Oil Corporation **Ans** (C)

15. During the primary treatment of sewage, solid particles that settle down are called

(A) activated sludge (B) secondary sludge

(C) primary sludge (D) anaerobic sludge **Ans** (C)

16. The purpose of biological treatment of waste water is to

(A) reduce BOD (B) increase BOD

(C) reduce sedimentation (D) increase sedimentation **Ans** (A)

17. The free-living fungus *Trichoderma* can be used for

(A) killing insects (B) biological control of plant diseases

(C) controlling butterfly caterpillars

(D) producing antibiotics **Ans** (B)

18. The most important of the symbiotic nitrogen fixing bacteria, which forms nodules on the roots of legume plants is

(A) *Aspergillus* (B) *Rhizobium*

(C) *Penicillium* (D) *Streptococcus* **Ans** (B)

19. The most common fungal partner of mycorrhiza belongs to genus

(A) *Azotobacter* (B) *Glomus*

(C) *Azolla* (D) *Frankia* **Ans** (B)

20. *Bacillus thuringiensisis* is used as

(A) biofungicide (B) biopesticide

(C) bioweedicide (D) bioweapon **Ans** (B)

21. In the sewage treatment bacterial flocs are allowed to sediment in a settling-tank. This sediment is called as

(A) activated sludge (B) primary sludge

(C) anaerobic sludge (D) secondary sludge

Ans (A)

22. Baculoviruses do not show harmful effect on

I. plants

II. Mammals

III. Bird

IV. Non-target insects

Choose the correct option.

(A) I, II and III (B) II, III and IV

(C) I, III and IV (D) I, II, III and IV **Ans** (D)

23. Penicillin was discovered by

(A) Alexander Flemming; 1928

(B) Alexander Flemming; 1930

(C) S Waksman; 1928 (D) S Waksman; 1930 **Ans** (A)

24. An un-distilled alcoholic beverage produced from grain-mesh fermentation is

(A) beer (B) rum

(C) curd (D) wine **Ans** (A)

25. The residue left after methane production from cattle dung is

(A) burnt (B) burned in land fills

(C) used as manure (D) used in civil construction

Ans (C)

****

2^{nd} PU

Biotechnology – Principles and Processes

1. Which of the following steps are catalysed by *taq* polymerase in PCR?

   (A) Denaturation of template DNA

   (B) Annealing of primers to template DNA

   (C) Extension of primer end on the template DNA

   (D) All of the above

   Ans (C)

2. Stirred-tank bioreactors have been designed for

   (A) purification of the product

   (B) addition of preservatives to the product

   (C) availability of oxygen throughout the process

   (D) ensuring anaerobic conditions in the culture vessel

   Ans (C)

3. EFB stands for

   (A) European Federation of Biotechnology

   (B) Eurasian Federation of Biotechnology

   (C) East Asia Federation of Biotechnology

   (D) Ethiopian Federation of Biotechnology

   Ans (A)

4. The first recombinant DNA was constructed by

   (A) Stanley Cohen (B) Herbert Boyer

   (C) Both (A) and (B) (D) Temin and Baltimore

   Ans (C)

5. Which of the following is known as molecular scissors of DNA?

   (A) Ligase (B) Polymerases

   (C) Restriction endonucleases (D) Transcriptase

   Ans (C)

6. There is a restriction endonuclease called *Eco* RI. What does '*co*' part in it stands for?

(A) coelom (B) strain of bacterium

(C) coli (D) colon

Ans (C)

7. 5' GAATTC 3' is the recognition site for the restriction endonuclease

(A) *Eco* RI (B) *Hind* II

(C) *Eco* RII (D) Bam HI

Ans (A)

8. The linking of antibiotic resistance gene with the plasmid vector became possible with

(A) DNA ligase (B) RNA ligase

(C) DNA polymerase (D) RNA polymerase

Ans (A)

9. Which one of the following is commonly used in transfer of foreign DNA into crop plants?

(A) *Trichoderma hazarnium* (B) *Meloidogyne incognitia*

(C) *Agrobacterium tumefaciens* (D) *Penicillium expansum*

Ans (C)

10. Biolistics (gene gun) is suitable for

(A) disarming pathogen vectors

(B) transformation of plant cells

(C) construction recombinant DNA by joining with vectors

(D) DNA fingerprinting

Ans (B)

11. The two main techniques that gave birth to modern biotechnology are

I. chemical engineering. II. genetic engineering.

III. human genome engineering. IV. molecular biology.

Choose the correct option.

(A) I and II

(B) I and III

(C) II and IV

(D) II and III

Ans (A)

12. The enzymes commonly used in genetic engineering are

    (A) restriction endonuclease and polymerase

    (B) endonuclease and ligase

    (C) restriction endonuclease and ligase

    (D) ligase and polymerase

    Ans (C)

13. You completed gel electrophoresis as requested by your teacher. Where would you find the smallest segment of DNA?

    (A) Near the positive electrode, farthest away from the wells

    (B) Near the negative electrode, close to the wells

    (C) Near the top - near the negative pole

    (D) Near the middle

    Ans (A)

14. Which of the following steps are involved in process of recombinant biotechnology? Arrange the correct order.

    I. Extraction of the DNA.

    II. Amplification of the gene of interest.

    III. Isolation of a desired DNA fragment.

    IV. Ligation of the DNA fragment into a vector.

    V. Insertion of recombinant DNA into the host.

    Correct order is

    (A) I, II, III, IV and V

    (B) I, III, II, IV and V

    (C) II, IV, V, III and I

(D) I, IV, V, III and II

Ans (B)

15. Polymerase Chain Reaction (PCR) needs

(A) DNA template (B) Primers

(C) *Taq* polymerase (D) All of these Ans (D)

16. After completion of the biosynthetic stage in the bioreactors, the product undergoes separation and purification processes, collectively termed as

(A) transformation (B) transduction

(C) downstream processing (D) upstream processing

Ans (C)

17. Agarose is extracted from

(A) sea weeds (B) blue-green algae

(C) bacteria (D) mosses **Ans** (A)

18. In gel electrophoresis, the separated DNA fragments are visualized after staining the DNA with ___(a)___ followed by exposure to ___(b)___ Here a and b refers to

	(a)	**(b)**
(A)	B-galactosidase	Infrared radiation
(B)	Ethidium bromide	UV radiation
(C)	Ethidium nitrate	X-rays
(D)	Ethidium chloride	Radiowaves

Ans (B)

19. Which of the following is a plasmid?

(A) pBR322 (B) *Bam* II (C) *Sal* I

(D) *Eco* RI **Ans** (A)

20. Significance of heat shock method in bacterial transformation facilitates

(A) binding of DNA to the cell wall

(B) uptake of DNA through membrane transport proteins

(C) uptake of DNA through transient pores in the bacterial cell wall

(D) expression of antibiotic resistance gene

Ans (C)

****

2^{nd} PU

Biotechnology – Applications

1. RNAi stands for

   (A) RNA interference (B) RNA interferon

   (C) RNA inactivation (D) RNA initiation **Ans** (A)

2. *Bacillus thuringiensis* is a bacterium of

   (A) polluted water (B) mammalian skin

   (C) soil (D) surface of midgut of molluscs

   Ans (C)

3. C-peptide of human insulin is

   (A) a part of mature insulin molecule

   (B) responsible for the formation of disulphide bridges

   (C) removed during the maturation of pro-insulin to insulin

   (D) responsible for its biological activity

   Ans (C)

4. A functional ADA cDNA can be introduced into the cells of the patients receiving gene therapy by using vector constituted by

   (A) *E. coli* (B) Retrovirus

   (C) *Bacillus thuringiensis* (D) *Agrobacterium* **Ans** (B)

5. The crops having *cry* genes need

   (A) no insecticide (B) small amount of insecticide

   (C) large amount of insecticide (D) regular insecticide

   Ans (A)

6. ………..is a collection of methods that allows correction of gene defects diagnosed in a child or embryo.

   (A) Medical therapy (B) Gene therapy

   (C) Molecular diagnosis (D) ELISA **Ans** (B)

7. *Bt* toxin protein crystals present in bacterium *Bacillus thuringiensis*, do not kill the bacteria themselves because

   (A) bacteria are resistant to the toxin

   (B) bacteria enclose toxins in a special sac

   (C) toxins occur as inactive protoxins in bacteria

   (D) the toxin is produced by the insect

   Ans (C)

8. Golden rice is a transgenic variety of rice which contains good quantities of

   (A) β-carotene (pro-vitamin-A)

   (B) α-carotene (pro-vitamin-A)

   (C) γ-carotene (pro-vitamin-B)

   (D) All of the above

   Ans (B)

9. Which of the following nematode infects the roots of the tobacco plants which reduce the production of tobacco?

   (A) *Wuchereria* (B) *Ascaris*

   (C) *Melodegyne incognitia* (D) *Enterobius* **Ans** (C)

10. Applications, like bioremediation, processed food, therapeutics and diagnostics are related with

   (A) Biochemistry (B) Microbiology

   (C) Biotechnology (D) Medical science **Ans (C)**

11. In RNAi, genes are silenced using

   (A) *ds*DNA (B) *ds*RNA

   (C) *ss*DNA (D) *ss*RNA **Ans** (B)

12. In 1983, Eli Lilly an American company, first prepared two DNA sequences corresponding to A and B-chains of the human insulin and introduced them in the plasmids of *Escherichia coli* to produce insulin chains. Chains A and B were prepared separately, extracted and combined by creating

   (A) hydrogen bond (B) disulphide bond

(C) covalent bond (D) peptide bond **Ans** (B)

13. What is the demerit of using insulin from cow and pig for diabetic patients?

    (A) It leads to hypercalcemia (B) It is expensive

    (C) It may cause allergic reactions

    (D) It may lead to mutations in human genome **Ans** (C)

14. The protein products of the following Bt toxin genes *cry* IAc and *cry* IIAb are responsible for controlling

    (A) bollworm (B) roundworm

    (C) moth (D) fruitfly **Ans** (A)

15. The first time in 1990, scientists attempted gene therapy on a 4 year old girl with which of the following enzyme deficiency?

    (A) Cytosine deaminase (CDA)

    (B) Adenosine deaminase (ADA)

    (C) Tyrosine oxidase (D) Glutamate trihydrogenase

    Ans (B)

16. ELISA is based on

    (A) antigen-antibody interaction

    (B) antigen-protein interaction

    (C) lectin-antibody interaction

    (D) All of the above **Ans** (A)

17. A single strand of nucleic acid tagged with a radioactive molecule is called

    (A) plasmid (B) vector (C) probe

    (D) selectable marker **Ans** (C)

18. Transgenic animals are those which have foreign

    (A) DNA in some of its cells (B) DNA in all of its cells

    (C) RNA in all of its cells (D) RNA in some of its cells

    Ans (B)

19. Which gene was introduced in the first transgenic cow?

(A) Human α-lactalbumin (B) α-1-antitrypsin

(C) β-1-antitrypsin (D) *cry*-IAc **Ans** (A)

20. Which variety of rice was patented by a US company even though the highest number of varieties of this rice is found in India?

(A) Basmati (B) Parmal

(C) Lerma Roja (D) CO-668 **Ans** (A)

21. The decisions regarding the validity of GMO research and the safety of introducing GMO for the public services in India is taken by

(A) Genetic Engineering Approval Committee

(B) Department of Recombinant DNA Technology

(C) Department of Science and Biotechnology

(D) National Biotechnology Board **Ans** (A)

22. Use of biological resources of other countries without any legal authorisation of the countries concerned is called

(A) biopatent (B) biopiracy

(C) bioethics (D) all of these **Ans** (B)

23. Today, transgenic models have been developed for many human diseases, which includes

I. rheumatoid arthritis II. Alzheimer's disease

III. common cold IV. cystic fibrosis

Choose the correct option.

(A) I and II (B) II arid IV

(C) I, II and IV (D) I, II, III and IV **Ans** (C)

24. Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called

(A) genetically modified organisms

(B) hybrid organisms (C) pest resistant organisms

(D) insect resistant organisms **Ans** (A)

25. In 1997, the first transgenic cow, Rosie produced

(A) human protein enriched milk (2.4 g/L)

(B) human protein enriched milk (2.8 g/L)

(C) human calcium enriched milk (2.4 g/L)

(D) human calcium enriched milk (2.8 g/L)

Ans (A)

****

2nd PU

Organisms and Populations

1. Which of the following is not a part of an organism's abiotic environment?

   (A) Temperature (B) Light

   (C) Other organisms (D) Humidity **Ans** (C)

2. Organisms that can tolerate a wide range of salt concentration are termed as

   (A) stenosaline (B) stenohaline

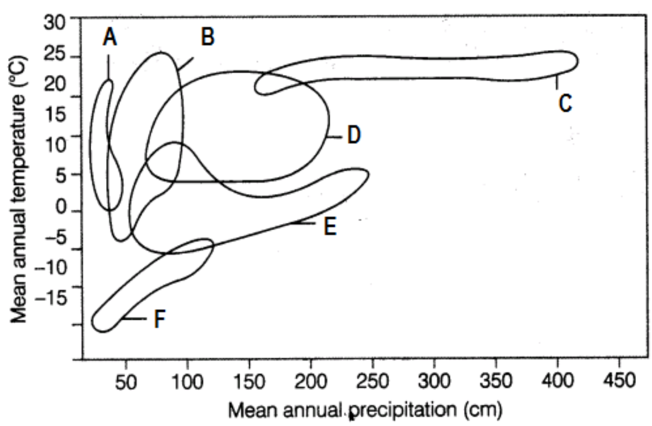
   (C) euryhaline (D) eurysaline **Ans** (C)

3. The branch of science which studies the interactions among organisms and between organisms and physical environment is called as

   (A) epidemiology (B) ecology

   (C) ethology (D) etiology **Ans** (B)

4. In the given figure, identify the temperate forest and coniferous forest respectively from the markings A – F and select the correct option.



   (A) A and B (B) B and D (C) D and E

   (D) C and F **Ans** (C)

5. Deserts, rainforests, tundra, etc. are examples of

   (A) community (B) biome

   (C) ecosystem (D) population **Ans** (B)

6. Seasonal variations on earth occur due to its

   (A) tilted axis (B) rotation around its own axis

   (C) revolution around sun (D) both (A) and (C)

   Ans (D)

7. Many animals use the diurnal and seasonal variations in light intensity and photoperiod to time their

   (A) migration (B) reproductive activities

   (C) forgaing (D) all of (A), (B), and (C) **Ans** (D)

8. When we are in a hot room, we sweat profusely. It is a _________ means of maintaining homeostasis.

   (A) morphological (B) physiological

   (C) behavioural (D) all of (A), (B), and (C) **Ans** (B)

9. _________ is an attribute of the organism (morphological, physiological, behavioural) to survive and reproduce in its habitat.

   (A) Migration (B) Hibernation

   (C) Adaptation (D) Homeostasis **Ans** (C)

10. Which of the following is an incorrect match regarding suspension?

    (A) Bacteria – Thick walled resting spores

    (B) Bear – Hibernation (C) Zooplanktons – Diapause

    (D) Lizard – Aestivation **Ans** (D)

11. ________ rule states that mammals from colder climates generally have shorter ears and limbs to minimise heat loss.

    (A) Allen's (B) Berger's

    (C) Borge's (D) Powell's **Ans** (A)

12. In the sea, salt concentration (measured as salinity in parts per thousand) is

    (A) < 5% (B) 30-35% (C) >100%

(D) 5-10%   **Ans** (B)

13. Symptoms of altitude sickness include all except

    (A) nausea   (B) fatigue

    (C) heart palpitations   (D) excess energy   **Ans** (D)

14. Select the incorrect statement.

    (A) Majority of animals and nearly all plants do not maintain a constant internal temperature

    (B) An orchid growing as an epiphyte on a branch is an example of mutualism

    (C) In brood parasitism, the parasite bird lays its eggs in the nest of its host and let the host incubate them.

    (D) In amensalism, one species is harmed whereas the other is unaffected.

    Ans (B)

15. Diapause is a stage of _______ .

    (A) perpetual development   (B) intermittent development

    (C) suspended development   (D) sequential development

    Ans (C)

16. Which of the following organisms is capable of meeting its water requirement through internal oxidation of fats?

    (A) Desert lizard   (B) Antarctic fish

    (C) Kangaroo rat   (D) Seal   **Ans** (C)

17. Thick cuticle, sunken stomata, CAM photosynthesis and conversion of leaves into spines are some of the important characters of

    (A) desert plants   (B) hydrophytes

    (C) mesophytes   (D) aquatic plants   **Ans** (A)

18. Natality refers to

    (A) number of births in a given geographical area

    (B) number of births in a given time period

    (C) number of births under influence of a given environmental factor

(D) number of deaths in a given time period. **Ans** (B)

19. Carrying capacity K means

(A) organism's capability of maximum reproduction

(B) nature's limit for supporting maximum growth of a species

(C) nature's limit for supporting maximum number of genera

(D) organism's capability to withstand environment odds.

Ans (B)

20. When one organism is benefitted without affecting the others, it is called

(A) parasitism (B) commensalism

(C) saprophytism (D) symbiosis. **Ans** (B)

21. Match Column-I (interspecific relations) with Column-II (their examples) and choose the correct option.

Column-I		**Column-II**	
(a)	Commensalism	(i)	Epiphyte on tree
(b)	Mutualism	(ii)	Fig tree and wasp
(c)	Co-evolution	(iii)	Cattle egret and grazing cattle
(d)	Sexual deceit	(iv)	Sea anemone and clown fish
		(v)	Lichen
		(vi)	Mycorrhiza
		(vii)	Mediterranean orchid and *Ophrys*

(A) (a) → (i), (iii), (iv); (b) → (ii), (v), (vi); (c) → (ii); (d) → (vii)

(B) (a) → (iii), (iv); (b) → (i), (ii), (v); (c) → (iii); (d) → (v), (vi)

(C) (a) → (i), (iii); (b) → (ii), (iv); (c) → (ii); (d) → (vii)

(D) (a) → (iv); (b) → (v), (vi); (c) → (i); (d) → (vii) **Ans** (A)

22. Abingdon tortoise in Galapagos Islands became extinct within a decade after _______ were introduced on the island, because of the greater browsing efficiency of the introduced animals on the island.

(A) cows (B) buffaloes (C) goats

(D) camels **Ans** (C)

23. Commensalism is shown by all except

(A) orchid on mango branch

(B) cattle egret and grazing cattle

(C) sea anemone and clown fish

(D) cuckoo (koel) and crow. **Ans** (D)

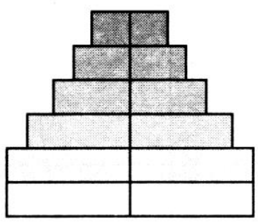
24. Which of the following would necessarily decrease the density of a population in a given habitat?

(A) Natality > mortality (B) Immigration > emigration

(C) Mortality and emigration (D) Natality and immigration

Ans (C)

25. Given diagram represents age pyramid for human population. Identify it.



(A) Declining

(B) Stable

(C) Expanding

(D) Expanding or Declining

Ans (B)

****

2^{nd} PU

Ecosystem

1. Percentage of photosynthetically active radiation (PAR) in the incident solar radiation is

   (A) 1-5% (B) 2-10%

   (C) less than 50% (D) approx. 100% **Ans** (C)

2. Select the incorrect food chain.

   (A) Grass → Grasshopper → Frog → Snake → Eagle

   (B) Phytoplanktons → Zooplanktons → Small fish → Large fish

   (C) Diatoms → Zooplanktons → Small fish

   (D) Grass → Lion → Vulture

   Ans (D)

3. ________ is the rate of production of organic matter by consumers.

   (A) Primary productivity (B) Secondary productivity

   (C) Net primary productivity (D) Gross primary productivity

   Ans (B)

4. Which one of the following exhibits least productivity?

   (A) Salty marshes (B) Grasslands

   (C) Open oceans (D) Coral reefs **Ans** (C)

5. Which one of the following aspects is not a component nor functional unit of ecosystem?

   (A) Productivity (B) Decomposition

   (C) Energy flow (D) Ecological pyramids **Ans** (D)

6. The annual net primary productivity of the whole biosphere is approximately

   (A) 150 billion tons (B) 160 billion tons

   (C) 170 billion tons (D) 180 billion tons **Ans** (C)

7. Rate of decomposition depends upon

(A) chemical composition of detritus

(B) temperature (C) soil moisture and soil pH

(D) all of these **Ans** (D)

8. If 10 joules of energy is available at the producer level, then amount of energy present at the level of secondary consumers is

(A) 10 J (B) 1 J

(C) 0.1 J (D) 0.01 J **Ans** (C)

9. Which one of the following animals may occupy more than one trophic levels in the same ecosystem at the same time?

(A) Sparrow (B) Lion

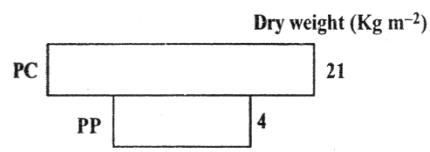
(C) Goat (D) Grass **Ans** (A)

10. In an aquatic ecosystem, the organism present at the trophic level equivalent to cows in grasslands is

(A) phytoplanktons (B) large fishes

(C) sea gulls (D) zooplanktons **Ans** (D)

11. Which kind of pyramid is represented by the given figure?



(A) Pyramid of numbers in terrestrial ecosystem

(B) Pyramid of biomass in terrestrial ecosystem

(C) Pyramid of biomass in aquatic ecosystem

(D) Pyramid of numbers in aquatic ecosystem

Ans (C)

12. Given below are some of the stages of the hydrarch.

a. Marsh meadow stage b. Reed swamp stage

c. Submerged plant stage d. Phytoplankton stage

e. Free floating plant stage

Select the option that represents the correct sequence of these stages.

(A) d, c, e, b and a (B) c, e, a, b and d

(C) b, d, c, a and e (D) d, e, c, b and a **Ans** (A)

13. Which of these is considered as pioneers in xerarch succession?

(A) Annual herbs (B) Perennial herbs

(C) Shrubs (D) Lichens **Ans** (D)

14. Select the pairs of sedimentary biogeochemical cycles.

I. Hydrogen cycle and water cycle

II. Phosphorus cycle and sulphur cycle

III. Carbon cycle and nitrogen cycle

(A) I and II (B) II

(C) III and IV (D) IV **Ans** (B)

15. What is the amount of average price tag on nature's life support services determined by Robert Constanza and his colleagues?

(a) US $ 3 trillion a year

(B) US $ 13 trillion a year

(C) US $ 23 trillion a year

(D) US $33 trillion a year

Ans (D)

****

2^{nd} PU

Biodiversity

1. Which of these hotspots cover natural regions of India:

   (A) Western Ghats
   (B) Western Ghats and Indo-Burma region
   (C) Western Ghats and Sri Lanka, Indo Burma and Himalayas
   (D) Western Ghats and Sri Lanka, Indo Burma, Eastern Ghats and Himalaya
   Ans (C)

2. How many species worldwide are presently facing the threat of extinction?

   (A) 1200 (B) 1500 (C) 15500 (D) 12200
   Ans (C)

(A) More than ________% of the drugs currently sold in the market worldwide are derived from plants.

(A) 70 (B) 25 (C) 90 (D) 55 **Ans** (B)

(B) The historic convention on Biological Diversity held in Rio de Janeiro in 1992 is known as

(A) CITES Convention (B) The Earth Summit

(C) G-16 Summit (D) MAB Programme **Ans** (B)

(C) Which of the following forests is known as the 'Lungs of Planet Earth'?

(A) Taiga forest (B) Tundra forest

(C) Amazon rain forest (D) Rain forests of North East India

Ans (C)

(D) Amongst the animal groups given below, which one has the highest percentage of endangered species?

(A) Insects (B) Mammals

(C) Amphibians (D) Reptiles **Ans** (C)

(E) Presently, India has ——— biosphere reserves, ——— national parks and ——— wildlife sanctuaries respectively.

(A) 20; 90; 500 (B) 14; 85; 348

(C) 4; 89; 448 (D) 11; 91; 500 **Ans** (C)

(F) Choose the incorrect statement from the following

(A) Eastern Ghats have greater amphibian species diversity than the Western Ghats

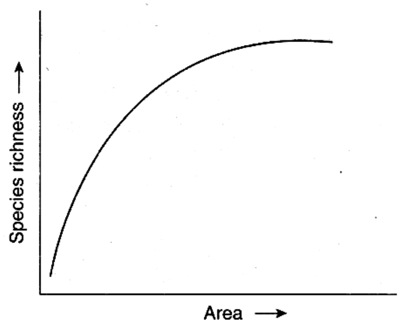
(B) Colombia has higher bird diversity than New York

(C) India has more ecological diversity than Norway.

(D) Greenland has lesser bird diversity than New York.

Ans A

(G) Which is the correct formula of the graph shown below?



(A) $S = C\,A^Z$ (B) $S = C\,Z^A$

(C) $S = Z\,C^A$ (D) $Z = S\,C^A$ **Ans** (A)

(H) Find the correct statement(s) from the following.

(A) If *Anopheles* mosquito becomes extinct, humans will become extinct.
(B) If *Plasmodium* becomes extinct, humans will become extinct.
(C) If *Plasmodium* becomes extinct, *Anopheles* will become extinct.
(D) If *Anopheles* mosquito becomes extinct, *Plasmodium* will become extinct.

Ans (D)

(I) India has only _______ per cent of the world's land area; its share of the global species diversity is _______ . The blanks are respectively

(A) 4.2; 1.8 (B) 2.4; 8.1

(C) 2.4; 13 (D) 4.2; 13 **Ans** (B)

(J) log S log C + Z log A. In the relation given, which of the alphabets has been correctly defined?

(A) S = Species richness; A = Area

(B) Z = Regression Coefficient

(C) C = Y - Intercept

(D) All of A, B and C.

Ans (D)

(K) For frugivorous (fruit eating) birds and mammals in the tropical forests of different continents, the slope of species-area relationship is found to be approximately

(A) 0.6 (B) 1.3 (C) 1.15 (D) 1

Ans (C)

(L) Which of the following is incorrect about Amazon rainforest?

(A) It is being destroyed rapidly due to man's activities.

(B) Its destruction will not affect Asian countries like India.

(C) The main reason for its destruction is conversion of forest landscape into agricultural fields or meadows

(D) It has one of the greatest biodiversity among natural biomes.

Ans (B)

(M) Which hypothesis suggest ecosystems are like aeroplane wings where flight (ecosystem functioning) may or may not be compromised depending upon which species are lost?

(A) Rivet popper hypothesis (B) Gaia hypothesis

(C) Gause exclusion hypothesis (D) Odum's hypothesis

Ans (A)

(16) Conventional taxonomic methods are not suitable for identifying

(A) amphibian species (B) insect species

(C) microbial species (D) gymnosperm species.

Ans (C)

(17) Match the following Column-I (recently extinct animals) with Column-II (places from where they are extinct) and select the correct option.

Column – I		Column – II	
(a)	Dodo	(i)	Mauritius
(b)	Quagga	(ii)	Africa
(c)	Thylacine	(iii)	Australia
(d)	Sea cow	(iv)	Russia

(A) (a) → (i); (b) → (ii); (c) → (iii); (d) → (iv)

(B) (a) → (i); (b) → (ii); (c) → (iv); (d) → (iii)

(c) (a) → (ii); (b) → (i); (c) → (iii); (d) → (iv)

(D) (a) → (iii); (b) → (i); (c) → (ii); (d) → (iv)

Ans (A)

(18) The Evil Quartet is the sobriquet used to describe

(A) Reasons for population growth

(B) Causes of biodiversity losses

(C) Main water pollutants

(D) Major air pollutants .

Ans (B)

(19) Co-extinction means

(A) introduction of alien species leading to decline or extinction of indigenous species

(B) extinction due to over-exploitation

(C) extinction due to habitat loss

(D) extinction due to obligatory association of two organisms.

Ans (D)

(20) Sacred groves are

(A) Present in Khasi and Jaintia hills in Meghalaya

(B) An example of *in-situ* conservation of wildlife

(C) Are protected by local humans on religious basis

(D) All of A, B and C.

Ans (D)

****

2^{nd} PU

Environmental Issues

1. If there is no greenhouse effect, the average temperature at the surface of earth would have been

   (A) 15° C   (B) – 18° C

   (C) – 6° C   (D) 20° C   **Ans** (B)

2. Motor vehicles equipped with catalytic converter should use unleaded petrol because lead

   (A) in petrol inactivates the catalyst

   (B) increases the burning of petrol

   (C) decreases the efficiency of vehicles

   (D) is a heavy metal

   Ans (A)

3. Which act was formulated in the year 1974?

   (A) The Water (Prevention and Control of Pollution) Act

   (B) The Air (Prevention and Control of Pollution) Act

   (C) The Noise (Prevention and Control of Pollution) Act

   (D) The Environmental (Protection) Act

   Ans (A)

4. In plants, air pollution causes

   (A) reduced growth and yield   (B) leads to premature death

   (C) both (A) and (B)   (D) flowering

   Ans (C)

5. Which method is used to remove particulate matter present in exhaust of thermal power plant?

   (A) Wet scrubbers   (B) Absorption

   (C) Electrostatic precipitator   (D) Gravitational method

   Ans (C)

6. Which method is used for the removal of sulphur dioxide and ammonia from the polluted air?

(A) Electrostatic precipitator (B) Wet scrubber

(C) Gravitational method (D) Absorption

Ans (B)

7. Montreal Protocol aims at

(A) reduction of ozone depleting substances

(B) biodiversity conservation (C) control of water pollution

(D) control of CO_2 emission **Ans** (A)

8. Major cause of air pollution in big cities is

(A) domestic exhaust (B) burning of cooking gas

(C) thermal power plant (D) automobile exhaust

Ans (D)

9. What device is fitted to automobiles for reducing the emission of poisonous gases like NO_2 and CO?

(A) Catalytic converters (B) Electrostatic precipitator

(C) Scrubber (D) Bag filter

Ans (A)

10. According to the Central Pollution Control Board (CPCB), particles that are responsible for causing great harm to human health are of diameter___________ or less.

(A) 2.50 micrometers (B) 5.00 micrometers

(C) 10.00 micrometers (D) 7.5 micrometers **Ans** (A)

11. The thickness of ozone in a column of air from the ground to the top of the atmosphere is measured in terms of

(A) Decibel units (B) Pascal units

(C) Svedberg units (D) Dobson units **Ans** (D)

12. In the 1990s, Delhi ranked _____ among the 41 most polluted cities in the world

(A) 4^{th} (B) 5^{th} (C) 6^{th} (D) 7^{th} **Ans** (A)

13. When was noise recognized as an air pollutant in India?

(A) 1992 (B) 1963

(C) 1949 (D) 1987 **Ans** (D)

14. Which of the following compounds are well known for biological magnification?

(A) DDT (B) Mercury

(C) Both (A) and (B) (D) Methane **Ans** (C)

15. Nutrient enrichment of a lake will cause

(A) eutrophication (B) stratification

(C) biomagnification (D) bioaccumulation **Ans** (A)

16. In which State of India, EcoSan toilets are not found?

(A) Kerala (B) Bihar

(C) Sri Lanka (D) Both (A) and (C) **Ans** (B)

17. Polyblend is a

(A) mixture of two different type of plastics

(B) mixture of two same type of plastics

(C) fine powder of recycled modified plastic

(D) blend of plastic and bitumen

Ans (C)

18. Irreparable computers and other electronic goods are known as

(A) electronic waste (B) radioactive waste

(C) electronic industrial waste (D) solid waste

Ans (A)

19. Which of the following process is a cyclic, zero-waste procedure where waste products from one process are cycled in as nutrients for other processes, allowing maximum utilisation of resources and increasing the efficiency of production?

(A) Natural farming (B) Organic farming

(C) Chemical farming (D) Artificial farming **Ans** (B)

20. The natural phenomenon of keeping earth warm due to presence of certain gases in the atmosphere is called

(A) global warming (B) ozone depletion

(C) greenhouse effect (D) EI-Nino effect **Ans** (C)

21. Good ozone is formed in

(A) atmosphere (B) ionosphere

(C) stratosphere (D) troposphere **Ans** (C)

22. Ozone hole is largest over

(A) Antarctica (B) New York

(C) Arctic (D) Tokyo **Ans** (A)

23. Jhum cultivation refers to

(A) cultivation of neem trees

(B) cultivation of medicinal plants

(C) tribal methods of shifting cultivation by slash and burn

(D) cultivation of timber plants **Ans** (C)

24. El Nino effect is closely associated with

(A) global warming (B) excess rain

(C) pollutant gases (D) all of A, B, C **Ans** (A)

25. If a pond food chain gets polluted by DDT, the tissue concentration of DDT would be highest in

(A) aquatic weed (B) herbivorous fish

(C) carnivorous fish (D) bird feeding on fish

Ans (D)

26. Amrita Devi Bishnoi Award is for the individuals or communities from rural areas that have shown extraordinary courage in

(A) reducing greenhouse effect (B) reducing air pollution

(C) reducing global warming (D) protecting wildlife

Ans (D)

27. Three Mile Island and Chernobyl disasters are associated with accidental leakage of

(A) radioactive wastes (B) industrial wastes

(C) municipal wastes (D) hospital wastes

Ans (A)

28. What steps should be taken before the disposal of nuclear waste?

(A) Nuclear waste should be pre-treated

(B) It should be stored in shielded containers

(C) It should be buried about 500 m deep within rock

(D) All of the above

Ans (D)

29. Why CNG is considered as a good fuel over diesel/petrol?

I. CNG burns most efficiently without leaving any unburnt remnant behind.

II. CNG is fragrant than petrol or diesel.

III. CNG cannot be siphoned off by thieves and adulterated like petrol or diesel.

Which of the statements given above are correct?

(A) I and II (B) I and III

(C) II and III (D) I, II and III **Ans** (B)

30. The two gases making highest relative contribution to the greenhouse gases are

(A) CO_2 and N_2O (B) CO_2 and CH_4

(C) CH_4 and N_2O (D) CFC_S and N_2O **Ans** (B)

****

Chief Execuitve Officer

Karnataka Science and Technology Academy (KSTA)

Prof. U.R. Rao Vijnana Bhavan, Major Sandeep Unnikrishnan Road

Opp. Doddabettahalli Layout Bus Stop, Vidyaranyapura Post, Bengaluru-560097

+91-80-29721550 ksta.gok@gmail.com www.kstacademy.in