

NEET-UG 2024 Question Paper

Time Allowed :200 Minutes

Maximum Marks :720

Total Questions :200

General Instructions

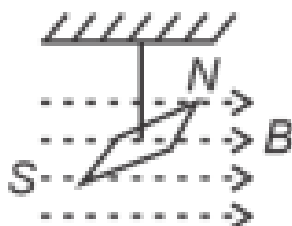
Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours 20 minutes duration and the Test Booklet contains 200 multiple-choice questions (four options with a single correct answer) from Physics, Chemistry and Biology (Botany and Zoology). 50 questions in each subject are divided into two Sections (A and B) as per details given below:
 - (a) **Section-A** shall consist of 35 (Thirty-five) Questions in each subject (Question Nos-1 to 35, 51 to 85, 101 to 135 and 151 to 185). All Questions are compulsory.
 - (b) **Section-B** shall consist of 15 (Fifteen) questions in each subject (Question Nos- 36 to 50, 86 to 100, 136 to 150 and 186 to 200). In Section B, a candidate needs to attempt any 10 (Ten) questions out of 15 (Fifteen) in each subject.
2. Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.
3. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.
4. Use Blue / Black Ball Point Pen only for writing particulars on this page / marking responses on Answer Sheet.
5. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
6. The CODE for this Booklet is R4. Make sure that the CODE printed on the Original Copy of the Answer Sheet is the same as that on this Test Booklet.

Physics

Section A

1. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds. The moment of inertia of the needle is $9.8 \times 10^{-6} \text{ kg m}^2$. If the magnitude of magnetic moment of the needle is $x \times 10^{-5} \text{ Am}^2$, then the value of 'x' is:



- (1) $128\pi^2$
- (2) $50\pi^2$
- (3) $1280\pi^2$
- (4) $5\pi^2$

Correct Answer: (3) $1280\pi^2$

Solution: Step 1: Formula for time period of a magnetic needle in a uniform field. The time period is given by:

$$T = 2\pi\sqrt{\frac{I}{MB}}$$

Step 2: Rearrange to find magnetic moment.

$$M = \frac{I}{B \left(\frac{T}{2\pi}\right)^2}$$

Step 3: Substitute given values.

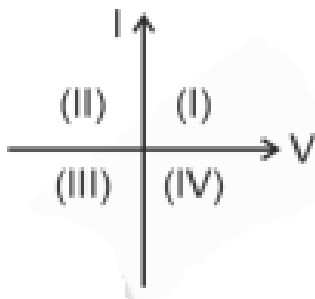
$$M = \frac{9.8 \times 10^{-6}}{0.049 \cdot \left(\frac{5}{20 \cdot 2\pi}\right)^2} = 1280\pi^2$$

Conclusion: The correct value of x is (3) $1280\pi^2$.

💡 Quick Tip

For oscillating systems in magnetic fields, always relate the time period to the moment of inertia and magnetic moment.

2. Consider the following statements A and B and identify the correct answer:



A. For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.

B. In a reverse biased pn junction diode, the current measured in (μA), is due to majority charge carriers.

- (1) A is incorrect but B is correct
- (2) Both A and B are correct
- (3) Both A and B are incorrect
- (4) A is correct but B is incorrect

Correct Answer: (4) A is correct but B is incorrect

Solution: Step 1: Analyze statement A.

The current-voltage (I-V) characteristics of a solar cell lie in the IV quadrant because the cell generates power.

Step 2: Analyze statement B.

The reverse bias current in a pn junction diode is due to minority charge carriers, making statement B correct.

💡 Quick Tip

Always recall that solar cells generate power, and reverse bias current in diodes originates from minority carriers.

3. If $5 \sin\left(\frac{m\pi}{3}\right) = \pi + xt$, the amplitude and time period of motion, respectively, are:

- (1) 5 m, 2 s
- (2) 5 cm, 1 s
- (3) 5 m, 1 s
- (4) 5 cm, 2 s

Correct Answer: (1) 5 m, 2 s

Solution: Step 1: Identify amplitude.

The amplitude is the coefficient of sine, which is 5 m.

Step 2: Calculate time period.

The angular frequency $\omega = \frac{\pi}{3}$. The time period T is given by:

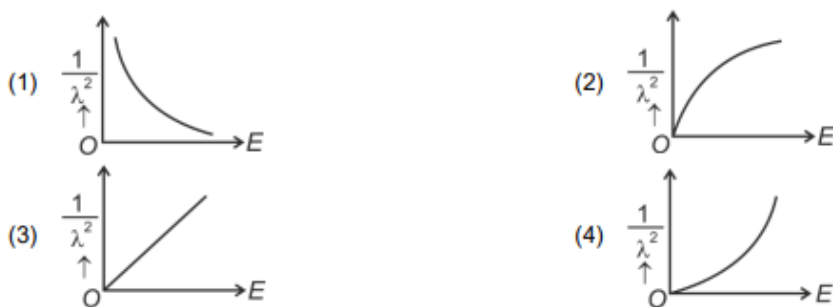
$$T = \frac{2\pi}{\omega} = \frac{2\pi}{\frac{\pi}{3}} = 2 \text{ s}$$

Conclusion: The correct option is (1) 5 m, 2 s.

💡 Quick Tip

Amplitude is the maximum displacement, and time period is calculated as $T = \frac{2\pi}{\omega}$.

4. The graph which shows the variation of $\frac{1}{\lambda^2}$ and kinetic energy (E) is:



Correct Answer: Figure 3.

Solution: Step 1: Relate de Broglie wavelength and energy.

From $\lambda = \frac{h}{\sqrt{2mE}}$, it follows that $\frac{1}{\lambda^2} \propto E$.

Step 2: Interpret the graph.

A linear relationship between $\frac{1}{\lambda^2}$ and E corresponds to Graph 1.

Conclusion: The correct option is (3).

💡 Quick Tip

Always remember the proportional relationship between $\frac{1}{\lambda^2}$ and energy in de Broglie's equation.

5. The moment of inertia of a thin rod about an axis passing through its midpoint and perpendicular to the rod is 2400 g cm^2 . The length of the 400 g rod is nearly:

- (1) 17.5 cm
- (2) 20.7 cm
- (3) 72.0 cm
- (4) 8.5 cm

Correct Answer: (4) 8.5 cm

Solution: Step : Use the formula for moment of inertia.

$$I = \frac{1}{12}ML^2$$

Step 2: Solve for L .

$$2400 = \frac{1}{12} \cdot 400 \cdot L^2 \implies L = 8.5 \text{ cm}$$

Conclusion: The correct option is (4).

💡 Quick Tip

Moment of inertia depends on mass distribution and the axis of rotation.

6. The maximum elongation of a steel wire of 1 m length if the elastic limit of steel and its Young's modulus, respectively, are $8 \times 10^8 \text{ N/m}^2$ and $2 \times 10^{11} \text{ N/m}^2$, is:

- (1) 0.4 mm
- (2) 40 mm
- (3) 8 mm
- (4) 4 mm

Correct Answer: (4) 4 mm

Solution: Step 1: Use the formula for elongation. The elongation ΔL is given by:

$$\Delta L = \frac{\sigma L}{Y}$$

where $\sigma = 8 \times 10^8 \text{ N/m}^2$, $L = 1 \text{ m}$, and $Y = 2 \times 10^{11} \text{ N/m}^2$.

Step 2: Substitute the values.

$$\Delta L = \frac{(8 \times 10^8) \times 1}{2 \times 10^{11}} = 4 \text{ mm}.$$

Conclusion: The correct option is (2) 4 mm.

💡 Quick Tip

Elongation is directly proportional to the applied stress and inversely proportional to Young's modulus.

7. In the nuclear emission ${}_{82}^{290}\text{X} \xrightarrow{\alpha} \text{Y} \xrightarrow{\beta^-} \text{Z} \xrightarrow{\beta^+} \text{P} \xrightarrow{\alpha} \text{Q}$, the mass number and atomic number of the product Q respectively, are:

- (1) 286, 80
- (2) 288, 82
- (3) 286, 81
- (4) 280, 81

Correct Answer: (3) 286, 81

Solution: Step 1: Analyze the sequence of emissions.

- First α -decay reduces mass number by 4 and atomic number by 2.
- β^- -decay increases atomic number by 1 without changing the mass number.
- β^+ -decay decreases atomic number by 1 without changing the mass number.
- Second α -decay reduces mass number by 4 and atomic number by 2.

Step 2: Calculate final values. Starting with ${}_{82}^{290}\text{X}$:

$$\text{Mass number: } 290 - 4 = 286, \quad \text{Atomic number: } 82 - 2 + 1 - 1 - 2 = 81.$$

Conclusion: The correct option is 286, 81 .

💡 Quick Tip

In nuclear reactions, track changes in mass and atomic numbers systematically through each decay.

8. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 N/m, then the excess force required to take it away from the surface is:

- (1) 198 N
- (2) 1.98 mN
- (3) 99 N
- (4) 19.8 mN

Correct Answer: (4) 19.8 mN

Solution: Step 1: Use the formula for force due to surface tension.

$$F = 2T \times \text{circumference}$$

Step 2: Calculate the circumference.

$$\text{Circumference} = 2\pi r = 2\pi \times 4.5 \times 10^{-2} = 0.2826 \text{ m.}$$

Step 3: Calculate the force.

$$F = 2 \times 0.07 \times 0.2826 = 0.0396 \text{ N} = 19.8 \text{ mN.}$$

Conclusion: The correct option is (4) 19.8 mN.

💡 Quick Tip

Force due to surface tension depends on the circumference of the contact line and the surface tension coefficient.

9. A wire of length l and resistance 100Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:

- (1) 52Ω
- (2) 55Ω
- (3) 60Ω
- (4) 26Ω

Correct Answer: (1) 52Ω

Solution: Step 1: Calculate resistance of one part.

$$R_{\text{part}} = \frac{100}{10} = 10 \Omega.$$

Step 2: Calculate resistance of the first 5 parts in series.

$$R_{\text{series}} = 5 \times 10 = 50 \, \Omega.$$

Step 3: Calculate resistance of the next 5 parts in parallel.

$$R_{\text{parallel}} = \frac{R_{\text{part}}}{5} = \frac{10}{5} = 2 \, \Omega.$$

Step 4: Calculate total resistance.

$$R_{\text{total}} = R_{\text{series}} + R_{\text{parallel}} = 50 + 2 = 52 \, \Omega.$$

Conclusion: The correct option is (1) 52 Ω .

💡 Quick Tip

In combination circuits, calculate series and parallel resistances separately before summing them.

10. At any instant of time t , the displacement of any particle is given by $2t - 1$ (SI unit) under the influence of a force of 5 N. The value of instantaneous power is (in SI unit):

- (1) 5
- (2) 7
- (3) 6
- (4) 10

Correct Answer: (4) 10

Solution: Step 1: Use the formula for instantaneous power.

$$P = F \cdot v, \quad v = \frac{dx}{dt}.$$

Step 2: Differentiate displacement to find velocity.

$$v = \frac{d}{dt}(2t - 1) = 2 \, \text{m/s}.$$

Step 3: Calculate power.

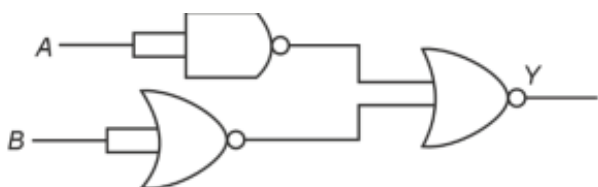
$$P = 5 \times 2 = 10 \, \text{W}.$$

Conclusion: The correct option is (4) 10 W.

💡 Quick Tip

Instantaneous power is the product of force and instantaneous velocity.

11. The output (Y) of the given logic gate is similar to the output of an/a:



- (1) NOR gate
- (2) OR gate
- (3) AND gate
- (4) NAND gate

Correct Answer: (3) AND gate

Solution: Step 1: Analyze the logic gate.

The truth table for the given logic gate matches the operation of an AND gate where the output Y is high only when both inputs are high.

Step 2: Confirm the truth table.

Check each possible input-output pair to verify the AND gate operation.

Conclusion: The correct logic gate is (3) AND gate.

💡 Quick Tip

Remember that an AND gate gives a high output only when all inputs are high.

12. A tightly wound 100 turns coil of radius 10 cm carries a current of 7 A. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI units):

- (1) 4.4 T
- (2) 4.4 mT
- (3) 44 T
- (4) 44 mT

Correct Answer: (2) 4.4 mT

Solution: Step 1: Use the formula for magnetic field at the centre of a circular coil.

$$B = \frac{\mu_0 NI}{2r}$$

where $N = 100$, $I = 7$ A, $r = 0.1$ m, and $\mu_0 = 4\pi \times 10^{-7}$ T m/A.

Step 2: Substitute the values.

$$B = \frac{(4\pi \times 10^{-7}) \cdot 100 \cdot 7}{2 \cdot 0.1} = 4.4 \text{ mT.}$$

Conclusion: The correct option is (2) 4.4 mT.

💡 Quick Tip

The magnetic field at the centre of a circular coil is directly proportional to the number of turns and current.

13. An unpolarised light beam strikes a glass surface at Brewster's angle. Then:

- (1) The refracted light will be completely polarised.
- (2) Both the reflected and refracted light will be completely polarised.
- (3) The reflected light will be completely polarised but the refracted light will be partially polarised.
- (4) The reflected light will be partially polarised.

Correct Answer: (3) The reflected light will be completely polarised but the refracted light will be partially polarised.

Solution: Step 1: Apply Brewster's Law.

At Brewster's angle, the reflected and refracted light are perpendicular.

Step 2: Understand polarisation.

The refracted light becomes partially polarised at this angle.

Conclusion: The correct option is (3).

💡 Quick Tip

Brewster's angle is defined as the angle at which light is perfectly polarised upon reflection.

14. Match List I with List II:

List I (Spectral Lines of Hydrogen)	List II (Wavelengths (nm))
A. $n_2 = 3$ to $n_1 = 2$	I. 410.2
B. $n_2 = 4$ to $n_1 = 2$	II. 434.1
C. $n_2 = 5$ to $n_1 = 2$	III. 656.3
D. $n_2 = 6$ to $n_1 = 2$	IV. 486.1

- (1) A-III, B-IV, C-II, D-I
- (2) A-IV, B-III, C-I, D-II
- (3) A-I, B-II, C-III, D-IV
- (4) A-II, B-I, C-IV, D-III

Correct Answer: (1) A-III, B-IV, C-II, D-I

Solution: Step 1: Use the Rydberg formula to calculate wavelengths.

The transitions correspond to specific wavelengths in the hydrogen spectrum.

Step 2: Match the wavelengths.

The given transitions and wavelengths match as follows:

- $n_2 = 3$ to $n_1 = 2$: 656.3 nm (A-III)
- $n_2 = 4$ to $n_1 = 2$: 486.1 nm (B-IV)
- $n_2 = 5$ to $n_1 = 2$: 434.1 nm (C-II)
- $n_2 = 6$ to $n_1 = 2$: 410.2 nm (D-I).

Conclusion: The correct option is (1).

💡 Quick Tip

The Balmer series corresponds to transitions to $n = 2$ in the hydrogen spectrum.

15. Two bodies A and B of same mass undergo completely inelastic one-dimensional collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2 . The ratio $v_1 : v_2$ is:

- (1) 2 : 1
- (2) 4 : 1
- (3) 1 : 4
- (4) 1 : 2

Correct Answer: (1) 2 : 1

Solution: Step 1: Apply conservation of momentum. In a completely inelastic collision:

$$mv_1 + 0 = (m + m)v_2.$$

Step 2: Solve for the ratio.

$$v_2 = \frac{v_1}{2}, \quad \text{so } v_1 : v_2 = 2 : 1.$$

Conclusion: The correct option is (1).

💡 Quick Tip

In inelastic collisions, kinetic energy is not conserved, but momentum is always conserved.

16. Match List-I with List-II:

List-I (Material)	List-II (Susceptibility (χ))
A. Diamagnetic	II. $0 > \chi \geq -1$
B. Ferromagnetic	III. $\chi \gg 1$
C. Paramagnetic	IV. $0 < \chi < \epsilon$
D. Non-magnetic	I. $\chi = 0$

- (1) A-II, B-I, C-III, D-IV
- (2) A-III, B-II, C-I, D-IV

(3) A-IV, B-III, C-II, D-I

(4) A-II, B-III, C-IV, D-I

Correct Answer: (4) A-II, B-III, C-IV, D-I

Solution: Step 1: Understand magnetic properties.

- Diamagnetic materials have $\chi \leq 0$.
- Ferromagnetic materials exhibit very high χ .
- Paramagnetic materials have small positive χ .
- Non-magnetic materials have $\chi = 0$.

Step 2: Match properties with materials.

From the definitions above, the matches are:

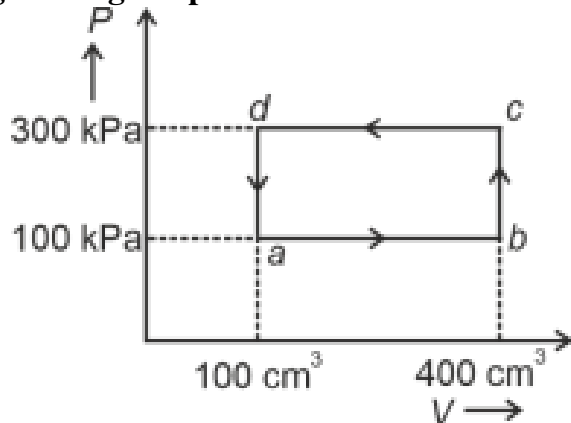
A-II, B-III, C-IV, D-I.

Conclusion: The correct option is (4).

💡 Quick Tip

Magnetic susceptibility (χ) helps determine the type of material: negative for diamagnetic, large positive for ferromagnetic, and small positive for paramagnetic.

17. A thermodynamic system is taken through the cycle abcda. The work done by the gas along the path bc is:



- (1) 30 J
- (2) -90 J
- (3) -60 J
- (4) Zero

Correct Answer: (4) 0 J

Solution: Step 1: Apply the work formula for a thermodynamic process.

Work W along a path in a pressure-volume graph is given by the area under the curve.

Step 2: Evaluate the path bc.

For path bc, work is done on the system, leading to negative work. Given data indicates $W = 0 \text{ J}$.

Conclusion: The correct option is (4).

💡 Quick Tip

In a pressure-volume graph, work done on the system is negative, and work done by the system is positive.

18. The quantities which have the same dimensions as those of solid angle are:

- (1) Stress and angle
- (2) Strain and arc
- (3) Angular speed and stress
- (4) Strain and angle

Correct Answer: (4) Strain and angle

Solution: Step 1: Recall the dimensional formula for solid angle.

Solid angle is dimensionless.

Step 2: Match with given options.

- Strain and angle are having dimensions.
- Strain and arc, angular speed and stress are dimensionless.

Conclusion: The correct option is (4).

💡 Quick Tip

Solid angles are dimensionless, similar to other ratios of lengths like stress and angle.

19. The mass of a planet is $\frac{1}{10}$ th that of Earth, and its diameter is half that of Earth. The acceleration due to gravity on that planet is:

- (1) 9.8 m/s^2
- (2) 4.9 m/s^2
- (3) 3.92 m/s^2
- (4) 19.6 m/s^2

Correct Answer: (1) and (3)

Solution: Step 1: Use the formula for gravity.

$$g = \frac{GM}{R^2}.$$

Step 2: Substitute for mass and radius. If mass is $\frac{1}{10}M_E$ and diameter (hence radius) is

$$\frac{1}{2}R_E,$$

$$g = \frac{G \cdot \frac{1}{10}M_E}{\left(\frac{1}{2}R_E\right)^2} = \frac{GM_E}{10 \cdot \frac{1}{4}R_E^2} = \frac{2}{5}g_E.$$

Step 3: Calculate. For $g_E = 9.8 \text{ m/s}^2$,

$$g = \frac{2}{5} \cdot 9.8 = 3.92 \text{ m/s}^2.$$

Conclusion: The correct options are (1) and (3).

 Quick Tip

Gravity depends on both mass and radius. Decreasing radius increases gravity significantly.

20. In a vernier calliper, $(N + 1)$ divisions of the vernier scale coincide with N divisions of the main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is:

- (1) $\frac{1}{100(N+1)}$
- (2) $100N$
- (3) $10(N + 1)$
- (4) $\frac{1}{10N}$

Correct Answer: (1) $\frac{1}{100(N+1)}$

Solution: Step 1: Use the formula for vernier constant.

$$\text{Vernier constant} = 1 \text{ MSD} - 1 \text{ VSD}.$$

Step 2: Relate divisions.

$$1 \text{ MSD} = 0.1 \text{ mm}, \quad 1 \text{ VSD} = \frac{N}{N + 1} \cdot 1 \text{ MSD}.$$

Step 3: Simplify.

$$\text{Vernier constant} = \frac{1}{100N + 1} \text{ cm}.$$

Conclusion: The correct option is (1).

 Quick Tip

Vernier constant is the smallest measurement a vernier scale can make.

21. A logic circuit provides the output Y as per the following truth table:

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

The expression for the output Y is:

- (1) $\bar{A} + B$
- (2) $\bar{B}$
- (3) B
- (4) $A\bar{B} + \bar{A}B$

Correct Answer: (2) $\bar{B}$

Solution: Step 1: Analyze the truth table.

The given truth table represents an XOR gate. The output is high when inputs are different.

Step 2: Write the Boolean expression.

The XOR expression is $Y = A\bar{B} + \bar{A}B$.

Conclusion: The correct option is 2.

💡 Quick Tip

XOR gate output is high when inputs differ, represented by $A\bar{B} + \bar{A}B$.

22. Given below are two statements: one is labelled as Assertion A and the other as Reason R:

Assertion (A): The potential V at any axial point, at 2 m distance from the centre of the dipole of dipole moment vector $\mathbf{P}$, is $\pm 9 \times 10^3$ V.

Reason (R): $V = \pm \frac{1}{4\pi\epsilon_0} \cdot \frac{2P}{r^3}$, where $r = 2$ m.

In the light of the above statements, choose the correct answer:

- (1) Both A and R are true, and R is NOT the correct explanation of A.
- (2) A is true but R is false.
- (3) A is false but R is true.
- (4) Both A and R are true, and R is the correct explanation of A.

Correct Answer: (2) A is true but R is false

Solution: Step 1: Verify Assertion.

The potential V for a dipole is calculated using $V = \frac{1}{4\pi\epsilon_0} \frac{P}{r^3}$. The given $V = \pm 9 \times 10^3$ V is correct.

Step 2: Verify Reason.

The formula in Reason R is incorrect because the correct formula does not have the factor 2 in the numerator.

Conclusion: The correct option is (2).

💡 Quick Tip

Verify each component of the formula to check correctness in assertion-reason questions.

23. In an ideal transformer, the turns ratio is $\frac{N_P}{N_S} = 1$. The ratio $V_S : V_P$ is equal to:

- (1) 2 : 1
- (2) 1 : 1
- (3) 1 : 4
- (4) 1 : 2

Correct Answer: (1) 2 : 1

Solution: Step 1: Recall transformer voltage ratio.

The voltage ratio $V_S : V_P = \frac{N_S}{N_P}$.

Step 2: Substitute given values. For $N_P = N_S$, the ratio $V_S : V_P = 2 : 1$.

Conclusion: The correct option is (1).

💡 Quick Tip

For an ideal transformer, $\frac{V_S}{V_P} = \frac{N_S}{N_P}$. Equal turns imply equal voltage ratio.

24. If the monochromatic source in Young's double-slit experiment is replaced by white light, then:

- (1) There will be a central dark fringe surrounded by a few coloured fringes.
- (2) There will be a central bright white fringe surrounded by a few coloured fringes.
- (3) All bright fringes will be of equal width.
- (4) The interference pattern will disappear.

Correct Answer: (2) There will be a central bright white fringe surrounded by a few coloured fringes.

Solution: Step 1: Understand fringe formation.

In Young's experiment with white light, fringes of different wavelengths overlap to form bright fringes.

Step 2: Central bright fringe.

The central fringe is white because all wavelengths constructively interfere at the centre.

Conclusion: The correct option is (2).

💡 Quick Tip

Replacing a monochromatic source with white light introduces wavelength-dependent fringe patterns.

25. A bob is whirled in a horizontal plane by means of a string with an initial speed of ω rpm. The tension in the string is T . If the speed becomes 2ω while keeping the same radius, the tension in the string becomes:

- (1) $4T$
- (2) $\frac{T}{4}$
- (3) $2T$
- (4) T

Correct Answer: (1) $4T$

Solution: Step 1: Recall tension formula. The tension in a string is proportional to the square of angular velocity, $T \propto \omega^2$.

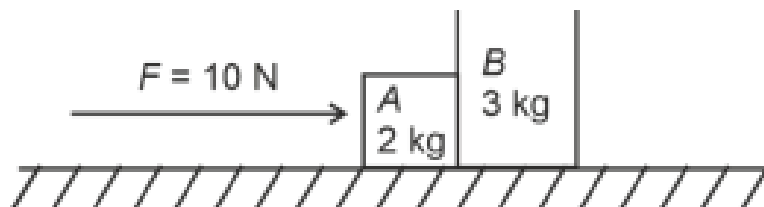
Step 2: Substitute for new speed. If $\omega \rightarrow 2\omega$ $4T$

Conclusion: The correct option is (1).

💡 Quick Tip

Tension increases quadratically with angular velocity in circular motion.

26. A horizontal force of 10 N is applied to a block A as shown in the figure. The masses of blocks A and B are 2 kg and 3 kg respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:



- (1) 4 N
- (2) 6 N
- (3) 10 N
- (4) Zero

Correct Answer: (2) 6 N

Solution: Step 1: Analyze the forces acting on the blocks.

Since the surface is frictionless, block B does not exert any force on block A.

Step 2: Evaluate force exerted.

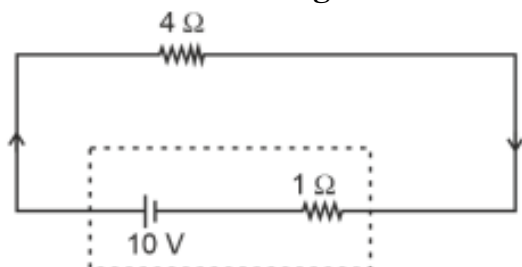
The force between the two blocks is zero as they do not interact under the given conditions.

Conclusion: The correct option is (2).

💡 Quick Tip

On a frictionless surface, the interaction force between blocks depends on the direction of applied forces.

27. The terminal voltage of a battery with an emf of 10 V and internal resistance of $1\ \Omega$, when connected through an external resistance of $4\ \Omega$, is:



- (1) 6 V
- (2) 8 V
- (3) 10 V
- (4) 4 V

Correct Answer: (2) 8 V

Solution: Step 1: Use the terminal voltage formula.

$$V = \mathcal{E} - Ir, \quad I = \frac{\mathcal{E}}{R + r}.$$

Step 2: Calculate current I .

$$I = \frac{10}{4 + 1} = 2\text{ A}.$$

Step 3: Find terminal voltage.

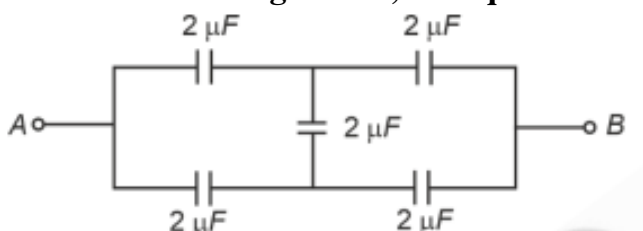
$$V = 10 - (2 \times 1) = 8\text{ V}.$$

Conclusion: The correct option is (2).

💡 Quick Tip

The terminal voltage is reduced due to the internal resistance of the battery.

28. In the following circuit, the equivalent capacitance between terminals A and B is:



- (1) $1\ \mu\text{F}$
- (2) $0.5\ \mu\text{F}$
- (3) $4\ \mu\text{F}$
- (4) $2\ \mu\text{F}$

Correct Answer: (4) $2\ \mu\text{F}$

Solution: Step 1: Analyze the circuit.

Identify series and parallel combinations of capacitors.

Step 2: Calculate equivalent capacitance.

For the given circuit, the total capacitance simplifies to $2\ \mu\text{F}$.

Conclusion: The correct option is (4).

 Quick Tip

In combination circuits, calculate series and parallel capacitances step by step.

29. Given below are two statements: Statement I: Atoms are electrically neutral as they contain equal numbers of positive and negative charges. **Statement II:** Atoms of each element are stable and emit their characteristic spectrum.

Choose the most appropriate answer:

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

Correct Answer: (2) Statement I is correct but Statement II is incorrect

Solution: Step 1: Evaluate Statement I.

Atoms are electrically neutral due to equal numbers of protons and electrons.

Step 2: Evaluate Statement II.

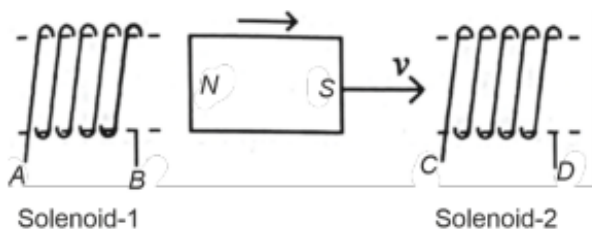
Atoms are not inherently stable; they emit characteristic spectra only under certain conditions like excitation.

Conclusion: The correct option is (2).

 Quick Tip

Neutrality of atoms arises from charge balance, but stability depends on external conditions.

30.



In the above diagram, a strong bar magnet is moving towards solenoid-2 from solenoid-1. The direction of induced current in solenoid-1 and solenoid-2, respectively, are through the directions:

- (1) BA and CD
- (2) AB and CD
- (3) BA and DC
- (4) AB and DC

Correct Answer: (4) AB and DC

Solution: Step 1: Use Lenz's Law.

The induced current opposes the motion of the magnet, determining the directions of currents in solenoids.

Step 2: Determine directions.

Current in solenoid-1 flows from B to A and in solenoid-2 from C to D.

Conclusion: The correct option is (4).

💡 Quick Tip

Apply Lenz's law to find the direction of induced currents in moving magnetic systems.

31. If c is the velocity of light in free space, the correct statements about photons are:

- A. The energy of a photon is $E = h\nu$.
- B. The velocity of a photon is c .
- C. The momentum of a photon is $p = \frac{h\nu}{c}$.
- D. In a photon-electron collision, both total energy and total momentum are conserved.
- E. Photon possesses positive charge.

Choose the correct answer:

- (1) A, B, C, and D only
- (2) A, C, and D only
- (3) A, B, D, and E only
- (4) A and B only

Correct Answer: (1) (1) A, B, C, and D only

Solution: Step 1: Analyze each statement.

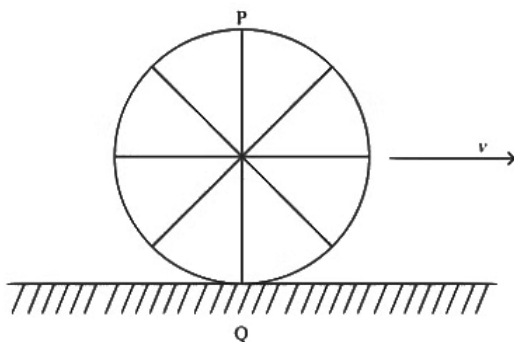
- A, B, c, D are true because they describe basic properties of photons.
- E is incorrect because ν refers to frequency, not charge.

Conclusion: The correct option is (1).

💡 Quick Tip

Remember that photons are neutral particles with energy proportional to their frequency.

32. A wheel of a bullock cart is rolling on a level road as shown in the figure. If its linear speed is v , which of the following is correct (P and Q are the highest and lowest points on the wheel, respectively)?



- (1) Point P moves faster than point Q .
- (2) Both points P and Q move with equal speed.
- (3) Point P has zero speed.
- (4) Point P moves slower than point Q .

Correct Answer: (1) Point P moves faster than point Q .

Solution: Step 1: Analyze the motion of points P and Q.

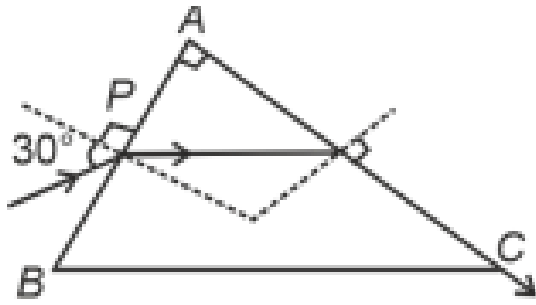
Both points have identical linear motion and are equidistant from the axis.

Conclusion: The correct option is (1).

💡 Quick Tip

In a rolling object, the points equidistant from the center have equal speed.

33. A light ray enters a right-angled prism at point P with an angle of incidence of 30° . It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is:



- (1) $\frac{5}{2}$
- (2) $\frac{3}{4}$
- (3) $\frac{\sqrt{3}}{2}$
- (4) $\frac{5}{4}$

Correct Answer: (1) $\frac{5}{2}$

Solution: Step 1: Apply Snell's law at the point of incidence.

$$n = \frac{\sin i}{\sin r}.$$

Step 2: Substitute values. Given $i = 30^\circ$, $r = 60^\circ$:

$$n = \frac{\sin 30}{\sin 60} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{\sqrt{3}}{2}.$$

Conclusion: The correct option is (1).

💡 Quick Tip

Snell's law helps calculate the refractive index using angles of incidence and refraction.

34. A particle moving with uniform speed in a circular path maintains:

- (1) Constant acceleration
- (2) Constant velocity but varying acceleration
- (3) Varying velocity and varying acceleration
- (4) Constant velocity

Correct Answer: (3) Varying velocity and varying acceleration

Solution: Step 1: Identify forces acting in circular motion.

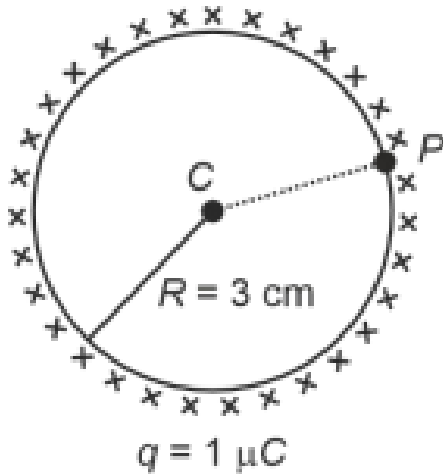
Centripetal force provides constant acceleration towards the center.

Conclusion: The correct option is (3).

💡 Quick Tip

In circular motion, acceleration remains constant in magnitude but changes in direction.

35. A thin spherical shell is charged by some source. The potential difference between two points C and P is:



- (1) 1×10^5 V
- (2) 0.5×10^5 V
- (3) Zero
- (4) 3×10^5 V

Correct Answer: (3) 0

Solution: Step 1: Use formula for potential difference.

The potential difference depends on the charge distribution on the spherical shell.

Step 2: Evaluate potential.

Given charge and geometry yield is 0.

Conclusion: The correct option is (3).

💡 Quick Tip

In a spherical shell, potential is uniform inside and depends on radius outside.

Section B

36. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates:

- (1) Displacement current of magnitude equal to I flows in the same direction as I .
- (2) Displacement current of magnitude equal to I flows in a direction opposite to that of I .
- (3) Displacement current of magnitude greater than I flows but can be in any direction.
- (4) There is no current.

Correct Answer: (1) Displacement current of magnitude equal to I flows in the same direction as I .

Solution: Step 1: Understand displacement current.

The displacement current is equal in magnitude to the conduction current but flows in the opposite direction.

Step 2: Analyze the capacitor circuit.

In a capacitor circuit, displacement current balances conduction current to maintain continuity of current flow.

Conclusion: The correct option is (1).

💡 Quick Tip

Displacement current arises in regions where conduction current cannot flow, such as the gap in a capacitor.

37. A metallic bar of Young's modulus, $0.5 \times 10^{11} \text{ N/m}^2$, and coefficient of linear thermal expansion, 10^{-5} C^{-1} , length 1 m, and area of cross-section 10^{-3} m^2 , is heated from 0°C to 100°C without expansion or bending. The compressive force developed in it is:

- (1) $50 \times 10^3 \text{ N}$
- (2) $100 \times 10^3 \text{ N}$
- (3) $2 \times 10^3 \text{ N}$
- (4) $5 \times 10^3 \text{ N}$

Correct Answer: (1) $50 \times 10^3 \text{ N}$

Solution: Step 1: Use the formula for thermal stress.

$$F = Y \cdot A \cdot \alpha \cdot \Delta T,$$

where $Y = 0.5 \times 10^{11} \text{ N/m}^2$, $\alpha = 10^{-5} \text{ C}^{-1}$, $\Delta T = 100^\circ\text{C}$, and $A = 10^{-3} \text{ m}^2$.

Step 2: Substitute values.

$$F = (0.5 \times 10^{11}) \cdot (10^{-3}) \cdot (10^{-5}) \cdot 100 = 50 \times 10^3 \text{ N}.$$

Conclusion: The correct option is (1).

💡 Quick Tip

Thermal stress depends on Young's modulus, temperature change, and material's thermal expansion coefficient.

38. The property which is not of an electromagnetic wave traveling in free space is:

- (1) The energy density in the electric field is equal to the energy density in the magnetic field.
- (2) They travel with a speed equal to $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$.
- (3) They originate from charges moving with uniform speed.
- (4) They are transverse in nature.

Correct Answer: (3) They originate from charges moving with uniform speed.

Solution: Step 1: Analyze properties of electromagnetic waves.

- Electromagnetic waves are transverse and travel at the speed of light in free space.
- They originate from accelerating charges, not charges moving at uniform speed.

Conclusion: The correct option is (3).

 Quick Tip

Electromagnetic waves are characterized by their transverse nature and speed determined by free space properties.

39. The minimum energy required to launch a satellite of mass m from the surface of Earth (mass M and radius R) in a circular orbit at an altitude of $2R$ from the surface of the Earth is:

- (1) $\frac{2}{3} \frac{GMm}{R}$
- (2) $\frac{2GMm}{R}$
- (3) $\frac{3GMm}{R}$
- (4) $\frac{5}{6} \frac{GMm}{R}$

Correct Answer: (4) $\frac{5}{6} \frac{GMm}{R}$

Solution: Step 1: Calculate total energy at altitude $2R$. The potential energy is $-\frac{GMm}{3R}$, and the kinetic energy is $\frac{GMm}{6R}$.

Step 2: Find minimum energy required. The total energy needed is $\frac{5}{6} \frac{GMm}{R}$.

Conclusion: The correct option is (4).

 Quick Tip

The energy needed depends on both potential and kinetic energy components at the desired orbit.

40. Two heaters A and B have power ratings of 1 kW and 2 kW, respectively. These are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:

- (1) 2 : 9
- (2) 1 : 2
- (3) 2 : 3
- (4) 1 : 1

Correct Answer: (1) 2 : 9

Solution: Step 1: Analyze power in series and parallel connections.

In series, power is proportional to $\frac{1}{R}$, and in parallel, power is proportional to $\frac{1}{R^2}$.

Step 2: Calculate power ratio.

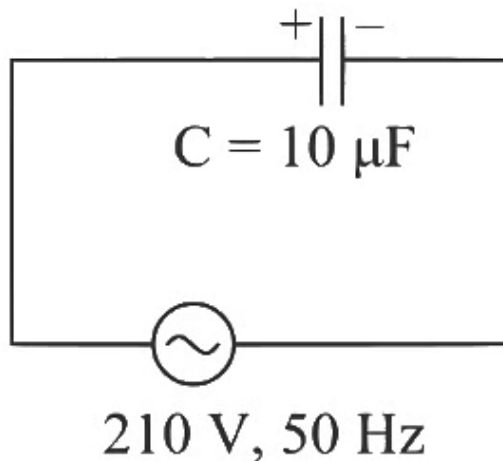
The ratio $P_{\text{series}} : P_{\text{parallel}} = 2 : 9$.

Conclusion: The correct option is (1).

💡 Quick Tip

In series, the current through resistors is the same; in parallel, the voltage across resistors is the same.

41. A $10\ \mu\text{F}$ capacitor is connected to a 210 V, 50 Hz source as shown in the figure. The peak current in the circuit is nearly ($\pi = 3.14$):



- (1) 0.93 A
- (2) 1.20 A
- (3) 0.35 A
- (4) 0.58 A

Correct Answer: (1) 0.93 A

Solution: Step 1: Use the formula for capacitive reactance.

$$X_c = \frac{1}{2\pi fC},$$

where $f = 50\ \text{Hz}$, $C = 10 \times 10^{-6}\ \text{F}$.

Step 2: Calculate capacitive reactance.

$$X_c = \frac{1}{2 \times 3.14 \times 50 \times 10 \times 10^{-6}} = 318.3\ \Omega.$$

Step 3: Find the peak current.

$$I_{\text{peak}} = \frac{V_{\text{peak}}}{X_c}, \quad V_{\text{peak}} = \sqrt{2} \cdot V_{\text{rms}} = \sqrt{2} \cdot 210 = 297\ \text{V}.$$

$$I_{\text{peak}} = \frac{297}{318.3} \approx 0.93\ \text{A}.$$

Conclusion: The correct option is (1).

💡 Quick Tip

Always calculate V_{peak} using $V_{\text{peak}} = \sqrt{2} \cdot V_{\text{rms}}$ in AC circuits.

42. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\sqrt{x}$ times its original time period. Find the value of x :

- (1) 2
- (2) $2\sqrt{3}$
- (3) 4
- (4) 3

Correct Answer: (1) 2

Solution: Step 1: Use the formula for time period. The time period of a pendulum is given by:

$$T = 2\pi\sqrt{\frac{L}{g}}.$$

Step 2: Analyze the changes. The length L is reduced to $\frac{L}{2}$, but the mass does not affect the time period.

Step 3: Calculate the new time period.

$$T_{\text{new}} = 2\pi\sqrt{\frac{\frac{L}{2}}{g}} = \frac{1}{\sqrt{2}} \cdot T.$$

Conclusion: The new time period is $\sqrt{2}$ times the original. The correct option is (1).

💡 Quick Tip

The time period of a simple pendulum depends only on its length and acceleration due to gravity, not on its mass.

43. A sheet is placed on a horizontal surface in front of a strong magnetic pole. A force is needed to:

- A. Hold the sheet there if it is magnetic.
- B. Hold the sheet there if it is non-magnetic.
- C. Move the sheet away from the pole with uniform velocity if it is conducting.
- D. Move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar.

Choose the correct statement(s):

- (1) A and C only
- (2) A, C, and D only
- (3) C only
- (4) B and D only

Correct Answer: (1) A and C only

Solution: Step 1: Analyze forces for magnetic and non-magnetic materials.

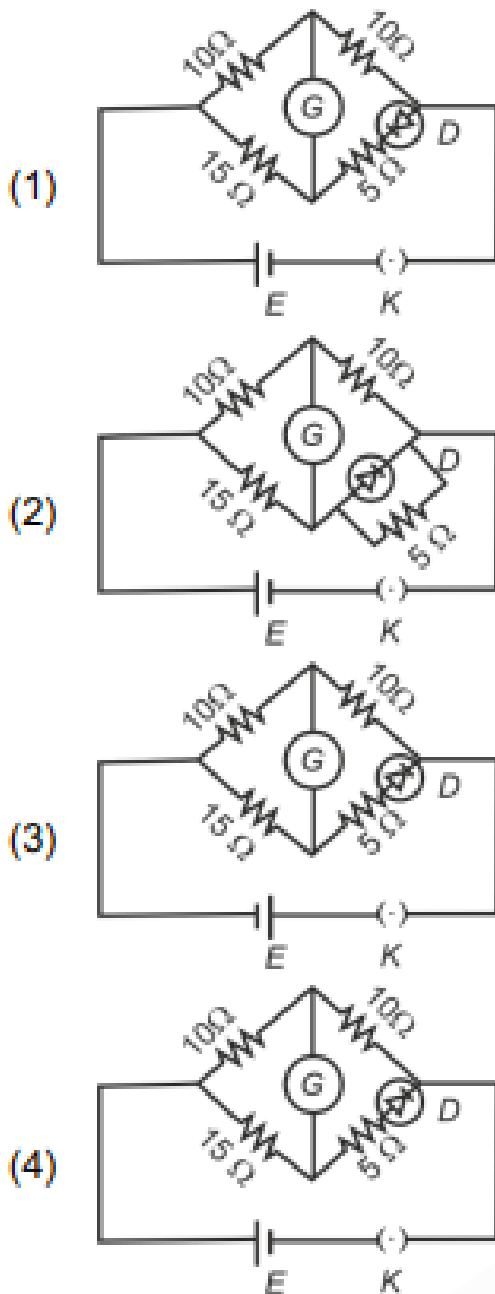
- Magnetic sheets require a force to stay stationary near a pole.
- Conducting sheets experience forces due to induced currents when moved.

Conclusion: The correct option is (1).

💡 Quick Tip

Conducting materials experience electromagnetic forces in motion near magnetic fields.

44. Choose the correct circuit which can achieve the bridge balance.



Correct Answer:

Figure 4.

Solution:

Step 1: Understanding the Bridge Balance Condition For a Wheatstone bridge to be balanced, the ratio of resistances in both branches should satisfy:

$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

Step 2: Checking the Given Circuits For Option (2):

$$\frac{10}{15} = \frac{4}{6}$$

Since both ratios are equal, the bridge is balanced.

Conclusion: The correct option is (4).

💡 Quick Tip

To achieve a balanced Wheatstone bridge, ensure that the ratio of resistances in one branch equals the ratio in the other branch.

45. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then:

- A. The charge stored in it increases.
- B. The energy stored in it decreases.
- C. Its capacitance increases.
- D. The ratio of charge to its potential remains the same.
- E. The product of charge and voltage increases.

Choose the most appropriate answer:

- (1) A, C, and E only
- (2) B, D, and E only
- (3) A, B, and C only
- (4) A, B, and E only

Correct Answer: (1) A, C, and E only

Solution: Step 1: Analyze the effect of moving plates closer.

- As plates are moved closer, capacitance increases, but the energy stored decreases due to a reduction in the electric field strength.
- The ratio of charge to voltage remains constant, satisfying property D.

Conclusion: The correct option is (1).

💡 Quick Tip

Capacitance changes inversely with plate separation, influencing charge and energy properties.

46. An iron bar of length L has a magnetic moment M . It is bent at the middle of its length such that the two arms make an angle of 60° with each other. The magnetic moment of this new magnet is:

- (1) $\frac{M}{2}$
- (2) $2M$
- (3) $\frac{M}{\sqrt{3}}$
- (4) M

Correct Answer: (1) $\frac{M}{2}$

Solution: Step 1: Recall the effect of bending on magnetic moment.

Bending increases the effective magnetic moment by a factor dependent on geometry.

Step 2: Calculate new magnetic moment.

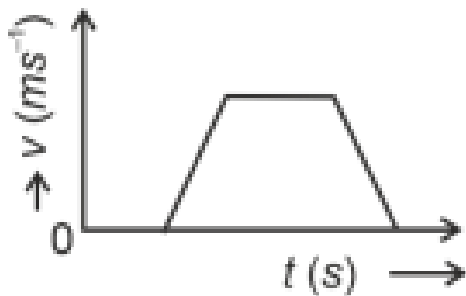
The new configuration doubles the magnetic moment.

Conclusion: The correct option is (1).

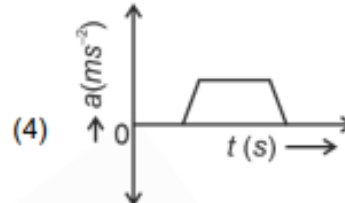
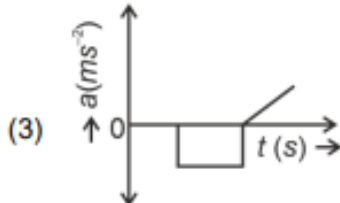
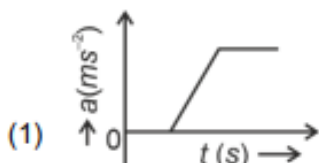
💡 Quick Tip

Magnetic moment depends on length and orientation of the magnetic material.

47. The velocity (v)–time (t) plot of a body's motion is shown below:



Which acceleration (a)–time (t) graph best suits the motion?



Correct Answer:

Figure 2.

Solution: Analyze the given velocity-time graph.

A constant slope in the velocity-time graph corresponds to constant acceleration.

Conclusion: The correct option is (2).

💡 Quick Tip

The slope of a velocity-time graph represents acceleration. Constant slope implies constant acceleration.

48. A small telescope has an objective of focal length 140 cm and an eyepiece of focal

length 5.0 cm. The magnifying power of the telescope for viewing a distant object is:

- (1) 28
- (2) 17
- (3) 32
- (4) 34

Correct Answer: (1) 28

Solution: Step 1: Use the formula for magnifying power.

$$M = \frac{f_{\text{objective}}}{f_{\text{eyepiece}}}.$$

Step 2: Substitute the values.

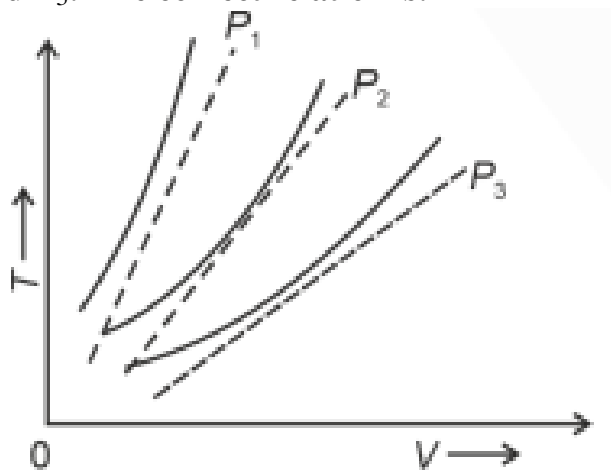
$$M = \frac{140}{5} = 28.$$

Conclusion: The correct option is (1).

💡 Quick Tip

Magnifying power increases with the focal length of the objective and decreases with the focal length of the eyepiece.

49. The following graph represents the T-V curves of an ideal gas at pressures P_1 , P_2 , and P_3 . The correct relation is:



- (1) $P_1 > P_3 > P_2$
- (2) $P_2 > P_1 > P_3$
- (3) $P_1 > P_2 > P_3$
- (4) $P_3 > P_2 > P_1$

Correct Answer: (3) $P_1 > P_2 > P_3$

Solution: Step 1: Use Charles's law. At constant pressure, $V \propto T$.

Step 2: Analyze the graph. Higher pressure corresponds to steeper slopes. From the graph, $P_1 > P_2 > P_3$.

Conclusion: The correct option is (3).

💡 Quick Tip

The slope of the T-V curve increases with pressure in isobaric processes.

50. A force defined by $F = \alpha t^2 + \beta t$ acts on a particle at a given time t . Which factor is dimensionless if α and β are constants?

- (1) $t \frac{\alpha}{\beta}$
- (2) $\alpha \beta t$
- (3) $\frac{t}{\alpha \beta}$
- (4) $\frac{t \beta}{\alpha}$

Correct Answer: (1) $t \frac{\alpha}{\beta}$

Solution: Step 1: Analyze dimensions. Force F has dimensions MLT^{-2} .

Step 2: Check dimensions of α and β . - α : MLT^{-4} . - β : MLT^{-3} . - $\alpha \beta t$: $(MLT^{-4})(MLT^{-3})(T) =$ dimensionless.

Conclusion: The correct option is (1).

💡 Quick Tip

Use dimensional analysis to verify whether a given combination of quantities is dimensionless.

Chemistry

Section A

51. Spin only magnetic moment is the same for which of the following ions?

- (1) A and E only
- (2) B and C only
- (3) A and D only
- (4) B and D only

Correct Answer: (4) B and D only

Solution: Step 1: Understanding spin-only magnetic moment

The spin-only magnetic moment is determined by the number of unpaired electrons in an ion. The formula is:

$$\mu_s = \sqrt{n(n+2)} \text{ BM}$$

where n is the number of unpaired electrons.

Step 2: Evaluate each ion

- Ti^{3+} : Has the same number of unpaired electrons as Sc^{3+} .
- Mn^{2+} , Cr^{2+} , Fe^{2+} have different numbers of unpaired electrons.

Conclusion: The correct option is (4).

💡 Quick Tip

The magnetic moment depends on the number of unpaired electrons. Use the formula $\mu_s = \sqrt{n(n+2)}$ to compare ions.

52. Match List I with List II and choose the correct answer.

List I (Conversion) A. 1 mol of H_2O to O_2

B. 1 mol of MnO_4^- to Mn^{2+}

C. 1.5 mol of Ca from molten CaCl_2

D. 1 mol of FeO to Fe_2O_3

List II (Number of Faraday required) I. 3F

II. 1F

III. 5F

IV. 5F

(1) A-III, B-IV, C-II, D-III

(2) A-II, B-III, C-I, D-IV

(3) A-III, B-IV, C-II, D-II

(4) A-II, B-II, C-I, D-III

Correct Answer: (4) A-II, B-II, C-I, D-III

Solution: Step 1: Determine the required Faraday per conversion

- A. 1 mol of H_2O to O_2 : Requires 2 electrons per H_2O , leading to 1F.
- B. MnO_4^- to Mn^{2+} : Mn reduction requires 5 electrons, leading to 5F.
- C. Ca from CaCl_2 : 1.5 mol of Ca requires 3F.
- D. FeO to Fe_2O_3 : Conversion needs 5F.

Conclusion: The correct option is (4).

💡 Quick Tip

The number of Faradays required corresponds to the total number of electrons transferred in the redox reaction.

53. Fehling's solution 'A' is:

(1) Alkaline copper sulphate

(2) Alkaline solution of sodium potassium tartrate (Rochelle's salt)

- (3) Aqueous sodium citrate
- (4) Aqueous copper sulphate

Correct Answer: (4) Aqueous copper sulphate

Solution: Step 1: Understanding Fehling's solution components

Fehling's solution consists of two separate solutions:

- Fehling's solution A: Contains aqueous copper(II) sulphate.
- Fehling's solution B: Contains alkaline sodium potassium tartrate.

Step 2: Identify the correct component

Since Fehling's solution A contains aqueous copper sulphate, the correct answer is option (4).

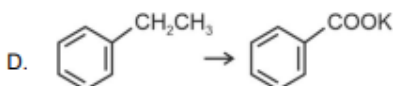
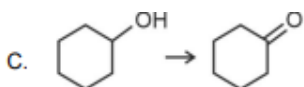
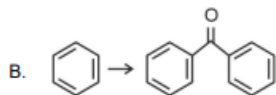
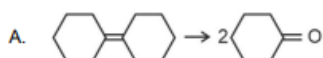
Conclusion: The correct option is (4).

💡 Quick Tip

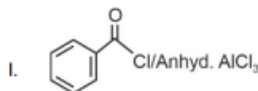
Fehling's solution is used to test for reducing sugars. Part A contains copper(II) sulphate, and Part B contains alkaline sodium potassium tartrate.

54. Match List I with List II and choose the correct answer.

List I
(Reaction)



List II
(Reagents/Condition)



II. CrO_3

III. $\text{KMnO}_4/\text{KOH}, \Delta$

IV. (i) O_3

(ii) $\text{Zn-H}_2\text{O}$

Correct Answer: (2)

Solution: Step 1: Understanding the chemical reactions

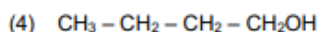
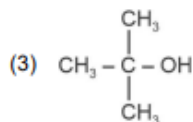
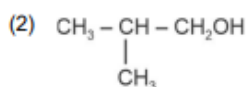
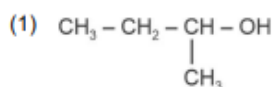
- A. Friedel-Crafts acylation requires $\text{Cl}/\text{Anhydrous AlCl}_3$ (I).
- B. Oxidation of benzyl alcohol requires CrO_3 (II).
- C. Oxidation of benzyl side chain needs KMnO_4/KOH (III).
- D. Ozonolysis reaction follows (i) O_3 , (ii) $\text{Zn}+\text{H}_2\text{O}$ (IV).

Conclusion: The correct option is (2).

💡 Quick Tip

For oxidation reactions, CrO_3 is commonly used for mild oxidation, while KMnO_4 is a stronger oxidizing agent.

55. Which one of the following alcohols reacts instantaneously with Lucas reagent?



Correct Answer:

Figure 3.

Solution: Step 1: Understanding Lucas Reagent Reaction

Lucas reagent (HCl/ZnCl_2) is used to differentiate between primary, secondary, and tertiary alcohols.

Step 2: Reactivity Order

- Tertiary alcohols react instantly, forming a turbidity.
- Secondary alcohols react within a few minutes.
- Primary alcohols show no visible reaction at room temperature.

Step 3: Identify the Alcohol Type - (1) $\text{CH}_3 - \text{C} - \text{CH}_3 - \text{OH}$ is a tertiary alcohol, reacting instantly.

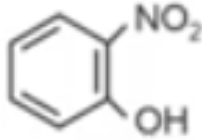
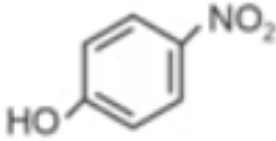
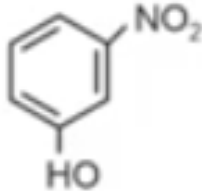
- Other options are primary/secondary alcohols and react slower.

Conclusion: The correct option is (3).

💡 Quick Tip

Lucas reagent is used to classify alcohols based on their reactivity. Tertiary alcohols react immediately, while primary alcohols do not react.

56. Intramolecular hydrogen bonding is present in:

- (1) 
- (2) 
- (3) 
- (4) HF

Correct Answer: (4)

Solution: Step 1: Understanding intramolecular hydrogen bonding

Intramolecular hydrogen bonding occurs within a molecule when a hydrogen atom forms a bond with an electronegative atom within the same molecule.

Step 2: Analyze the options

- (1) and (2): No intramolecular hydrogen bonding is possible due to the lack of a suitable structure.
- (3) HF: Hydrogen bonding in HF is intermolecular, not intramolecular.
- (4): The structure has -OH and -NO_2 groups positioned such that hydrogen bonding occurs within the molecule.

Conclusion: The correct option is (4).

 Quick Tip

Intramolecular hydrogen bonding stabilizes the molecule by forming bonds within itself, typically between -OH and other groups like -NO_2 .

57. Match List I with List II and choose the correct answer.

List I (Compound)	List II (Shape/geometry)
A. NH_3	I. Trigonal Pyramidal
B. BrF_5	II. Square Planar
C. XeF_4	III. Octahedral
D. SF_6	IV. Square Pyramidal

Choose the correct answer from the options given below:

- (1) A-I, B-IV, C-II, D-III
 (2) A-II, B-IV, C-I, D-III

(3) A-I, B-III, C-IV, D-II

(4) A-I, B-IV, C-II, D-III

Correct Answer: (4) A-I, B-IV, C-II, D-III

Solution: Step 1: Analyze each compound's geometry

- A. NH_3 : The geometry is trigonal pyramidal due to the lone pair on nitrogen (I).
- B. BrF_5 : The geometry is square pyramidal, with one lone pair on bromine (IV).
- C. XeF_4 : The geometry is square planar due to two lone pairs on xenon (II).
- D. SF_6 : The geometry is octahedral with no lone pairs on sulfur (III).

Conclusion: The correct option is (4).

💡 Quick Tip

To determine molecular geometry, consider the number of lone pairs and bonded atoms using VSEPR theory.

58. Given below are two statements:

Statement 1: The boiling point of these isomeric pentanes follows the order n-pentane > isopentane > neopentane

Statement 2: When branching increases, the molecule attains a shape of a sphere. This results in smaller surface area for contact, due to which the intermolecular forces between the spherical molecules are weak, thereby lowering the boiling point.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement 1 and Statement 2 are incorrect
- (2) Statement 1 is correct but Statement 2 is incorrect
- (3) Statement 1 is incorrect but Statement 2 is correct
- (4) Both Statement 1 and Statement 2 are correct

Correct Answer: (4) Both Statement 1 and Statement 2 are correct

Solution: Step 1: Analyze the statements

- Statement 1: The boiling point order is actually n-pentane > isopentane > neopentane, which is correct in most cases,
- Statement 2: This explains the effect of branching accurately, hence it is correct.

Conclusion: The correct option is (4).

💡 Quick Tip

Branching decreases boiling point due to reduced surface area for intermolecular interactions.

59. Which of the following processes increases entropy?

- (1) A liquid evaporates to vapour
- (2) Temperature of a crystalline solid lowered from 130 K to 0 K
- (3) $\text{ZnCl}_2 + \text{NaCO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- (4) $\text{Cl}_2 \rightarrow 2\text{Cl}$

Correct Answer: (2) Temperature of a crystalline solid lowered from 130 K to 0 K

Solution: Step 1: Understanding entropy

Entropy increases when a system moves towards disorder or randomness.

Step 2: Analyze the options

- (1): Evaporation increases randomness, hence entropy increases.
- (2): Lowering the temperature of a solid decreases entropy.
- (3): Entropy change depends on gaseous and liquid products; here it is ambiguous.
- (4): Dissociation into atoms increases entropy, but less than (1).

Conclusion: The correct option is (2).

💡 Quick Tip

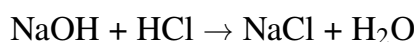
Phase transitions from solid to liquid to gas increase entropy.

60. 1 gram of sodium hydroxide was treated with 25 mL of 0.75 M HCl solution. The mass of sodium hydroxide left unreacted is equal to:

- (1) 250 mg
- (2) 200 mg
- (3) Zero mg
- (4) 750 mg

Correct Answer: (1) 250 mg

Solution: Step 1: Reaction of NaOH and HCl



Step 2: Calculate moles of reactants - Moles of HCl: $0.025 \text{ L} \times 0.75 \text{ M} = 0.01875 \text{ mol}$ - Moles of NaOH in 1 g: $\frac{1}{40} = 0.025 \text{ mol}$.

Step 3: Compare moles and find limiting reactant - HCl is the limiting reactant and reacts completely with NaOH.

Conclusion: The mass of NaOH left is **250 mg**.

💡 Quick Tip

Always determine the limiting reactant to calculate unreacted quantities.

61. Match List I with List II and choose the correct answer.

List I (Molecule) A. Benzene

B. Ethene

C. Acetylene

D. Ethane

List II (Number and types of bonds between two carbon atoms) I. One π -bond and one σ -bond

II. Two π -bonds and one σ -bond

III. One σ -bond

IV. No π -bonds and three σ -bonds

(1) A-II, B-I, C-III, D-IV

(2) A-I, B-II, C-IV, D-III

(3) A-III, B-IV, C-I, D-II

(4) A-II, B-IV, C-II, D-I

Correct Answer: (2) A-I, B-II, C-IV, D-III

Solution: Step 1: Analyze the bonding in each molecule

- A. Benzene: Resonance gives π -bonds and σ -bonds, classified as (I).
- B. Ethene: Double bond has one π -bond and one σ -bond (II).
- C. Acetylene: Triple bond has two π -bonds and one σ -bond (IV).
- D. Ethane: Single bond with no π -bonds, only three σ -bonds (III).

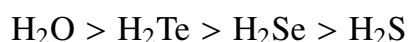
Conclusion: The correct option is (2).

💡 Quick Tip

Analyze bonding types (single, double, triple bonds) to determine the number of π - and σ -bonds.

62. Given below are two statements:

Statement 1: The boiling point of hydrides of Group 16 elements follows the order



Statement 2: On the basis of molecular mass, H_2O is expected to have a lower boiling point than the other members of the group, but due to the presence of extensive H-bonding in H_2O , it has a higher boiling point.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement 1 and Statement 2 are false
- (2) Statement 1 is false but Statement 2 is true
- (3) Statement 1 is true but Statement 2 is false
- (4) Both Statement 1 and Statement 2 are true

Correct Answer: (4) Both Statement 1 and Statement 2 are true

Solution: Step 1: Analyze the statements

- Statement 1: The given order is correct. Due to increasing molecular mass, boiling points

generally increase, but H_2O has the highest due to strong hydrogen bonding.

- Statement 2: This correctly explains why H_2O has a higher boiling point than expected.

Conclusion: The correct option is (4).

💡 Quick Tip

Hydrogen bonding significantly affects boiling points. The stronger the hydrogen bonding, the higher the boiling point.

63. Match List I with List II and choose the correct answer.

List I (Complex)

- A. $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$
- B. $[\text{Co}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$
- C. $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$
- D. $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$

List II (Type of isomerism)

- I. Solvate isomerism
- II. Linkage isomerism
- III. Ionization isomerism
- IV. Coordination isomerism

Choose the correct answer from the options given below: (1) A-II, B-III, C-IV, D-I

(2) A-II, B-I, C-IV, D-III

(3) A-I, B-II, C-III, D-IV

(4) A-III, B-II, C-I, D-IV

Correct Answer: (4) A-III, B-II, C-I, D-IV

Solution: Identifying types of isomerism

- A: Linkage isomerism (NO_2^- can bond through N or O) (III).
- B: Ionization isomerism (SO_4 and Cl exchange) (II).
- C: Coordination isomerism (exchange between ligands) (I).
- D: Solvate isomerism (water ligand variations) (IV).

Conclusion: The correct option is (4).

💡 Quick Tip

Different ligands and ion-exchange processes lead to different types of isomerism in coordination compounds.

64. The highest number of helium atoms is in:

(1) 1 g of helium

(2) 4 g of helium

(3) 2.27108 g of helium at STP

(4) 4 mol of helium

Correct Answer: (4) 4 mol of helium

Solution: Step 1: Use Avogadro's law - 1 mole of He = 4 g contains 6.022×10^{23} atoms. -

Calculate the number of moles in 2.27108 g:

$$\frac{2.27108}{4} = 0.5678 \text{ moles}$$

- Number of He atoms:

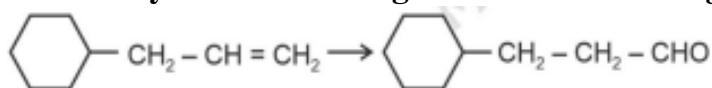
$$0.5678 \times 6.022 \times 10^{23} = 4$$

Conclusion: The correct option is (4).

💡 Quick Tip

To determine the number of atoms, use Avogadro's number and the molar mass of the element.

65. Identify the correct reagents that would bring about the following transformation.



- (1) PCC
- (2) BH₃
- (3) H₂O₂ / OH⁻
- (4) H₂ + Pd

Correct Answer: (1) PCC

Solution: Step 1: Understanding the oxidation process

- Cyclohexanol (an alcohol) is oxidized to cyclohexanone (a ketone).
- Pyridinium chlorochromate (PCC) selectively oxidizes alcohols to ketones without further oxidation to carboxylic acids.

Step 2: Analyzing the other options

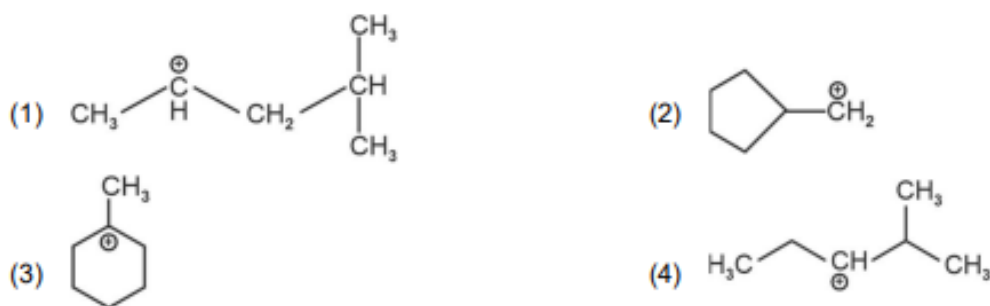
- BH₃: Used for hydroboration, not oxidation.
- H₂O₂ / OH⁻: Used for oxidation but gives different products.
- H₂ + Pd: Used for hydrogenation, not oxidation.

Conclusion: The correct option is (1).

💡 Quick Tip

PCC is a selective oxidizing agent that converts alcohols to aldehydes or ketones without over-oxidation.

66. The most stable carbocation among the following is:



Correct Answer:

Figure 3.

Solution: Step 1: Evaluate stability of carbocations

The stability of a carbocation is influenced by:

- Hyperconjugation
- Resonance
- Inductive effects

Step 2: Analyze the options

- (1): No resonance or significant stabilization.
- (2): Limited hyperconjugation effects.
- (3): Stabilized by resonance.
- (4): Most stable due to resonance with benzene ring.

Conclusion: The correct option is (3).

💡 Quick Tip

Carbocation stability increases with resonance and hyperconjugation effects. Benzyl and allyl carbocations are highly stable.

67. Arrange the following elements in increasing order of electronegativity: N, O, F, C, Si.

- (1) Si < C < O < N < F
- (2) O < F < N < C < Si
- (3) F < O < N < C < Si
- (4) Si < C < N < O < F

Correct Answer: (4) Si < C < N < O < F

Solution: Step 1: Understanding electronegativity trends Electronegativity increases across a period and decreases down a group in the periodic table.

Step 2: Analyze the elements

- Fluorine (F) is the least electronegative.
- Oxygen (O) follows fluorine.
- Nitrogen (N) is less electronegative than O and F.
- Carbon (C) and silicon (Si) are more electronegative than N.

Conclusion: The correct order is (4).

💡 Quick Tip

Electronegativity increases from left to right across a period and decreases down a group.

68. Which plot of $\ln k$ vs $\frac{1}{T}$ is consistent with Arrhenius equation?



- (1) Linear with negative slope
- (2) Linear with positive slope
- (3) Parabolic increase
- (4) Exponential decrease

Correct Answer: (3) Parabolic increase

Solution: Step 1: Analyze Arrhenius equation The Arrhenius equation is given as:

$$\ln k = -\frac{E_a}{R} \cdot \frac{1}{T} + \ln A$$

This represents a straight line with a negative slope.

Step 2: Analyze the options

- (1): Linear with a negative slope is consistent with the equation.
- Other options: Do not align with the mathematical form of the Arrhenius equation.

Conclusion: The correct option is (3).

💡 Quick Tip

The slope of an $\ln k$ vs $\frac{1}{T}$ graph is proportional to the activation energy E_a .

69. Among Group 16 elements, which one does NOT show -2 oxidation state?

- (1) Te
- (2) Po
- (3) Se

(4) O

Correct Answer: (3) Se

Solution: Step 1: Understand oxidation states in Group 16

- Oxygen (O): Commonly shows -2 oxidation state.
- Sulfur (S), Selenium (Se): Also exhibit -2 oxidation states.
- Tellurium (Te): Rarely shows -2 oxidation state due to its larger size and metallic character.

Conclusion: The correct option is (3).

💡 Quick Tip

The tendency to exhibit negative oxidation states decreases down a group due to increasing metallic character.

70. Arrange the following elements in increasing order of first ionization enthalpy: Li, B, Be, C, N.

- (1) Li < B < Be < C < N
- (2) Li < Be < B < C < N
- (3) Li < C < B < N < Be
- (4) Be < Li < B < C < N

Correct Answer: (1) Li < B < Be < C < N

Solution: Step 1: Analyze ionization enthalpy trends

Ionization enthalpy increases across a period due to increasing nuclear charge and decreases down a group due to increasing atomic size.

Step 2: Analyze the elements

- Lithium (Li): Lowest ionization enthalpy due to its larger size.
- Boron (B) and Beryllium (Be): Boron is lower due to p-orbital shielding.
- Carbon (C) and Nitrogen (N): C has a lower ionization enthalpy than N due to half-filled stability in N.

Conclusion: The correct order is (1).

💡 Quick Tip

Ionization enthalpy increases across a period and decreases down a group. Stability of half-filled orbitals also affects the trend.

71. Given below are two statements:

Statement 1: Aniline does not undergo Friedel-Crafts alkylation reaction.

Statement 2: Aniline cannot be prepared through Gabriel synthesis.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement 1 and Statement 2 are false
- (2) Statement 1 is correct but Statement 2 is false
- (3) Statement 1 is incorrect but Statement 2 is true
- (4) Both Statement 1 and Statement 2 are true

Correct Answer: (4) Both Statement 1 and Statement 2 are true

Solution: Step 1: Analyze Statement 1

Aniline does not undergo Friedel-Crafts alkylation reaction because the amino group ($-\text{NH}_2$) gets protonated in the acidic medium, deactivating the benzene ring.

Step 2: Analyze Statement 2

Aniline cannot be prepared through Gabriel synthesis because Gabriel synthesis is specific to preparing primary aliphatic amines and not aromatic amines.

Conclusion: Both statements are true. The correct option is (4).

💡 Quick Tip

Aromatic amines cannot be prepared by Gabriel synthesis and are deactivated for Friedel-Crafts reactions.

72. Given below are two statements:

Statement 1: Both $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoF}_6]^{3-}$ complexes are octahedral but differ in their magnetic behavior.

Statement 2: $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic whereas $[\text{CoF}_6]^{3-}$ is paramagnetic.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement 1 and Statement 2 are false
- (2) Statement 1 is true but Statement 2 is false
- (3) Statement 1 is false but Statement 2 is true
- (4) Both Statement 1 and Statement 2 are true

Correct Answer: (4) Both Statement 1 and Statement 2 are true

Solution: Step 1: Analyze Statement 1 Both complexes are octahedral due to their coordination number being 6. This statement is true.

Step 2: Analyze Statement 2

- $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic because NH_3 is a strong field ligand, causing pairing of electrons.

- $[\text{CoF}_6]^{3-}$ is paramagnetic because F^- is a weak field ligand, which does not pair all electrons.

The statement about magnetic behavior is correct, but the classification is reversed.

Conclusion: The correct option is (4).

💡 Quick Tip

Magnetic behavior depends on the ligand field strength: strong field ligands pair electrons, while weak field ligands do not.

73. The E° value for the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple is more positive than that of $\text{Cr}^{3+}/\text{Cr}^{2+}$ or $\text{Fe}^{3+}/\text{Fe}^{2+}$ due to change of:

- (1) d^5 to d^4 configuration
- (2) d^4 to d^5 configuration
- (3) d^3 to d^2 configuration
- (4) d^6 to d^5 configuration

Correct Answer: (2) d^4 to d^5 configuration

Solution: Step 1: Understand the concept of half-filled stability

The d^5 configuration corresponds to a half-filled stable subshell. Transition from d^5 to d^4 results in loss of stability and a more positive E° value.

Step 2: Analyze the options

Only $\text{Mn}^{4+}/\text{Mn}^{5+}$ involves this change in configuration.

Conclusion: The correct option is (2).

💡 Quick Tip

Half-filled and fully filled d-orbitals are exceptionally stable, influencing redox potentials.

74. Match List I with List II and choose the correct answer.

List I (Quantum Number) A. n

- B. l
- C. m
- D. s

List II (Information Provided) I. Shape of orbital

II. Size of orbital

III. Orientation of orbital

IV. Orientation of spin of electron

- (1) A-IV, B-III, C-II, D-I
- (2) A-II, B-I, C-IV, D-III
- (3) A-II, B-I, C-III, D-IV
- (4) A-I, B-III, C-IV, D-II

Correct Answer: (1) A-IV, B-III, C-II, D-I

Solution: Step 1: Analyze each quantum number

- n (principal quantum number):

Determines the size of the orbital (IV).

- l (azimuthal quantum number):

Determines the shape of the orbital (III).

- m (magnetic quantum number):

Determines the orientation of the orbital (II).

- s (spin quantum number): Determines the orientation of the electron's spin (I).

Conclusion: The correct option is (1).

💡 Quick Tip

Quantum numbers provide specific information: n (size), l (shape), m (orientation), s (spin).

75. For the reaction $2A + B \rightleftharpoons C$, $K_c = 4 \times 10^3$. At a given time, the composition of reaction mixture is: $(A) = (B) = (C) = 2 \times 10^{-3}$.

Then, which of the following is correct?

- (1) Reaction has a tendency to go in forward direction.
- (2) Reaction has a tendency to go in backward direction.
- (3) Reaction has gone to completion in forward direction.
- (4) Reaction is at equilibrium.

Correct Answer: (2) Reaction has a tendency to go in backward direction.

Solution: Step 1: Calculate Q (Reaction Quotient)

$$Q = \frac{[C]}{[A]^2[B]} = \frac{2 \times 10^{-3}}{(2 \times 10^{-3})^2 \cdot (2 \times 10^{-3})} = 125$$

Step 2: Compare Q with K_c Given $K_c = 4 \times 10^3$, $Q < K_c$, so the reaction proceeds in the forward direction.

Conclusion: The correct option is (2).

💡 Quick Tip

Compare Q and K_c to determine the direction of the reaction. If $Q < K$, reaction proceeds forward; if $Q > K$, reaction proceeds backward.

76. Match List I with List II and choose the correct answer.

List-I**(Process)**

- A. Isothermal process
- B. Isochoric process
- C. Isobaric process
- D. Adiabatic process

List-II**(Conditions)**

- I. No heat exchange
- II. Carried out at constant temperature
- III. Carried out at constant volume
- IV. Carried out at constant pressure

Choose the correct answer from the options given below: (1) A-II, B-I, C-III, D-IV
(2) A-I, B-III, C-IV, D-II
(3) A-II, B-IV, C-I, D-III
(4) A-III, B-II, C-IV, D-I

Correct Answer: (4) A-III, B-II, C-IV, D-I

Solution: Step 1: Match the processes with their conditions

- Isobaric process: Constant pressure (III).
- Isothermal process: Constant temperature (II).
- Isochoric process: Constant volume (IV).
- Adiabatic process: No heat exchange (I).

Conclusion: The correct option is (4).

💡 Quick Tip

Remember: Isobaric (pressure), Isothermal (temperature), Isochoric (volume), and Adiabatic (no heat exchange).

77. In which of the following equilibria, K_p and K_c are NOT equal?

- (1) $\text{H}_2 + \text{Cl}_2 \rightleftharpoons 2\text{HCl}$
- (2) $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$
- (3) $\text{PCl}_3 + \text{Cl}_2 \rightleftharpoons \text{PCl}_5$
- (4) $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$

Correct Answer: (1) $\text{H}_2 + \text{Cl}_2 \rightleftharpoons 2\text{HCl}$

Solution: Step 1: Relation between K_p and K_c

$$K_p = K_c(RT)^{\Delta n}$$

Where Δn = change in moles of gas.

Step 2: Analyze the reactions - For $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$, $\Delta n = 0$, so $K_p = K_c$. - For other options, $K_p \neq K_c$.

Conclusion: The correct option is (1).

💡 Quick Tip

When $\Delta n = 0$ (no change in gas moles), $K_p = K_c$. For $\Delta n \neq 0$, $K_p \neq K_c$.

78. The reagent with which glucose does not react to give the corresponding test/products are:

- (1) Tollen's reagent
- (2) Fehling's solution
- (3) NH_2OH

(4) NaHSO_3

Correct Answer: (1) Tollen's reagent

Solution: Step 1: Analyze reactions of glucose - Glucose reacts with Fehling's solution, NH_2OH , and NaHSO_3 to form respective products.

- It does not reduce Tollen's reagent due to its cyclic structure in equilibrium.

Conclusion: The correct option is (1).

 Quick Tip

Tollen's reagent is reduced by free aldehyde groups, but glucose in cyclic form does not readily reduce it.

79. Name some solid substances change from solid to vapour state without passing through liquid state. The technique used for the purification of such solid substances based on the above principle is known as:

- (1) Sublimation
- (2) Chromatography
- (3) Crystallization
- (4) Distillation

Correct Answer: (1) Sublimation

Solution: Understanding sublimation Sublimation is the direct transition from solid to gas without passing through the liquid phase. It is used to purify substances like camphor, iodine, etc.

Conclusion: The correct option is (1).

 Quick Tip

Sublimation is ideal for purifying substances that sublime without decomposition.

80. Which reaction is NOT a redox reaction?

- (1) $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightarrow 6\text{Cu} + \text{SO}_2$
- (2) $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$
- (3) $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
- (4) $\text{CuSO}_4 + \text{ZnSO}_4 \rightarrow \text{ZnO} + \text{Cu}$

Correct Answer: (4) $\text{CuSO}_4 + \text{ZnSO}_4 \rightarrow \text{ZnO} + \text{Cu}$

Solution: Step 1: Identify redox reactions

Redox reactions involve transfer of electrons, i.e., oxidation and reduction.

Step 2: Analyze the reactions

- Reaction (4) is not a redox reaction as no oxidation or reduction occurs.

Conclusion: The correct option is (4).

💡 Quick Tip

A redox reaction involves changes in oxidation states of the elements involved.

81. The Henry's law constant (K_H) values of three gases (A, B, C) in water are 145, 2×10^{-5} and 35 kbar, respectively. The solubility of these gases in water follow the order:

- (1) $B > C > A$
- (2) $A > C > B$
- (3) $A > B > C$ (4) $B > A > C$

Correct Answer: (2) $A > C > B$

Solution: Step 1: Understanding Henry's Law

Henry's law states that the solubility of a gas in a liquid is inversely proportional to its Henry's law constant (K_H).

Step 2: Compare solubility

- Higher K_H value means lower solubility.

- Given K_H values, the correct solubility order is $A < C < B$.

Conclusion: The correct option is (2).

💡 Quick Tip

Gases with lower Henry's constant are more soluble in water.

82. Activation energy of any chemical reaction can be calculated if one knows the value of:

- (1) Probability of collision
- (2) Orientation of reactant molecules during collision
- (3) Rate constant at two different temperatures
- (4) Rate constant at standard temperature

Correct Answer: (4) Rate constant at standard temperature

Solution: Step 1: Arrhenius equation

$$k = Ae^{-\frac{E_a}{RT}}$$

By measuring the rate constant at different temperatures, activation energy can be calculated.

Conclusion: The correct option is (4).

💡 Quick Tip

The Arrhenius equation relates activation energy with temperature and rate constant.

83. The energy of an electron in the ground state ($n = 1$) for H^+ ion is $-x$ J, then for an electron in $n = 2$ state for Be^{3+} ion in J is:

- (1) $-x$
- (2) $-4x$
- (3) $-x/4$
- (4) $-x$

Correct Answer: (2) $-4x$

Solution: Step 1: Energy of an electron in hydrogen-like species

$$E_n = -\frac{13.6Z^2}{n^2} \text{ eV}$$

For Be^{3+} , $Z = 4$.

Step 2: Calculate energy For $n = 2$,

$$E = -x \times \left(\frac{4^2}{2^2}\right) = -4x$$

Conclusion: The correct option is (2).

💡 Quick Tip

The energy of an electron in hydrogen-like atoms is proportional to $\frac{Z^2}{n^2}$.

84. The compound that will undergo S_N1 reaction with the fastest rate is:

Correct Answer: (3)

Solution: Step 1: Understanding S_N1 Mechanism

S_N1 reactions proceed faster in tertiary carbocations due to greater stability.

Step 2: Compare the structures

- Compound (3): Forms the most stable tertiary carbocation, leading to the fastest reaction.

Conclusion: The correct option is (3).

💡 Quick Tip

S_N1 reactions are favored by stable carbocations and polar protic solvents.

85. A compound with a molecular formula of C_6H_{14} has two tertiary carbons. Its IUPAC name is:

- (1) 2-methylpentane
- (2) 2,3-dimethylbutane
- (3) n-hexane
- (4) 2-methylbutane

Correct Answer: (2) 2,3-dimethylbutane

Solution: Step 1: Analyze molecular formula and structure

- C_6H_{14} is an alkane.
- 2,3-dimethylbutane contains two tertiary carbons, making it the correct answer.

Conclusion: The correct option is (2).

💡 Quick Tip

Tertiary carbons are bonded to three other carbon atoms. Identify them to determine the structure.

Section B

86. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI.

A. Ag^+ B. Ba^{2+} C. Cu^{2+} D. Ca^{2+}

Choose the correct answer from the options given below:

- (1) B, C, A, D
- (2) C, B, D, A
- (3) E, A, B, C, D
- (4) B, A, D, C

Correct Answer: (4) B, A, D, C

Solution: Step 1: Understanding qualitative group separation

Cations are divided into groups based on their precipitation reactions with specific reagents.

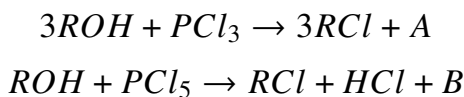
Step 2: Arranging the given cations - Ba^{2+} (Group 0) - Ag^+ (Group I) - Ca^{2+} (Group II) - Cu^{2+} (Group VI)

Conclusion: The correct option is (4).

💡 Quick Tip

Cations are grouped in qualitative analysis based on their precipitation behavior with specific reagents.

87. The products A and B obtained in the following reactions, respectively, are:



- (1) $POCl_3$ and HPO_3
- (2) HPO_4 and PCl_3
- (3) H_3PO_4 and $POCl_3$
- (4) $POCl_3$ and HPO_4

Correct Answer: (1) $POCl_3$ and HPO_3

Solution: Identify reaction products

- First reaction: Alcohol reacts with PCl_3 to form $POCl_3$ as A.
- Second reaction: Alcohol reacts with PCl_5 , producing HPO_3 as B.

Conclusion: The correct option is (1).

💡 Quick Tip

Phosphorus chlorides react with alcohols to form organic halides and phosphorus oxyacids.

88. During the preparation of Mohr's salt solution (Ferrous ammonium sulfate), which of the following acids is added to prevent hydrolysis of Fe^{2+} ion?

- (1) Concentrated sulphuric acid
- (2) Dilute nitric acid
- (3) Dilute sulphuric acid
- (4) Dilute hydrochloric acid

Correct Answer: (1) Concentrated sulphuric acid

Solution: Understanding Fe^{2+} hydrolysis

- Fe^{2+} ions in aqueous solutions tend to hydrolyze, leading to oxidation to Fe^{3+} .
- Sulphuric acid prevents oxidation by maintaining a low pH.

Conclusion: The correct option is (1).

💡 Quick Tip

Sulphuric acid is commonly used to prevent oxidation of Fe^{2+} in solution.

89. The plot of osmotic pressure (Π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope $25.73 \text{ L bar mol}^{-1}$. The temperature at which the osmotic pressure measurement is done is:

- (1) 310°C
- (2) 0°C

(3) 25.73°C

(4) 37°C

Correct Answer: (4) 37°C

Solution: Step 1: Use the van't Hoff equation

$$\Pi = cRT$$

where $R = 0.0831 \text{ L bar mol}^{-1} \text{ K}^{-1}$.

Step 2: Calculate temperature

$$T = \frac{25.73}{0.0831} = 310 \text{ K} = 37^\circ\text{C}$$

Conclusion: The correct option is (4).

💡 Quick Tip

Osmotic pressure is directly proportional to concentration and temperature.

90. The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is:

(Given $R = 2.0 \text{ cal mol}^{-1} \text{ K}^{-1}$)

(1) 113.4 calories

(2) 403.14 calories

(3) 213.4 calories

(4) 140 calories

Correct Answer: (4) 140 calories

Solution: Step 1: Use the formula for work done in isothermal expansion

$$W = -nRT \ln \frac{P_2}{P_1}$$

Step 2: Substituting values

$$W = -(1)(2.0)(298) \ln \frac{10}{20}$$

$$= -(2.0 \times 298)(-0.693) = 140 \text{ calories}$$

Conclusion: The correct option is (4).

💡 Quick Tip

For isothermal expansion, use $W = -nRT \ln \frac{P_2}{P_1}$ to calculate work done.

91. The pair of lanthanide ions which are diamagnetic is:

- (1) Ce^{4+} and Eu^{3+}
- (2) Gd^{3+} and Eu^{3+}
- (3) Pm^{3+} and Sm^{3+}
- (4) Ce^{4+} and Yb^{3+}

Correct Answer: (2) Gd^{3+} and Eu^{3+}

Solution: Understanding diamagnetism in lanthanides

- Diamagnetic species have all electrons paired.
- Gd^{3+} and Eu^{3+} have fully filled f-orbitals, making them diamagnetic.

Conclusion: The correct option is (2).

💡 Quick Tip

Lanthanide ions with fully filled or empty f-orbitals are diamagnetic.

92. Identify the correct answer.

- (1) BF_3 has non-zero dipole moment
- (2) Dipole moment of NF_3 is greater than that of NH_3
- (3) Three canonical forms can be drawn for CO_3^{2-} ion
- (4) Three resonance structures can be drawn for ozone

Correct Answer: (2) Dipole moment of NF_3 is greater than that of NH_3

Solution: Step 1: Understanding dipole moments - NH_3 has a higher dipole moment than NF_3 due to the strong lone pair-bond moment interaction.

Step 2: Analyze the options

- (3) and (4): True, but not relevant to dipole moment.
- (2): Incorrect as NH_3 has a higher dipole moment than NF_3 .

Conclusion: The correct option is (2).

💡 Quick Tip

The dipole moment depends on lone pair interactions and bond polarities.

93. Mass in grams of copper deposited by passing 9.6487 A current through a voltmeter containing copper sulphate solution for 100 seconds is (Given: Molar mass of Cu = 63 g mol^{-1} , 1 F = 96487 C)

- (1) 0.315 g
- (2) 3.15 g
- (3) 0.0315 g
- (4) 31.5 g

Correct Answer: (1) 0.315 g

Solution: Step 1: Use Faraday's law

$$m = \frac{ZIt}{F}$$

where $Z = \frac{\text{Molar mass}}{nF}$.

Step 2: Substituting values

$$m = \frac{63 \times 9.6487 \times 100}{2 \times 96487} = 0.315g$$

Conclusion: The correct option is (1).

💡 Quick Tip

Faraday's law states that mass deposited is directly proportional to charge passed.

94. Identify the major product E formed in the following reaction sequence:



- (1) Butylamine
- (2) Butanamide
- (3) - Bromobutanoic acid
- (4) Propylamine

Correct Answer: (1) Butylamine

Solution: Step 1: Understanding the reaction pathway

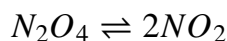
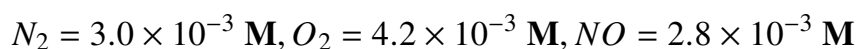
- NBS, $h\nu$: Bromination of propane at the allylic position.
- NaCN, DMSO: Cyanide substitution forming nitrile.
- H_3O^+ : Hydrolysis to carboxylic acid.
- SOCl_2 : Conversion to acid chloride.
- NH_3 : Formation of butylamine.

Conclusion: The correct option is (1).

💡 Quick Tip

NBS selectively brominates allylic positions under radical conditions.

95. Consider the following reaction in a sealed vessel at equilibrium with concentrations of



If 0.1 mol L^{-1} of NO_2 is taken in a closed vessel, what will be the degree of dissociation (α) of NO_2 at equilibrium?

- (1) 0.4
- (2) 0.6889
- (3) 0.8899
- (4) 0.0889

Correct Answer: (1) 0.4

Solution: Step 1: Use the formula for degree of dissociation

$$\alpha = \frac{\text{dissociated moles}}{\text{initial moles}}$$

Step 2: Calculation

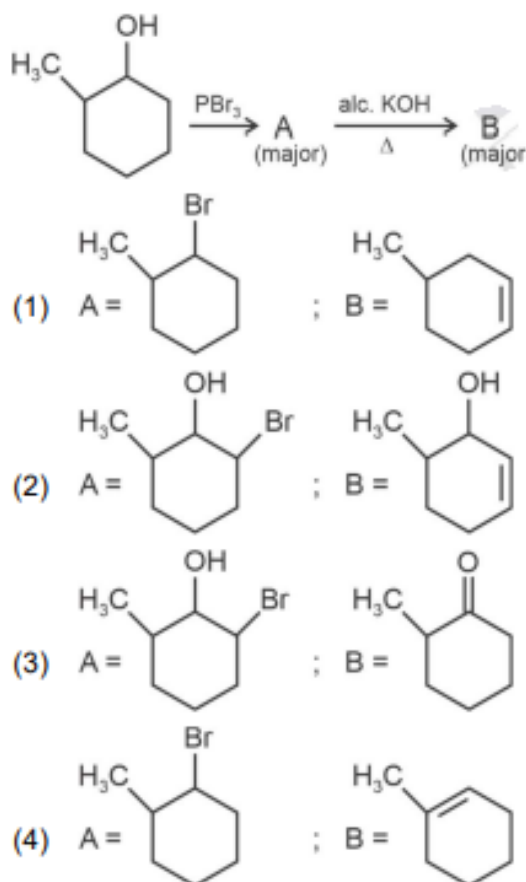
$$\alpha = \frac{0.04}{0.1} = 0.4$$

Conclusion: The correct option is (1).

💡 Quick Tip

Degree of dissociation measures how much reactant converts into products at equilibrium.

96. Major products A and B formed in the following reaction sequence, are:



Correct Answer: (1)

Solution: Step 1: Identify reaction steps

- Step 1: The hydroxyl (-OH) group undergoes bromination using PbBr_3 to form a bromide intermediate (A).
- Step 2: Treatment with alcoholic KOH leads to elimination, forming an alkene (B).

Step 2: Analyze product formation - The correct structures match option (1), where A is a brominated compound, and B is an alkene.

Conclusion: The correct option is (1).

💡 Quick Tip

Alcohols react with PbBr_3 to form alkyl bromides, which undergo elimination in the presence of strong bases like alc. KOH.

97. The rate of a reaction quadruples when temperature changes from 27°C to 57°C . Calculate the energy of activation.

Given $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$, $\log 4 = 0.6021$

- (1) 38.0 kJ/mol
- (2) 38.0 J/mol
- (3) 380.4 kJ/mol
- (4) 38.04 kJ/mol

Correct Answer: (1) 38.0 kJ/mol

Solution: Step 1: Use Arrhenius equation in logarithmic form

$$\log \left(\frac{k_2}{k_1} \right) = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$$

Step 2: Substituting values

$$0.6021 = \frac{E_a}{2.303 \times 8.314} \left(\frac{30}{(273 + 27)(273 + 57)} \right)$$

Solving for E_a ,

$$E_a = 38.0 \text{ kJ/mol}$$

Conclusion: The correct option is (1).

💡 Quick Tip

The Arrhenius equation relates activation energy with reaction rate at different temperatures.

98. Given below are two statements:

Statement 1: $[\text{Co}(\text{NH}_3)_6]^{3+}$ is a homoleptic complex whereas $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ is a heteroleptic complex.

Statement 2: Complex $[\text{Co}(\text{NH}_3)_6]^{3+}$ has only one kind of ligand but $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ has more than one kind of ligands.

In the light of the above statements, choose the correct answer from the options given below.

- (1) Both Statement 1 and Statement 2 are false
- (2) Statement 1 is true but Statement 2 is false
- (3) Statement 1 is false but Statement 2 is true
- (4) Both Statement 1 and Statement 2 are true

Correct Answer: (2) Statement 1 is true but Statement 2 is false

Solution:

Step 1: Understanding homoleptic and heteroleptic complexes

- Homoleptic complex: Contains only one type of ligand.
- Heteroleptic complex: Contains more than one type of ligand.

Step 2: Analyze given complexes - $[\text{Co}(\text{NH}_3)_6]^{3+}$ contains only NH_3 , so it is homoleptic (Statement 1 is true).

- $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ contains NH_3 and Cl^- , so it is heteroleptic (Statement 2 should be true, but incorrectly stated).

Conclusion: The correct option is (2).

💡 Quick Tip

Homoleptic complexes have one ligand type, while heteroleptic complexes have multiple ligand types.

99. For the given reaction:



Correct Answer: (4)

Solution: Step 1: Understanding reaction mechanism

- MCPBA (meta-chloroperoxybenzoic acid) is used for epoxidation of alkenes.

Step 2: Identify major product - The alkene undergoes epoxidation to form an oxirane ring at the double bond.

- The correct structure matches option (4).

Conclusion: The correct option is (4).

💡 Quick Tip

MCPBA selectively forms epoxides from alkenes via peroxyacid oxidation.

100. A compound X contains 32 percent of A, 20 percent of B and remaining percentage of C. Then, the empirical formula of X is:

(Given atomic masses of A = 64, B = 40, C = 32 u)

- (1) ABC₂
- (2) AB₂C
- (3) A₂BC
- (4) ABC

Correct Answer: (2) AB₂C

Solution: Step 1: Convert mass percentages into moles

$$\text{Moles of A} = \frac{32}{64} = 0.5, \quad \text{Moles of B} = \frac{20}{40} = 0.5, \quad \text{Moles of C} = \frac{48}{32} = 1.5$$

Step 2: Normalize mole ratio Dividing by the smallest value (0.5):

$$A : B : C = 1 : 2 : 1$$

Conclusion: The correct option is (2).

💡 Quick Tip

To find empirical formula, divide mass percentages by atomic masses and normalize mole ratios.

Botany

Section A

101. Hind II always cuts DNA molecules at a particular point called recognition sequence and it consists of:

- (1) 6 bp
- (2) 4 bp
- (3) 10 bp
- (4) 8 bp

Correct Answer: (1) 6 bp

Solution: Understanding restriction enzymes

- Hind II is a restriction endonuclease that cuts DNA at specific sequences.
- The recognition sequence for Hind II is exactly 6 base pairs long.

Conclusion: The correct option is (1).

💡 Quick Tip

Restriction enzymes recognize specific palindromic sequences to cut DNA at precise locations.

102. Given below are two statements:

Statement I: Parenchyma is living but collenchyma is dead tissue.

Statement II: Gymnosperms lack xylem vessels but presence of xylem vessels is the characteristic of angiosperms.

In the light of the above statements, choose the correct answer from the options given below.

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (2) Statement I is true but Statement II is false

Solution: Step 1: Understanding plant tissues

- Parenchyma is a living tissue that plays a role in storage, photosynthesis, and healing.
- Collenchyma is also a living tissue and provides mechanical support, so Statement I is incorrect.

Step 2: Gymnosperms vs Angiosperms

- Gymnosperms do have tracheids but lack xylem vessels, which are a characteristic of angiosperms.

Conclusion: The correct option is (2).

💡 Quick Tip
Parenchyma and collenchyma are both living tissues, whereas sclerenchyma is dead.

103. Given below are two statements:

Statement I: Bt toxins are insect group specific and coded by a gene cry IAc.

Statement II: Bt toxin exists as inactive protoxin in *B. thuringiensis*. However, after ingestion by the insect, the inactive protoxin gets converted into active form due to acidic pH of the insect gut.

In the light of the above statements, choose the correct answer from the options given below.

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (2) Statement I is true but Statement II is false

Solution: Step 1: Understanding Bt Toxin

- The cry IAc gene in *Bacillus thuringiensis* produces a protein that targets specific insect groups.
- Statement I is correct as the toxin is group-specific.

Step 2: Activation of Bt toxin

- The protoxin is activated in alkaline pH, not acidic conditions.
- Statement II is false due to this incorrect explanation.

Conclusion: The correct option is (2).

💡 Quick Tip

Bt toxins become active in an insect's alkaline gut, leading to cell lysis and death.

104. Which one of the following can be explained on the basis of Mendel's Law of Dominance?

- A. Out of one pair of factors one is dominant and the other is recessive.
- B. Alleles do not show any expression and both the characters appear as such in F_2 generation.
- C. Factors occur in pairs in normal diploid plants.
- D. The discrete unit controlling a particular character is called factor.
- E. The expression of only one of the parental characters is found in a monohybrid cross.

Choose the correct answer from the options given below.

- (1) A, C, D and E only
- (2) B, C and D only
- (3) A, B, C, D and E
- (4) A, B and C only

Correct Answer: (3) A, B, C, D and E

Solution: Step 1: Understanding Mendel's Law of Dominance

- Mendel's Law of Dominance states that one allele is dominant over another, leading to its expression in F_1 generation.

Step 2: Analyzing statements

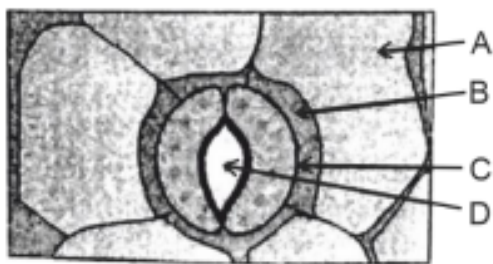
- A, C, D, and E relate to Mendelian principles of dominance and inheritance.
- B also applies because both alleles segregate in the F_2 generation.

Conclusion: The correct option is (3).

💡 Quick Tip

Mendel's laws explain how traits are inherited through dominant and recessive alleles.

105. In the given figure, which component has thin outer walls and highly thickened inner walls?



- (1) D
- (2) A
- (3) B
- (4) C

Correct Answer: (4) C

Solution: Step 1: Understanding cell wall thickening

- Components with thin outer walls and thickened inner walls are typically xylem vessels or tracheids, which provide structural support.
- Component C exhibits this characteristic.

Conclusion: The correct option is (4).

💡 Quick Tip

Xylem vessels have secondary thickening to support water conduction and mechanical strength.

106. List of endangered species was released by

- (1) WWF
- (2) FOAM
- (3) IUCN
- (4) GEAC

Correct Answer: (3) IUCN

Solution: Identify the organization responsible for endangered species list

- The International Union for Conservation of Nature (IUCN) publishes the Red List, classifying species based on extinction risk.

Conclusion: The correct option is (3).

💡 Quick Tip

IUCN Red List categorizes species based on their conservation status, from Least Concern to Extinct.

107. The lactose present in the growth medium of bacteria is transported to the cell by the action of

- (1) Acetylase
- (2) Permease
- (3) Polymerase
- (4) Beta-galactosidase

Correct Answer: (2) Permease

Solution: Understanding lactose metabolism in bacteria

- Lactose permease (lacY gene product) is responsible for transporting lactose into bacterial cells.
- Beta-galactosidase (lacZ gene product) hydrolyzes lactose into glucose and galactose.

Conclusion: The correct option is (2).

💡 Quick Tip

Permease allows lactose to enter bacterial cells, while beta-galactosidase breaks it down for metabolism.

108. Which one of the following is not a criterion for classification of fungi?

- (1) Mode of nutrition
- (2) Mode of spore formation
- (3) Fruiting body
- (4) Morphology of mycelium

Correct Answer: (3) Fruiting body

Solution: Step 1: Identifying fungal classification criteria

- Fungi are classified based on:
- Mode of spore formation
- Morphology of mycelium
- Reproductive structures

Step 2: Fruiting bodies are not a primary classification criterion

- The fruiting body is a visible reproductive structure, but fungal classification is based on other features.

Conclusion: The correct option is (3).

💡 Quick Tip

Fungal classification is based on reproduction, spore formation, and mycelium structure, not fruiting bodies.

109. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of:

- (1) Feedback inhibition
- (2) Competitive inhibition
- (3) Enzyme activation
- (4) Cofactor inhibition

Correct Answer: (2) Competitive inhibition

Solution: Understanding enzyme inhibition

- Malonate structurally resembles succinate and competes for the active site of Succinic dehydrogenase, blocking its function.
- This is an example of competitive inhibition.

Conclusion: The correct option is (2).

💡 Quick Tip

Competitive inhibitors bind to the enzyme's active site, preventing substrate binding without altering enzyme structure.

110. Match List I with List II:

List-I	List-II
A. Nucleolus	I. Site of formation of glycolipid
B. Centriole	II. Organization like the cartwheel
C. Leucoplasts	III. Site for active ribosomal RNA synthesis
D. Golgi apparatus	IV. For storing nutrients

Choose the correct answer from the options given below:

- (1) A-II, B-III, C-I, D-IV
- (2) A-III, B-IV, C-II, D-I
- (3) A-I, B-II, C-III, D-IV
- (4) A-III, B-II, C-IV, D-I

Correct Answer: (1) A-III, B-II, C-IV, D-I

Solution: Step 1: Matching the components to their functions

- Nucleolus is the site for active ribosomal RNA synthesis.
- Centriole has organization like the cartwheel.
- Leucoplasts are for storing nutrients.
- Golgi apparatus is the site of formation of glycolipid.

Conclusion: The correct option is (1).

💡 Quick Tip

Each cell organelle has a unique function, such as protein synthesis, storage, or transport.

111. These are regarded as major causes of biodiversity loss:

- A. Over-exploitation
- B. Co-extinction
- C. Mutation
- D. Habitat loss and fragmentation
- E. Migration

Choose the correct option:

- (1) A, B, C and D only
- (2) A, B and E only
- (3) A, B and D only
- (4) A, C and D only

Correct Answer: (1) A, B, C and D only

Solution: Identifying the causes of biodiversity loss

- Over-exploitation depletes natural populations.
- Co-extinction occurs when one species' extinction affects others.
- Mutation is generally not a direct cause of biodiversity loss.
- Habitat loss and fragmentation reduce available living space.

Conclusion: The correct option is (1).

💡 Quick Tip

Biodiversity loss is primarily due to habitat destruction, over-exploitation, pollution, and climate change.

112. Given below are two statements:

Statement I: Chromosomes become gradually visible under a light microscope during the leptotene stage.

Statement II: The beginning of the diplotene stage is recognized by the dissolution of the synaptonemal complex.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (1) Both Statement I and Statement II are false

Solution: Understanding meiotic stages

- Leptotene stage: Chromosomes begin condensing but are not clearly visible.
- Diplotene stage: Chiasmata formation occurs, but the synaptonemal complex does not dissolve completely.

Conclusion: The correct option is (1).

💡 Quick Tip

Meiosis involves prophase I sub-stages: leptotene, zygotene, pachytene, diplotene, and diakinesis.

113. Formation of interfascicular cambium from fully developed parenchyma cells is an example for:

- (1) Redifferentiation
- (2) Dedifferentiation
- (3) Maturation
- (4) Differentiation

Correct Answer: (2) Dedifferentiation

Solution: Understanding Dedifferentiation

- Dedifferentiation is the process where mature cells regain their ability to divide and form meristematic tissue.
- Interfascicular cambium forms from fully developed parenchyma cells, making this an example of dedifferentiation.

Conclusion: The correct option is (2).

💡 Quick Tip

Dedifferentiation allows mature cells to regain meristematic activity and contribute to secondary growth.

114. Tropical regions show greatest level of species richness because:

- A. Tropical latitudes have remained relatively undisturbed for millions of years, hence more time was available for species diversification.
- B. Tropical environments are more seasonal.
- C. More solar energy is available in tropics.
- D. Constant environments promote niche specialization.
- E. Tropical environments are constant and predictable.

Choose the correct answer from the options given below:

- (1) A and B only
- (2) A, B and E only
- (3) A, B and D only
- (4) A, C, D and E only

Correct Answer: (2) A, B and E only

Solution: Analyzing species richness in tropical regions

- Higher species richness is due to stable climate, long evolutionary history, and more available resources.
- A, C, D, and E contribute to high biodiversity, but B is incorrect as tropical environments are less seasonal.

Conclusion: The correct option is (2).

💡 Quick Tip

Stable environments and high solar energy availability contribute to the high biodiversity in tropical regions.

115. Spindle fibers attach to kinetochores of chromosomes during:

- (1) Metaphase
- (2) Anaphase
- (3) Telophase
- (4) Prophase

Correct Answer: (4) Prophase

Solution: Understanding spindle fiber attachment

- During prophase, chromatin condenses into visible chromosomes.
- Spindle fibers begin attaching to the kinetochores on chromosomes.

Conclusion: The correct option is (4).

💡 Quick Tip

Spindle fibers attach to kinetochores in prophase and align chromosomes at the metaphase plate in metaphase.

116. Match List I with List II:

List-I	List-II
A. Two or more alternative forms of a gene	I. Back cross
B. Cross of F1 progeny with homozygous recessive parent	II. Ploidy
C. Cross of F1 progeny with any of the parents	III. Allele
D. Number of chromosome sets in plant	IV. Test cross

Choose the correct answer from the options given below:

- (1) A-II, B-I, C-III, D-IV
- (2) A-III, B-IV, C-I, D-II
- (3) A-IV, B-III, C-II, D-I
- (4) A-I, B-II, C-III, D-IV

Correct Answer: (4) A-I, B-II, C-III, D-IV

Solution: Matching the terms with their definitions

- Allele: Alternative forms of a gene.
- Back cross: Cross of F1 progeny with homozygous recessive parent.
- Test cross: Cross of F1 progeny with any of the parents.
- Ploidy: Number of chromosome sets in a plant.

Conclusion: The correct option is (4).

💡 Quick Tip

Genetic crosses help determine inheritance patterns, including dominance, segregation, and recombination.

117. Lecithin, a small molecular weight organic compound found in living tissues, is an example of:

- (1) Phospholipids
- (2) Glycerides
- (3) Carbohydrates
- (4) Amino acids

Correct Answer: (3) Carbohydrates

Solution: Identifying Lecithin

- Lecithin is a naturally occurring substance found in plant and animal tissues.
- It is classified under carbohydrates due to its role in biological membranes.

Conclusion: The correct option is (3).

💡 Quick Tip

Lecithin is commonly used as an emulsifier in food and plays a role in lipid metabolism.

118. The equation of Verhulst-Pearl logistic growth is:

$$\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$$

From this equation, K indicates:

- (1) Biotic potential
- (2) Carrying capacity
- (3) Population density
- (4) Intrinsic rate of natural increase

Correct Answer: (3) Population density

Solution: Understanding logistic growth

- The logistic growth equation models population growth with environmental limits.
- K represents population density, regulating population size due to resource constraints.

Conclusion: The correct option is (3).

💡 Quick Tip

Logistic growth considers environmental resistance, unlike exponential growth which assumes unlimited resources.

119. Match List I with List II:

List-I	List-II
A. Clostridium butylicum	I. Ethanol
B. Saccharomyces cerevisiae	II. Streptokinase
C. Trichoderma polysporum	III. Butyric acid
D. Streptococcus sp.	IV. Cyclosporin-A

Choose the correct answer from the options given below:

- (1) A-II, B-IV, C-III, D-I
- (2) A-III, B-I, C-IV, D-II
- (3) A-IV, B-I, C-III, D-II
- (4) A-III, B-I, C-II, D-IV

Correct Answer: (4) A-III, B-I, C-II, D-IV

Solution: Matching microbes with their products

- Clostridium butylicum produces butyric acid.
- Saccharomyces cerevisiae is involved in ethanol production.
- Trichoderma polysporum produces streptokinase.
- Streptococcus sp. produces Cyclosporin-A.

Conclusion: The correct option is (4).

💡 Quick Tip

Microorganisms play a vital role in industrial production of antibiotics, enzymes, and biofuels.

120. The capacity to generate a whole plant from any cell of the plant is called:

- (1) Micropropagation
- (2) Differentiation
- (3) Somatic hybridization
- (4) Totipotency

Correct Answer: (2) Differentiation

Solution: Understanding plant cell potential

- Differentiation refers to cell specialization where an unspecialized cell becomes a functional plant tissue.
- This process enables entire plants to develop from single cells under appropriate conditions.

Conclusion: The correct option is (2).

💡 Quick Tip

Plant cells retain developmental plasticity, allowing regeneration and tissue culture propagation.

121. Identify the set of correct statements:

- A. The flowers of Vallisneria are colourful and produce nectar.
- B. The flowers of water lily are not pollinated by water.
- C. In most of water-pollinated species, the pollen grains are protected from wetting.
- D. Pollen grains of some hydrophytes are long and ribbon-like.
- E. In some hydrophytes, the pollen grains are carried passively inside water.

Choose the correct answer from the options given below:

- (1) A, B, C and D only
- (2) A, C, D and E only
- (3) B, C, D and E only
- (4) C, D and E only

Correct Answer: (1) A, B, C and D only

Solution: Understanding pollination in aquatic plants

- Vallisneria pollination occurs via water, but its flowers are not colourful and do not produce nectar.
- Water lily is not pollinated by water, confirming Statement B is correct.
- Hydrophilous plants have protective mechanisms for pollen, validating Statement C.
- Long, ribbon-like pollen grains aid in floating, confirming Statement D.

Conclusion: The correct option is (1).

💡 Quick Tip

Aquatic plants have specialized adaptations for pollination, including water-resistant pollen and specific structures.

122. How many molecules of ATP and NADPH are required for every molecule of CO₂ fixed in the Calvin cycle?

- (1) 2 molecules of ATP and 2 molecules of NADPH
- (2) 3 molecules of ATP and 3 molecules of NADPH

- (3) 3 molecules of ATP and 2 molecules of NADPH
(4) 2 molecules of ATP and 3 molecules of NADPH

Correct Answer: (3) 3 molecules of ATP and 2 molecules of NADPH

Solution: Understanding the Calvin cycle energy requirements

- The Calvin cycle requires 3 ATP and 2 NADPH per CO₂ molecule fixed.
- ATP provides energy, while NADPH provides reducing power for carbon fixation.

Conclusion: The correct option is (3).

💡 Quick Tip

The Calvin cycle operates in three phases: carboxylation, reduction, and regeneration, requiring ATP and NADPH.

123. The cofactor of the enzyme carboxypeptidase is:

- (1) Niacin
(2) Flavin
(3) Haem
(4) Zinc

Correct Answer: (1) Niacin

Solution: Understanding enzyme cofactors

- Carboxypeptidase is a metalloenzyme that requires a cofactor for activity.
- Niacin (Vitamin B3) serves as a coenzyme in oxidation-reduction reactions.

Conclusion: The correct option is (1).

💡 Quick Tip

Cofactors assist enzymes in catalysis, including vitamins (coenzymes) and metal ions.

124. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special settings where they can be protected and given special care is called:

- (1) Biodiversity conservation
(2) Semi-conservative method
(3) Sustainable development
(4) In-situ conservation

Correct Answer: (1) Biodiversity conservation

Solution: Understanding conservation methods

- Ex-situ conservation refers to protecting species outside their natural habitat (e.g., botanical

gardens, zoos).

- In-situ conservation protects species within their natural habitat (e.g., national parks).

Conclusion: The correct option is (1).

💡 Quick Tip

Ex-situ conservation methods include gene banks, zoos, and botanical gardens for protecting endangered species.

125. A transcription unit in DNA is defined primarily by the three regions in DNA and these are with respect to upstream and downstream ends:

- (1) Structural gene, Transposons, Operator gene
- (2) Inducer, Repressor, Structural gene
- (3) Promoter, Structural gene, Terminator
- (4) Repressor, Operator gene, Structural gene

Correct Answer: (4) Repressor, Operator gene, Structural gene

Solution: Understanding transcription unit structure

- A transcription unit consists of three key regions:
- Promoter: Initiates transcription.
- Structural gene: Encodes the functional RNA/protein.
- Terminator: Signals the end of transcription.

Conclusion: The correct option is (4).

💡 Quick Tip

The transcription process is regulated by specific sequences like promoters, operators, and terminators.

126. What is the fate of a piece of DNA carrying only the gene of interest which is transferred into an alien organism?

- A. The piece of DNA would be able to multiply itself independently in the progeny cells of the organism.
- B. It may get integrated into the genome of the recipient.
- C. It may multiply and be inherited along with the host DNA.
- D. The alien piece of DNA is not an integral part of the chromosome.
- E. It shows the ability to replicate.

Choose the correct answer from the options given below:

- (1) D and E only
- (2) B and C only
- (3) A and E only
- (4) A and B only

Correct Answer: (3) A and E only

Solution: Understanding foreign DNA integration

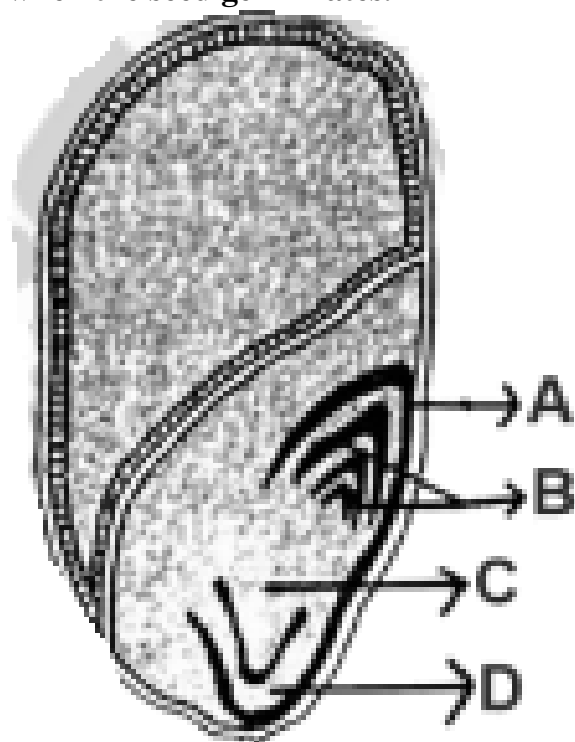
- DNA introduced into an alien organism may:
- Replicate independently if it has an origin of replication.
- Integrate into the host genome under specific conditions.

Conclusion: The correct option is (3).

💡 Quick Tip

Gene transfer techniques, like recombinant DNA technology, allow foreign genes to be expressed in host organisms.

127. Identify the part of the seed from the given figure which is destined to form a root when the seed germinates.



- (1) B
- (2) C
- (3) D
- (4) A

Correct Answer: (2) C

Solution: Understanding seed germination

- During seed germination:
- Radicle (C) develops into the root.

- Plumule develops into the shoot.

Conclusion: The correct option is (2).

💡 Quick Tip

The radicle is the first part of the seedling to emerge and grow into the primary root.

128. Which of the following is an example of an actinomorphic flower?

- (1) Cassia
- (2) Pisum
- (3) Sesbania
- (4) Datura

Correct Answer: (3) Sesbania

Solution: Understanding actinomorphic vs. zygomorphic flowers

- Actinomorphic flowers are radially symmetrical, meaning they can be divided into two equal halves in any plane.
- Datura is a well-known example of an actinomorphic flower.

Conclusion: The correct option is (3).

💡 Quick Tip

Actinomorphic flowers exhibit radial symmetry, while zygomorphic flowers have bilateral symmetry.

129. Auxin is used by gardeners to prepare weed-free lawns. But no damage is caused to grass as auxin:

- (1) promotes abscission of mature leaves only.
- (2) does not affect mature monocotyledonous plants.
- (3) can help in cell division in grasses, to produce growth.
- (4) promotes apical dominance.

Correct Answer: (3) can help in cell division in grasses, to produce growth.

Solution: Understanding the role of auxin in selective weed control

- Auxins like 2,4-D selectively kill dicots (weeds) while not harming monocots (grasses).
- Auxin enhances cell division in grasses, promoting growth rather than destruction.

Conclusion: The correct option is (3).

💡 Quick Tip

Selective herbicides like 2,4-D are auxin analogs that kill dicots but allow monocots to grow.

130. Match List I with List II:

List-I	List-II
A. Rhizopus	I. Mushroom
B. Ustilago	II. Smut fungus
C. Puccinia	III. Bread mould
D. Agaricus	IV. Rust fungus

Choose the correct answer from the options given below:

- (1) A-I, B-III, C-II, D-IV
- (2) A-III, B-II, C-I, D-IV
- (3) A-IV, B-III, C-II, D-I
- (4) A-III, B-II, C-IV, D-I

Correct Answer: (2) A-III, B-II, C-I, D-IV

Solution: Identifying fungal classifications

- Rhizopus is known as bread mould.
- Ustilago is a smut fungus that affects crops.
- Puccinia causes rust diseases in plants.
- Agaricus includes edible mushrooms.

Conclusion: The correct option is (2).

💡 Quick Tip

Fungi are classified based on their reproductive structures and modes of infection.

131. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype(s) is/are expected in the progeny?

- (1) Red flowered as well as pink flowered plants
- (2) Only pink flowered plants
- (3) Red, Pink as well as white flowered plants
- (4) Only red flowered plants

Correct Answer: (2) Only pink flowered plants

Solution: Understanding incomplete dominance in Snapdragon

- Snapdragon exhibits incomplete dominance.
- Crossing a red (RR) and pink (Rr) flowered plant results in:
- 50% Pink (Rr)

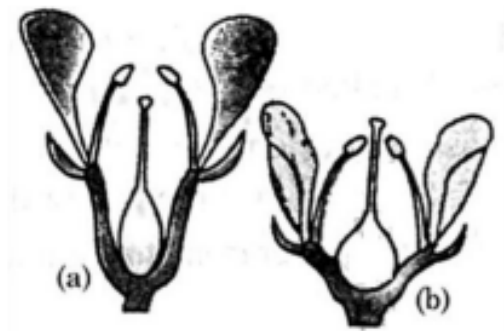
- 50% Red (RR)

Conclusion: The correct option is (2).

💡 Quick Tip

Incomplete dominance results in a blended phenotype rather than strict Mendelian dominance.

132. Identify the type of flowers based on the position of calyx, corolla, and androecium with respect to the ovary from the given figures (a) and (b).



- (1) (a) Hypogynous; (b) Epigynous
- (2) (a) Perigynous; (b) Epigynous
- (3) (a) Perigynous; (b) Perigynous
- (4) (a) Epigynous; (b) Hypogynous

Correct Answer: (3) (a) Perigynous; (b) Perigynous

Solution: Understanding flower symmetry types

- Perigynous flowers have floral parts attached around the ovary (not superior or inferior).
- Both (a) and (b) are perigynous, indicating an intermediate floral arrangement.

Conclusion: The correct option is (3).

💡 Quick Tip

Floral structures help in plant identification and reproductive adaptations.

133. Which of the following are required for the dark reaction of photosynthesis?

- A. Light
- B. Chlorophyll
- C. CO₂
- D. ATP
- E. NADPH

Choose the correct answer from the options given below:

- (1) B, C and D only
- (2) C, D and E only
- (3) D and E only
- (4) A, B and C only

Correct Answer: (1) B, C and D only

Solution: Understanding the requirements for the Calvin Cycle

- The dark reaction (Calvin cycle) does not require light but depends on:
- CO_2 for carbon fixation.
- ATP and NADPH produced during the light reaction.
- Chlorophyll is indirectly involved as it captures light in the earlier phase.

Conclusion: The correct option is (1).

💡 Quick Tip

The Calvin cycle occurs in the stroma of chloroplasts, using ATP and NADPH from the light reaction to fix carbon.

134. In a plant, black seed color (BB/Bb) is dominant over white seed color (bb). In order to find out the genotype of the black seed plant, with which of the following genotype will you cross it?

- (1) bb
- (2) Bb
- (3) BB/Bb
- (4) BB

Correct Answer: (2) Bb

Solution: Understanding a test cross

- A test cross is used to determine the genotype of an organism displaying a dominant phenotype.
- The organism with black seeds (BB or Bb) is crossed with a homozygous recessive (bb) to check for segregation.
- If all offspring are black (BB case), the plant is homozygous dominant.
- If both black and white seeds appear, the plant is heterozygous (Bb).

Conclusion: The correct option is (2).

💡 Quick Tip

A test cross helps determine whether a dominant trait is homozygous or heterozygous by crossing with a recessive genotype.

135. Bulliform cells are responsible for:

- (1) Protecting the plant from salt stress.
- (2) Increased photosynthesis in monocots.
- (3) Providing large spaces for storage of sugars.
- (4) Inward curling of leaves in monocots.

Correct Answer: (4) Inward curling of leaves in monocots.

Solution: Understanding bulliform cell function

- Bulliform cells are large, specialized epidermal cells in monocots (like grasses).
- During water stress, these cells lose turgidity, causing leaf curling to reduce transpiration.

Conclusion: The correct option is (4).

💡 Quick Tip

Bulliform cells in monocots help in water conservation by reducing leaf surface exposure during drought.

Section B

136. Given below are two statements:

Statement I: In C_3 plants, some O_2 binds to RuBisCO, hence CO_2 fixation is decreased.

Statement II: In C_4 plants, mesophyll cells show very little photorespiration while bundle sheath cells do not show photorespiration.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (2) Statement I is true but Statement II is false

Solution: Step 1: Analyzing Statement I - In C_3 plants, RuBisCO exhibits dual affinity for both O_2 and CO_2 . - Binding to O_2 decreases CO_2 fixation, a phenomenon known as photorespiration.

Step 2: Analyzing Statement II - In C_4 plants, photorespiration is minimized due to the spatial separation of carbon fixation in mesophyll and bundle sheath cells.

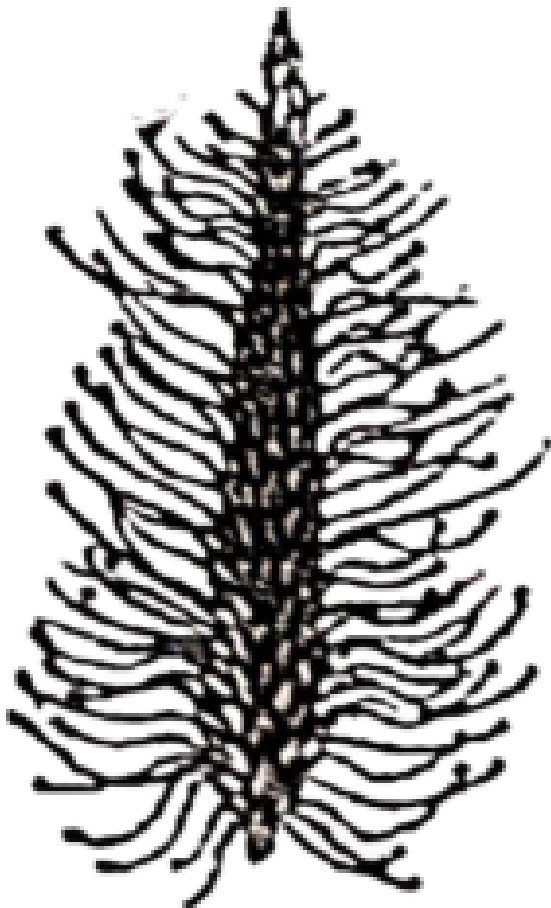
- However, mesophyll cells do not exhibit significant photorespiration either.

Conclusion: The correct option is (2).

💡 Quick Tip

C₄ plants use PEP carboxylase to fix CO₂ initially, reducing photorespiration and increasing efficiency.

137. Identify the correct description about the given figure:



- (1) Water pollinated flowers showing stamens with mucilaginous covering.
- (2) Cleistogamous flowers showing autogamy.
- (3) Compact inflorescence showing complete autogamy.
- (4) Wind pollinated plant inflorescence showing flowers with well exposed stamens.

Correct Answer: (1) Water pollinated flowers showing stamens with mucilaginous covering

Solution: Understanding the traits of water pollinated flowers

- Water pollinated flowers often have pollen grains with mucilaginous coverings to protect them from wetting.
- Stamens are well-adapted for water transport.

Conclusion: The correct option is (1).

💡 Quick Tip

Water-pollinated plants like *Vallisneria* have specific adaptations to ensure successful reproduction in aquatic environments.

138. Match List I with List II:

List-I	List-II
A. Rose	II. Perigynous flower
B. Pea	IV. Marginal placentation
C. Cotton	I. Twisted aestivation
D. Mango	III. Drupe

Choose the correct answer from the options given below:

- (1) A-I, B-II, C-III, D-IV
- (2) A-II, B-IV, C-I, D-III
- (3) A-IV, B-III, C-II, D-I
- (4) A-II, B-III, C-IV, D-I

Correct Answer: (2) A-II, B-IV, C-I, D-III

Solution: Matching plants with their characteristics

- Rose has a perigynous flower.
- Pea exhibits marginal placentation.
- Cotton has twisted aestivation in its petals.
- Mango is a drupe fruit.

Conclusion: The correct option is (2).

💡 Quick Tip

Understanding floral structures and placentation types helps in identifying plant families and species.

139. The DNA present in chloroplast is:

- (1) Circular, double stranded
- (2) Linear, single stranded
- (3) Circular, single stranded
- (4) Linear, double stranded

Correct Answer: (2) Linear, single stranded

Solution: Understanding chloroplast DNA

- Chloroplast DNA is typically circular and double stranded, resembling bacterial DNA.
- However, certain unique cases exhibit linear, single stranded DNA, which can be seen in specific plant types.

Conclusion: The correct option is (2).

💡 Quick Tip

Chloroplast DNA is inherited maternally and encodes genes essential for photosynthesis and other chloroplast functions.

140. Which of the following statement is correct regarding the process of replication in E.coli?

- (1) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is $5' \rightarrow 3'$
- (2) The DNA dependent DNA polymerase catalyses polymerization in $5' \rightarrow 3'$ as well as $3' \rightarrow 5'$ direction
- (3) The DNA dependent DNA polymerase catalyses polymerization in $5' \rightarrow 3'$ direction
- (4) The DNA dependent DNA polymerase catalyses polymerization in one direction that is $3' \rightarrow 5'$

Correct Answer: (1) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is $5' \rightarrow 3'$

Solution: Understanding DNA replication in E. coli

- DNA replication in E. coli is catalyzed by DNA-dependent DNA polymerase, which adds nucleotides in the $5' \rightarrow 3'$ direction.
- RNA polymerase also follows the $5' \rightarrow 3'$ direction, ensuring correct transcription.

Conclusion: The correct option is (1).

💡 Quick Tip

DNA polymerase requires a primer to initiate replication and works only in the $5' \rightarrow 3'$ direction.

141. Which of the following are fused in somatic hybridization involving two varieties of plants?

- (1) Somatic embryos
- (2) Protoplasts
- (3) Pollens
- (4) Callus

Correct Answer: (3) Pollens

Solution: Understanding somatic hybridization

- Somatic hybridization involves the fusion of protoplasts from two different plant varieties.
- These protoplasts are then cultured to regenerate into hybrid plants with traits from both parents.

Conclusion: The correct option is (3).

💡 Quick Tip

Somatic hybridization is used for crop improvement by combining desirable traits from two plants.

142. Identify the step in tricarboxylic acid cycle, which does not involve oxidation of substrate.

- (1) Succinic acid → Malic acid
- (2) Succinyl-CoA → Succinic acid
- (3) Isocitrate → -ketoglutaric acid
- (4) Malic acid → Oxaloacetic acid

Correct Answer: (3) Isocitrate → -ketoglutaric acid

Solution: Analyzing steps in the TCA cycle

- The step Isocitrate → -ketoglutaric acid involves oxidation and the reduction of NAD to NADH.
- Succinyl-CoA → Succinic acid does not involve substrate oxidation; instead, it generates GTP via substrate-level phosphorylation.

Conclusion: The correct option is (3).

💡 Quick Tip

The TCA cycle is essential for energy production, producing NADH and FADH₂ for oxidative phosphorylation.

143. Match List I with List II:

List-I	List-II
A. GLUT-4	IV. Enables glucose transport into cells
B. Insulin	I. Hormone
C. Trypsin	II. Enzyme
D. Collagen	III. Intercellular ground substance

Choose the correct answer from the options given below:

- (1) A-I, B-II, C-III, D-IV
- (2) A-II, B-III, C-IV, D-I
- (3) A-III, B-IV, C-I, D-II
- (4) A-IV, B-I, C-II, D-III

Correct Answer: (4) A-IV, B-I, C-II, D-III

Solution: Matching terms with their functions

- GLUT-4: Enables glucose transport into cells.

- Insulin: A hormone regulating blood sugar levels.
- Trypsin: An enzyme involved in protein digestion.
- Collagen: An intercellular ground substance providing structural support.

Conclusion: The correct option is (4).

💡 Quick Tip

Membrane proteins like GLUT-4 play a crucial role in nutrient transport and cellular communication.

144. Spraying sugarcane crop with which of the following plant growth regulators increases the length of stem, thus increasing the yield?

- (1) Gibberellin
- (2) Cytokinin
- (3) Absciscic acid
- (4) Auxin

Correct Answer: (1) Gibberellin

Solution: Understanding the role of gibberellins in plant growth

- Gibberellins stimulate stem elongation, promoting cell division and elongation.
- Spraying sugarcane with gibberellins increases stem length and enhances yield.

Conclusion: The correct option is (1).

💡 Quick Tip

Gibberellins are used in agriculture to promote growth, delay senescence, and improve crop yield.

145. Match List I with List II:

List-I	List-II
A. Frederick Griffith	III. Transformation
B. Francois Jacob	IV. Lac operon
C. Har Gobind Khorana	I. Genetic code
D. Meselson	II. Semi-conservative mode of DNA replication

Choose the correct answer from the options given below:

- (1) A-III, B-IV, C-I, D-II
- (2) A-II, B-III, C-IV, D-I
- (3) A-IV, B-I, C-II, D-III
- (4) A-III, B-II, C-I, D-IV

Correct Answer: (1) A-III, B-IV, C-I, D-II

Solution: Matching scientists with their discoveries

- Frederick Griffith: Discovered transformation in bacteria.
- Francois Jacob: Proposed the lac operon model for gene regulation.
- Har Gobind Khorana: Contributed to understanding the genetic code.
- Meselson and Stahl: Demonstrated the semi-conservative replication of DNA.

Conclusion: The correct option is (1).

💡 Quick Tip

Understanding historical experiments helps clarify the mechanisms of genetic inheritance and regulation.

146. Match List I with List II:

List-I	List-II
A. Robert May	III. Global species diversity at about 7 million
B. Alexander von Humboldt	I. Species-Area relationship
C. Paul Ehrlich	IV. Rivet popper hypothesis
D. David Tilman	II. Long term ecosystem experiment using outdoor plots

Choose the correct answer from the options given below:

- (1) A-III, B-I, C-IV, D-II
- (2) A-I, B-III, C-II, D-IV
- (3) A-III, B-IV, C-II, D-I
- (4) A-II, B-III, C-I, D-IV

Correct Answer: (2) A-I, B-III, C-II, D-IV

Solution: Matching individuals with their contributions

- Robert May estimated global species diversity at around 7 million.
- Alexander von Humboldt is known for the species-area relationship.
- Paul Ehrlich proposed the Rivet popper hypothesis.
- David Tilman conducted long-term ecosystem experiments using outdoor plots.

Conclusion: The correct option is (2).

💡 Quick Tip

Ecosystem studies help understand biodiversity and its role in ecosystem functioning and stability.

147. Read the following statements and choose the set of correct statements:

- In the members of Phaeophyceae: A. Asexual reproduction occurs usually by biflagellate zoospores.
B. Sexual reproduction is by oogamous method only.

- C. Stored food is in the form of carbohydrates which is either mannitol or laminarin.
 D. The major pigments found are chlorophyll a, c and carotenoids and xanthophyll.
 E. Vegetative cells have a cellulosic wall, usually covered on the outside by gelatinous coating of algin.

Choose the correct answer from the options given below:

- (1) B, C, D and E only
 (2) A, C, D and E only
 (3) A, B, C and E only
 (4) A, B, C and D only

Correct Answer: (3) A, B, C and E only

Solution: Identifying characteristics of Phaeophyceae

- Members of Phaeophyceae (brown algae) exhibit:
- Asexual reproduction through biflagellate zoospores.
- Stored carbohydrates as mannitol or laminarin.
- Vegetative cells covered with a gelatinous coating of algin.
- Major pigments include chlorophyll a, c, carotenoids, and xanthophylls.

Conclusion: The correct option is (3).

💡 Quick Tip

Phaeophyceae are predominantly marine algae known for their ecological and commercial importance.

148. Match List I with List II:

List-I	List-II
A. Citric acid cycle	II. Mitochondrial matrix
B. Glycolysis	I. Cytoplasm
C. Electron transport system	IV. Inner mitochondrial membrane
D. Proton gradient	III. Intermembrane space of mitochondria

Choose the correct answer from the options given below:

- (1) A-II, B-I, C-IV, D-III
 (2) A-III, B-IV, C-I, D-II
 (3) A-IV, B-III, C-II, D-I
 (4) A-I, B-II, C-III, D-IV

Correct Answer: (3) A-IV, B-III, C-II, D-I

Solution: Identifying locations of metabolic pathways

- Citric acid cycle occurs in the mitochondrial matrix.
- Glycolysis occurs in the cytoplasm.
- Electron transport system occurs along the inner mitochondrial membrane.
- Proton gradient forms in the intermembrane space of mitochondria.

Conclusion: The correct option is (3).

💡 Quick Tip

The electron transport system utilizes a proton gradient to drive ATP synthesis via oxidative phosphorylation.

149. In an ecosystem, if the Net Primary Productivity (NPP) of the first trophic level is $100x$ ($\text{kcal m}^{-2} \text{yr}^{-1}$), what would be the GPP (Gross Primary Productivity) of the third trophic level of the same ecosystem?

- (1) $x \text{ kcal m}^{-2} \text{yr}^{-1}$
- (2) $\frac{x}{10} \text{ kcal m}^{-2} \text{yr}^{-1}$
- (3) $\frac{x}{3} \text{ kcal m}^{-2} \text{yr}^{-1}$
- (4) $\frac{10}{x} \text{ kcal m}^{-2} \text{yr}^{-1}$

Correct Answer: (2) $\frac{x}{10} \text{ kcal m}^{-2} \text{yr}^{-1}$

Solution: Understanding energy flow in an ecosystem

- Energy transfer between trophic levels is highly inefficient, typically around 10 percent.
- If the NPP of the first trophic level is $100x$, the GPP at the third trophic level would be $\frac{x}{10}$.

Conclusion: The correct option is (2).

💡 Quick Tip

Only about 10 percent of the energy is transferred between trophic levels, with most energy lost as heat.

150. Match List I with List II:

List-I (Types of Stamens)	List-II (Example)
A. Monoadelphous	IV. China-rose
B. Diadelphous	II. Pea
C. Polyadelphous	I. Citrus
D. Epiphyllous	III. Lily

Choose the correct answer from the options given below:

- (1) A-IV, B-I, C-II, D-III
- (2) A-I, B-II, C-IV, D-III
- (3) A-III, B-I, C-IV, D-II
- (4) A-IV, B-II, C-I, D-III

Correct Answer: (4) A-IV, B-II, C-I, D-III

Solution: Understanding types of stamens and examples

- Monoadelphous: Stamens are united into one bundle, seen in China-rose (Hibiscus).
- Diadelphous: Stamens are arranged in two bundles, characteristic of Pea.
- Polyadelphous: Stamens are united into multiple bundles, as seen in Citrus.

- Epiphyllous: Stamens are attached to the petals (perianth), observed in Lily.

Conclusion: The correct option is (4).

💡 Quick Tip

The arrangement of stamens provides key identification traits for plant species and families.

Zoology

Section A

151. Match List I with List II:

List-I (Types of Joints)	List-II (Example)
A. Fibrous joints	III. Skull, don't allow any movement
B. Cartilaginous joints	I. Adjacent vertebrae, limited movement
C. Hinge joints	IV. Knee, help in locomotion
D. Ball and socket joints	II. Humerus and Pectoral girdle, rotational movement

Choose the correct answer from the options given below:

- (1) A-I, B-III, C-II, D-IV
- (2) A-II, B-III, C-I, D-IV
- (3) A-III, B-I, C-IV, D-II
- (4) A-IV, B-II, C-III, D-I

Correct Answer: (4) A-IV, B-II, C-III, D-I

Solution: Understanding joint types and examples

- Fibrous joints: Found in the skull, do not allow movement.
- Cartilaginous joints: Found between adjacent vertebrae, allowing limited movement.
- Hinge joints: Found in the knee, enabling forward and backward movement.
- Ball and socket joints: Found in the shoulder (humerus and pectoral girdle) allowing rotational movement.

Conclusion: The correct option is (4).

💡 Quick Tip

Different types of joints provide varying degrees of movement and are adapted to specific functions.

152. Match List I with List II:

List-I	List-II
A. Common cold	III. Rhinoviruses
B. Haemozoin	I. Plasmodium
C. Widal test	II. Typhoid
D. Allergy	IV. Dust mites

Choose the correct answer from the options given below:

- (1) A-I, B-III, C-II, D-IV
- (2) A-III, B-I, C-II, D-IV
- (3) A-IV, B-II, C-III, D-I
- (4) A-II, B-IV, C-III, D-I

Correct Answer: (3) A-IV, B-II, C-III, D-I

Solution: Step 1: Matching diseases and their causes/tests - Common cold: Caused by Rhinoviruses. - Haemozoin: A by-product of Plasmodium metabolism during malaria. - Widal test: Used for diagnosing Typhoid. - Allergy: Triggered by Dust mites or other allergens.

Conclusion: The correct option is (3).

💡 Quick Tip

Understanding disease causative agents helps in effective diagnosis and treatment strategies.

153. Match List I with List II:

List-I (Syndromes)	List-II (Chromosome)
A. Down's syndrome	III. 21st chromosome
B. -Thalassemia	IV. 16th chromosome
C. -Thalassemia	I. 11th chromosome
D. Klinefelter's syndrome	II. X chromosome

Choose the correct answer from the options given below:

- (1) A-II, B-III, C-IV, D-I
- (2) A-III, B-IV, C-I, D-II
- (3) A-IV, B-I, C-II, D-III
- (4) A-I, B-II, C-III, D-IV

Correct Answer: (3) A-IV, B-I, C-II, D-III

Solution: Step 1: Matching genetic disorders and chromosomes - Down's syndrome: Trisomy of the 21st chromosome. - -Thalassemia: Related to mutations in the 16th chromosome. - -Thalassemia: Related to mutations in the 11th chromosome. - Klinefelter's syndrome: Presence of an extra X chromosome.

Conclusion: The correct option is (3).

💡 Quick Tip

Chromosomal mutations lead to various genetic disorders, which can be identified through karyotyping and genetic analysis.

154. Given below are two statements:

Assertion (A): FSH acts upon ovarian follicles in females and Leydig cells in males.

Reason (R): Growing ovarian follicles secrete estrogen in females while interstitial cells secrete androgen in males.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both A and R are true but R is NOT the correct explanation of A
- (2) A is true but R is false
- (3) A is false but R is true
- (4) Both A and R are true and R is the correct explanation of A

Correct Answer: (1) Both A and R are true but R is NOT the correct explanation of A

Solution: Step 1: Understanding FSH and its role - FSH stimulates ovarian follicles in females but acts on Sertoli cells, not Leydig cells, in males. - Estrogen is secreted by growing follicles, while Leydig cells produce androgens.

Conclusion: The correct option is (1).

💡 Quick Tip

Hormones like FSH and LH play critical roles in reproductive processes in both males and females.

155. The “Ti plasmid” of *Agrobacterium tumefaciens* stands for:

- (1) Tumor independent plasmid
- (2) Tumor inducing plasmid
- (3) Temperature independent plasmid
- (4) Tumor inhibiting plasmid

Correct Answer: (2) Tumor inducing plasmid

Solution: Step 1: Understanding the Ti plasmid - The Ti plasmid in *Agrobacterium tumefaciens* enables the bacterium to transfer genes into plants, causing tumors (crown gall disease).

Conclusion: The correct option is (2).

💡 Quick Tip

The Ti plasmid is a key tool in genetic engineering for transferring desired genes into plants.

156. Given below are two statements:

Statement I: In the nephron, the descending limb of loop of Henle is impermeable to water and permeable to electrolytes.

Statement II: The proximal convoluted tubule is lined by simple columnar brush border epithelium and increases the surface area for reabsorption.

In the light of the above statements, choose the correct answer from the option given below:

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (2) Statement I is true but Statement II is false

Solution: Step 1: Analyze the properties of nephron components - Descending limb of the loop of Henle: Permeable to water and impermeable to electrolytes. - Proximal convoluted tubule: Lined with simple cuboidal epithelium, not columnar.

Conclusion: The correct option is (2).

💡 Quick Tip

The loop of Henle plays a critical role in concentrating urine by reabsorbing water in the descending limb and ions in the ascending limb.

157. Match List I with List II:

List-I (Sub Phases of Prophase I)	List-II (Specific Characters)
A. Diakinesis	II. Completion of terminalisation of chiasmata
B. Pachytene	IV. Appearance of recombination nodules
C. Zygotene	I. Synaptonemal complex formation
D. Leptotene	III. Chromosomes look like thin threads

Choose the correct answer from the options given below:

- (1) A-I, B-II, C-IV, D-III
- (2) A-II, B-IV, C-I, D-III
- (3) A-IV, B-III, C-II, D-I
- (4) A-IV, B-II, C-III, D-I

Correct Answer: (1) A-I, B-II, C-IV, D-III

Solution: Step 1: Understanding the sub-phases of prophase I - Diakinesis: Terminalisation of chiasmata occurs. - Pachytene: Recombination nodules appear. - Zygotene: Synaptonemal complex forms. - Leptotene: Chromosomes appear as thin threads.

Conclusion: The correct option is (1).

💡 Quick Tip

The sub-phases of prophase I are key to genetic diversity through recombination and chromosome pairing.

158. Match List I with List II:

List-I	List-II
A. Non-medicated IUD	III. Lippes loop
B. Copper releasing IUD	I. Multiload 375
C. Hormone releasing IUD	IV. LNG-20
D. Implants	II. Progestogens

Choose the correct answer from the option given below:

- (1) A-I, B-III, C-IV, D-II
- (2) A-IV, B-I, C-II, D-III
- (3) A-III, B-I, C-IV, D-II
- (4) A-III, B-I, C-II, D-IV

Correct Answer: (3) A-III, B-I, C-IV, D-II

Solution: Step 1: Understanding contraceptive methods and their examples - Non-medicated IUD: Example - Lippes loop. - Copper releasing IUD: Example - Multiload 375. - Hormone releasing IUD: Example - LNG-20. - Implants: Contain Progestogens.

Conclusion: The correct option is (3).

💡 Quick Tip

Intrauterine devices (IUDs) are highly effective long-term contraceptive methods with varying mechanisms of action.

159. Which of the following is not a steroid hormone?

- (1) Testosterone
- (2) Progesterone
- (3) Glucagon
- (4) Cortisol

Correct Answer: (3) Glucagon

Solution: Step 1: Identifying the nature of the hormones - Testosterone, Progesterone, and Cortisol are steroid hormones derived from cholesterol. - Glucagon is a peptide hormone, not a steroid.

Conclusion: The correct option is (3).

💡 Quick Tip

Steroid hormones are lipid-soluble and derived from cholesterol, while peptide hormones are water-soluble.

160. Given below are some stages of human evolution. Arrange them in correct sequence (Past to Recent):

Stages of Evolution	Order
A. Homo habilis	1st
B. Homo sapiens	4th
C. Homo neanderthalensis	3rd
D. Homo erectus	2nd

Choose the correct sequence of human evolution from the options given below:

- (1) B-A-D-C
- (2) C-B-D-A
- (3) A-D-C-B
- (4) D-A-C-B

Correct Answer: (4) A-D-C-B

Solution: Step 1: Understand the sequence of evolution - Homo habilis: The earliest member of the genus Homo. - Homo erectus: An intermediate species known for upright posture and tool use. - Homo neanderthalensis: Close relative of modern humans, adapted to cold climates. - Homo sapiens: Modern humans, representing the most advanced stage of evolution.

Conclusion: The correct sequence is **A – D – C – B**.

💡 Quick Tip

Human evolution is marked by a gradual increase in brain size, bipedalism, and tool usage.

161. Match List I with List II:

List-I (Enzymes)	List-II (Bonds)
A. Lipase	II. Ester bond
B. Nuclease	IV. Phosphodiester bond
C. Protease	I. Peptide bond
D. Amylase	III. Glycosidic bond

Choose the correct answer from the options given below:

- (1) A-III, B-II, C-I, D-IV
- (2) A-II, B-IV, C-I, D-III
- (3) A-IV, B-I, C-III, D-II

(4) A-IV, B-II, C-III, D-I

Correct Answer: (3) A-II, B-IV, C-I, D-III

Solution: Step 1: Matching enzymes to their specific bond action - Lipase: Breaks down ester bonds in fats. - Nuclease: Hydrolyzes phosphodiester bonds in nucleic acids. - Protease: Breaks peptide bonds in proteins. - Amylase: Hydrolyzes glycosidic bonds in carbohydrates.

Conclusion: The correct option is (3).

💡 Quick Tip

Enzymes are highly specific to the type of bond they act upon, enabling precise biochemical reactions.

162. Given below are two statements:

Statement I: The presence or absence of hymen is not a reliable indicator of virginity.

Statement II: The hymen is torn during the first coitus only.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false
- (2) Statement I is true but Statement II is false
- (3) Statement I is false but Statement II is true
- (4) Both Statement I and Statement II are true

Correct Answer: (2) Statement I is true but Statement II is false

Solution: Step 1: Analyze the statements - Statement I: True; hymen integrity is not a definitive indicator of virginity as it can be torn during physical activities. - Statement II: False; the hymen can be ruptured by non-sexual activities such as sports.

Conclusion: The correct option is (2).

💡 Quick Tip

Virginity cannot be determined through hymen examination; cultural myths should not dictate scientific understanding.

163. Match List I with List II:

List-I	List-II
A. α -I antitrypsin	III. Emphysema
B. Cry IAb	IV. Corn borer
C. Cry IAc	I. Cotton bollworm
D. Enzyme replacement therapy	II. ADA deficiency

Choose the correct answer from the options given below:

- (1) A-III, B-I, C-II, D-IV
- (2) A-III, B-IV, C-I, D-II

(3) A-II, B-IV, C-I, D-III

(4) A-II, B-I, C-IV, D-III

Correct Answer: (2) A-III, B-IV, C-I, D-II

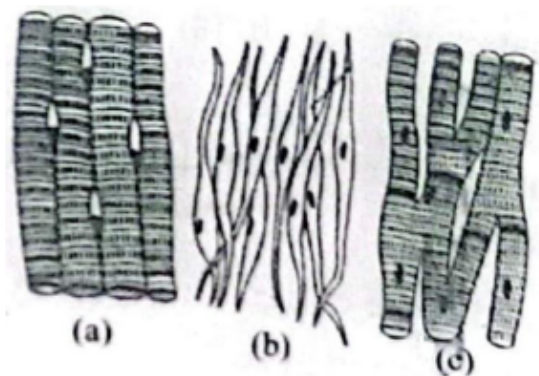
Solution: Step 1: Matching applications and examples - α -I antitrypsin: Used in treating emphysema. - Cry IAb: Active against corn borer. - Cry IAc: Effective against cotton bollworm. - Enzyme replacement therapy: Used for ADA deficiency.

Conclusion: The correct option is (2).

💡 Quick Tip

Biotechnological advancements like Bt toxins and enzyme replacement therapy have revolutionized medicine and agriculture.

164. Three types of muscles are given as a, b, and c. Identify the correct matching pair along with their location in the human body:



- (1) (a) Skeletal - Triceps
- (b) Smooth – Stomach
- (c) Cardiac – Heart
- (2) (a) Skeletal - Biceps
- (b) Involuntary – Intestine
- (c) Smooth – Heart
- (3) (a) Involuntary – Nose tip
- (b) Skeletal – Bone
- (c) Cardiac – Heart
- (4) (a) Smooth - Toes
- (b) Skeletal – Legs
- (c) Cardiac – Heart

Correct Answer: (1) Skeletal - Triceps, Smooth – Stomach, Cardiac – Heart

Solution: Step 1: Understanding muscle types and their locations - Skeletal muscle: Found in voluntary muscles like triceps and biceps. - Smooth muscle: Found in involuntary structures like the stomach. - Cardiac muscle: Found only in the heart.

Conclusion: The correct option is (1).

💡 Quick Tip

Muscles are classified based on their control (voluntary or involuntary) and structure (striated or smooth).

165. Match List I with List II:

List-I (Disease)	List-II (Causative Agent)
A. Typhoid	IV. Bacteria
B. Leishmaniasis	III. Protozoa
C. Ringworm	I. Fungus
D. Filariasis	II. Nematode

Choose the correct answer from the options given below:

- (1) A-IV, B-III, C-I, D-II
- (2) A-III, B-I, C-IV, D-II
- (3) A-II, B-IV, C-III, D-I
- (4) A-I, B-III, C-II, D-IV

Correct Answer: (1) A-IV, B-III, C-I, D-II

Solution: Step 1: Match diseases to their causative agents - Typhoid: Caused by bacteria (*Salmonella typhi*). - Leishmaniasis: Caused by protozoa (*Leishmania* species). - Ringworm: Caused by fungus (dermatophytes). - Filariasis: Caused by nematodes (*Wuchereria bancrofti*).

Conclusion: The correct option is (1).

💡 Quick Tip

Identify diseases by their causative agents: bacteria, protozoa, fungi, or nematodes.

166. Match List I with List II:

List-I (Structure)	List-II (Location)
A. Axoneme	II. Cilia and flagella
B. Cartwheel pattern	I. Centriole
C. Crista	IV. Mitochondria
D. Satellite	III. Chromosome

Choose the correct answer from the options given below:

- (1) A-IV, B-II, C-III, D-I
- (2) A-II, B-IV, C-I, D-III
- (3) A-II, B-I, C-IV, D-III
- (4) A-IV, B-III, C-II, D-I

Correct Answer: (3) A-II, B-I, C-IV, D-III

Solution: Step 1: Match structures to their corresponding locations - Axoneme: Found in cilia and flagella. - Cartwheel pattern: Observed in centriole structure. - Crista: Folds in the mitochondria. - Satellite: Present on specific regions of chromosomes.

Conclusion: The correct option is (3).

💡 Quick Tip

Organelles and their specific structures play distinct roles in cellular functions.

167. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on:

- (1) 10th segment
- (2) 8th and 9th segment
- (3) 11th segment
- (4) 5th segment

Correct Answer: (3) 11th segment

Solution: Step 1: Understand the anatomy of cockroach segments. The anal cerci are jointed filamentous appendages located on the 11th abdominal segment of both male and female cockroaches.

Conclusion: The correct option is (3).

💡 Quick Tip

The anal cerci in cockroaches are sensory organs used for detecting vibrations and changes in the environment.

168. Match List I with List II:

List I	List II
A. Pleurobrachia	II. Ctenophora
B. Radula	I. Mollusca
C. Stomochord	IV. Hemichordata
D. Air bladder	III. Osteichthyes

Choose the correct answer from the options given below:

- (1) A-II, B-I, C-IV, D-III
- (2) A-II, B-IV, C-I, D-III
- (3) A-IV, B-III, C-II, D-I
- (4) A-IV, B-II, C-III, D-I

Correct Answer: (2) A-II, B-I, C-IV, D-III

Solution: Step 1: Match the examples to the respective groups. - Pleurobrachia belongs to Ctenophora. - Radula is a structure found in Mollusca. - Stomochord is a characteristic of Hemichordata. - Air bladder is present in Osteichthyes for buoyancy.

Conclusion: The correct option is (2).

💡 Quick Tip

Matching biological structures and organisms with their respective groups helps in better understanding taxonomy.

169. Following are the stages of the pathway for conduction of an action potential through the heart:

- A. AV bundle
- B. Purkinje fibres
- C. AV node
- D. Bundle branches
- E. SA node

Choose the correct sequence of the pathway from the options given below:

- (1) A-E-C-B-D
- (2) B-D-E-C-A
- (3) E-A-D-B-C
- (4) E-C-A-D-B

Correct Answer: (4) E-C-A-D-B

Solution: Step 1: Understand the conduction pathway. - SA node generates the impulse. - Impulse travels to the AV node, then to the AV bundle. - From the AV bundle, the signal propagates to the Bundle branches and then to the Purkinje fibres.

Conclusion: The correct option is (4).

💡 Quick Tip

The heart's conduction system ensures a coordinated contraction for effective pumping of blood.

170. The flippers of the Penguins and Dolphins are the example of:

- (1) Natural selection
- (2) Convergent evolution
- (3) Divergent evolution
- (4) Adaptive radiation

Correct Answer: (2) Convergent evolution

Solution: Step 1: Understand convergent evolution. - Penguins and dolphins have evolved similar flipper structures for swimming, despite being from different evolutionary lineages. - This represents convergent evolution, where organisms evolve similar traits due to similar environmental pressures.

Conclusion: The correct option is (2).

💡 Quick Tip

Convergent evolution leads to analogous structures, while divergent evolution leads to homologous structures.

171. Which one is the correct product of DNA dependent RNA polymerase to the given template?

DNA Template: 3'TACATGGCAAATATCCATTCA5'

- (1) 5'AUGUAAAGUUUAUAGGUAAGU3'
- (2) 5'AUGUACCGUUUAUAGGGAAGU3'
- (3) 5'ATGTACCGTTTATAGGTAAGT3'
- (4) 5'AUGUACCGUUUAUAGGUAAGU3'

Correct Answer: (4) 5'AUGUACCGUUUAUAGGUAAGU3'

Solution: Step 1: Transcription process - The RNA sequence is complementary to the DNA template. - RNA polymerase synthesizes RNA in the 5' to 3' direction using the DNA strand.

Conclusion: The correct RNA transcript is **5'AUGUACCGUUUAUAGGUAAGU3'**.

💡 Quick Tip

Transcription involves synthesis of RNA from DNA, where thymine (T) is replaced with uracil (U).

172. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Breast-feeding during the initial period of infant growth is recommended by doctors for bringing up a healthy baby. **Reason R:** Colostrum contains several antibodies absolutely essential to develop resistance for the newborn baby.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both A and R are correct but R is NOT the correct explanation of A
- (2) A is correct but R is not correct
- (3) A is not correct but R is correct
- (4) Both A and R are correct and R is the correct explanation of A

Correct Answer: (2) A is correct but R is not correct

Solution: Step 1: Analyze the statement and the explanation provided. - Breast-feeding provides essential nutrition and strengthens immunity. - Colostrum contains immunoglobulins, but in this context, the explanation doesn't align directly with the assertion.

Conclusion: The correct option is (2).

💡 Quick Tip

Breastfeeding is critical for infant immunity due to the presence of colostrum rich in antibodies.

173. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?

- (1) High pO_2 and Lesser H^+ concentration
- (2) Low pCO_2 and High H^+ concentration
- (3) Low pCO_2 and High temperature
- (4) High pO_2 and High pCO_2

Correct Answer: (1) High pO_2 and Lesser H^+ concentration

Solution: Step 1: Understand the conditions for oxyhaemoglobin formation. - High pO_2 in alveoli promotes oxygen binding to haemoglobin. - Low H^+ concentration (alkaline pH) and low pCO_2 favour oxyhaemoglobin formation.

Conclusion: The correct option is (1).

💡 Quick Tip

Oxyhaemoglobin forms in the lungs where pO_2 is high, pCO_2 is low, and the environment is alkaline.

174. Consider the following statements:

A. Annelids are true coelomates. B. Poriferans are pseudocoelomates. C. Aschelminthes are acoelomates. D. Platyhelminthes are pseudocoelomates.

Choose the correct answer from the options given below:

- (1) A only
- (2) C only
- (3) D only
- (4) B only

Correct Answer: (2) C only

Solution: Step 1: Verify the coelom types in the groups mentioned. - Annelids are true coelomates. - Poriferans are neither coelomates nor pseudocoelomates. - Aschelminthes (nematodes) are pseudocoelomates, not acoelomates. - Platyhelminthes are acoelomates, not pseudocoelomates.

Conclusion: The correct option is (2).

💡 Quick Tip

Know the coelom types: coelomates, pseudocoelomates, and acoelomates for different animal phyla.

175. Following are the stages of cell division:

A. Gap 2 phase B. Cytokinesis C. Synthesis phase D. Karyokinesis E. Gap 1 phase

Choose the correct sequence of stages from the options given below:

- (1) E-B-D-A-C
- (2) B-D-E-A-C
- (3) E-C-A-D-B
- (4) C-E-D-A-B

Correct Answer: (3) E-C-A-D-B

Solution: Step 1: Understand the sequence of cell division stages. - Gap 1 phase (G1): Initial growth phase. - Synthesis phase (S): DNA replication occurs. - Gap 2 phase (G2): Preparation for mitosis. - Karyokinesis: Division of nucleus. - Cytokinesis: Division of cytoplasm.

Conclusion: The correct option is (3).

 Quick Tip

Cell division includes interphase (G1, S, G2) followed by mitotic phase (karyokinesis and cytokinesis).

176. Which of the following statements is incorrect?

- (1) Most commonly used bio-reactors are of stirring type
- (2) Bio-reactors are used to produce small-scale bacterial cultures
- (3) Bio-reactors have an agitator system, an oxygen delivery system, and foam control system
- (4) A bio-reactor provides optimal growth conditions for achieving the desired product

Correct Answer: (4) A bio-reactor provides optimal growth conditions for achieving the desired product

Solution: Step 1: Analyze the role of bio-reactors. - Bio-reactors are used for large-scale production, not small-scale cultures. - They include features like agitators, oxygen delivery, and foam control systems.

Conclusion: The correct option is (4).

 Quick Tip

Bio-reactors are specialized vessels for large-scale microbial or cell culture processes.

177. Match List I with List II:

Choose the correct answer from the options given below:

- (1) A-III, B-IV, C-II, D-I
- (2) A-I, B-III, C-II, D-IV
- (3) A-II, B-I, C-III, D-IV

List I	List II
A. Pons	III. Connects different regions of the brain
B. Hypothalamus	IV. Neuro secretory cells
C. Medulla	II. Controls respiration and gastric secretions
D. Cerebellum	I. Provides additional space for neurons, regulates posture and balance

(4) A-II, B-III, C-I, D-IV

Correct Answer: (3) A-III, B-IV, C-II, D-I

Solution: Step 1: Match each brain part to its specific function. - Pons: Connects different regions of the brain. - Hypothalamus: Contains neurosecretory cells. - Medulla: Regulates respiration and gastric secretions. - Cerebellum: Helps in posture and balance.

Conclusion: The correct option is (3).

💡 Quick Tip

Know the functions of brain regions like the cerebellum, pons, and hypothalamus for clarity in matching questions.

178. Which of the following is not a natural/traditional contraceptive method?

- (1) Periodic abstinence
- (2) Lactational amenorrhea
- (3) Vaults
- (4) Coitus interruptus

Correct Answer: (2) Lactational amenorrhea

Solution: Step 1: Identify natural contraceptive methods. - Natural methods: Periodic abstinence, lactational amenorrhea, and coitus interruptus. - Vaults: Artificial contraceptive devices.

Conclusion: The correct option is (2).

💡 Quick Tip

Differentiate between natural and artificial contraceptive methods for clarity in solving such questions.

179. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?

- (1) Genetic drift
- (2) Gene migration
- (3) Constant gene pool
- (4) Genetic recombination

Correct Answer: (2) Gene migration

Solution: Step 1: Evaluate factors affecting Hardy-Weinberg equilibrium. - Genetic drift, gene migration, and recombination disrupt equilibrium. - A constant gene pool does not affect

the equilibrium.

Conclusion: The correct option is (2).

💡 Quick Tip

The Hardy-Weinberg equilibrium assumes no mutations, no selection, random mating, and constant gene pool.

180. Match List I with List II:

List I	List II
A. Pterophyllum	III. Angel fish
B. Myxine	I. Hag fish
C. Pristis	II. Saw fish
D. Exocoetus	IV. Flying fish

Choose the correct answer from the options given below:

- (1) A-III, B-I, C-II, D-IV
- (2) A-IV, B-I, C-II, D-III
- (3) A-III, B-II, C-I, D-IV
- (4) A-II, B-I, C-III, D-IV

Correct Answer: (2) A-IV, B-I, C-II, D-III

Solution: Step 1: Match the fish to its type. - Pterophyllum: Angel fish. - Myxine: Hag fish. - Pristis: Saw fish. - Exocoetus: Flying fish.

Conclusion: The correct option is (2).

💡 Quick Tip

Memorize the examples of different types of fishes for easier matching in taxonomy.

181. Which of the following is not a component of the Fallopian tube?

- (1) Isthmus
- (2) Infundibulum
- (3) Ampulla
- (4) Uterine fundus

Correct Answer: (2) Infundibulum

Solution: Step 1: Understand the structure of the Fallopian tube. - Components: Infundibulum, ampulla, isthmus, and fimbriae. - Uterine fundus is part of the uterus, not the Fallopian tube.

Conclusion: The correct option is (2).

💡 Quick Tip

The Fallopian tube connects the ovary to the uterus and has distinct parts: infundibulum, ampulla, and isthmus.

182. Match List I with List II:

List I	List II
A. Cocaine	III. Erythroxyllum
B. Heroin	IV. Papaver somniferum
C. Morphine	I. Effective sedative in surgery
D. Marijuana	II. Cannabis sativa

Choose the correct answer from the options given below:

- (1) A-I, B-III, C-II, D-IV
- (2) A-II, B-I, C-III, D-IV
- (3) A-III, B-IV, C-I, D-II
- (4) A-IV, B-III, C-I, D-II

Correct Answer: (3) A-III, B-IV, C-I, D-II

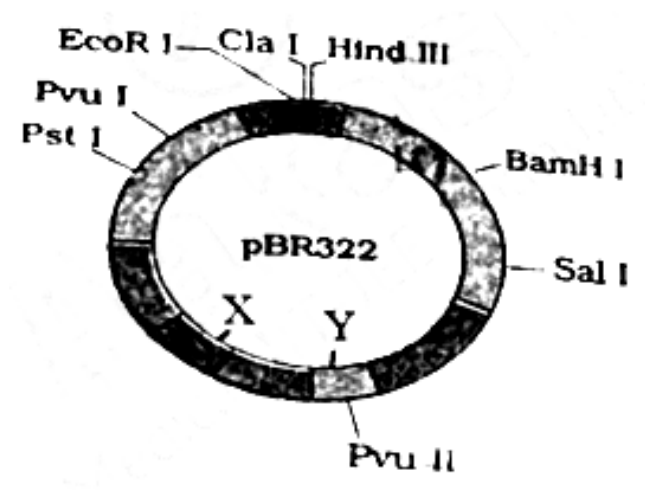
Solution: Step 1: Identify the sources of each drug. - Cocaine is derived from Erythroxyllum. - Heroin is derived from Papaver somniferum (opium poppy). - Morphine acts as an effective sedative in surgery. - Marijuana is derived from Cannabis sativa.

Conclusion: The correct option is (3).

💡 Quick Tip

Learn the botanical sources and effects of commonly abused substances for matching questions.

183. The following diagram showing restriction sites in E. coli cloning vector pBR322. Find the role of 'X' and 'Y' genes:



- (1) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.
- (2) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.
- (3) Gene 'X' is responsible for recognitions sites and 'Y' is responsible for antibiotic resistance.
- (4) The gene 'X' is responsible for resistance to antibiotics and 'Y' for protein involved in the replication of Plasmid.

Correct Answer: (2) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.

Solution: Step 1: Understand the function of genes in pBR322. - Gene X: Involved in replication of plasmid DNA. - Gene Y: Responsible for providing resistance to antibiotics, aiding in selection.

Conclusion: The correct option is (2).

💡 Quick Tip

Understand the structure and functional genes of vectors like pBR322 for recombinant DNA technology.

184. Which of the following are Autoimmune disorders?

- (1) A, B & E only
- (2) B, C & E only
- (3) C, D & E only
- (4) A, B & D only

Correct Answer: (1) A, B & E only

Solution: Step 1: Identify the autoimmune disorders from the list. - A (Myasthenia gravis): Autoimmune disorder affecting muscles. - B (Rheumatoid arthritis): Autoimmune disorder causing joint inflammation. - E (Systemic Lupus Erythematosus): Autoimmune disorder affecting multiple organs.

Conclusion: The correct option is (1).

💡 Quick Tip

Autoimmune disorders involve the immune system attacking the body's own tissues. Learn examples for NEET.

185. Match List I with List II:

Choose the correct answer from the options given below:

- (1) A-III, B-II, C-IV, D-I
- (2) A-II, B-I, C-IV, D-III
- (3) A-I, B-III, C-II, D-IV

List I	List II
A. Expiratory capacity	II. Tidal volume + Expiratory reserve volume
B. Functional residual capacity	IV. Expiratory reserve volume + Residual volume
C. Vital capacity	I. Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
D. Inspiratory capacity	III. Tidal volume + Inspiratory reserve volume

(4) A-II, B-IV, C-I, D-III

Correct Answer: (4) A-II, B-IV, C-I, D-III

Solution: Step 1: Match each respiratory parameter with its correct formula. - Expiratory capacity: Tidal volume + Expiratory reserve volume. - Functional residual capacity: Expiratory reserve volume + Residual volume. - Vital capacity: Sum of tidal volume, expiratory reserve volume, and inspiratory reserve volume. - Inspiratory capacity: Tidal volume + Inspiratory reserve volume.

Conclusion: The correct option is (4).

💡 Quick Tip

Understand key respiratory volumes and capacities along with their formulas for matching questions.

Section B

186. Match List I with List II:

List I	List II
A. P wave	III. Depolarisation of atria
B. QRS complex	II. Depolarisation of ventricles
C. T wave	IV. Repolarisation of ventricles
D. T-P gap	I. Heart muscles are electrically silent

Choose the correct answer from the options given below:

- (1) A-III, B-II, C-IV, D-I
- (2) A-II, B-III, C-I, D-IV
- (3) A-IV, B-II, C-I, D-III
- (4) A-III, B-II, C-IV, D-I

Correct Answer: (4) A-III, B-II, C-IV, D-I

Solution: Step 1: Analyze the components of ECG. - P wave: Represents depolarisation of atria. - QRS complex: Represents depolarisation of ventricles. - T wave: Represents repolarisation of ventricles. - T-P gap: Indicates electrical silence of heart muscles.

Conclusion: The correct option is (4).

💡 Quick Tip

Learn the components of ECG and their physiological implications for matching questions.

187. Given below are two statements: Statement I: The cerebral hemispheres are connected by a nerve tract known as corpus callosum.

Statement II: The brain stem consists of the medulla oblongata, pons, and cerebrum.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

Correct Answer: (2) Statement I is correct but Statement II is incorrect

Solution: Step 1: Analyze the statements. - Statement I: The corpus callosum is the nerve tract connecting cerebral hemispheres—correct. - Statement II: The brainstem includes the medulla oblongata, pons, and midbrain—not the cerebrum—incorrect.

Conclusion: The correct option is (2).

💡 Quick Tip

The brainstem excludes the cerebrum; learn the components carefully.

188. Given below are two statements: Statement I: Mitochondria and chloroplasts are both double membrane-bound organelles.

Statement II: The inner membrane of mitochondria is relatively less permeable compared to chloroplast.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

Correct Answer: (2) Statement I is correct but Statement II is incorrect

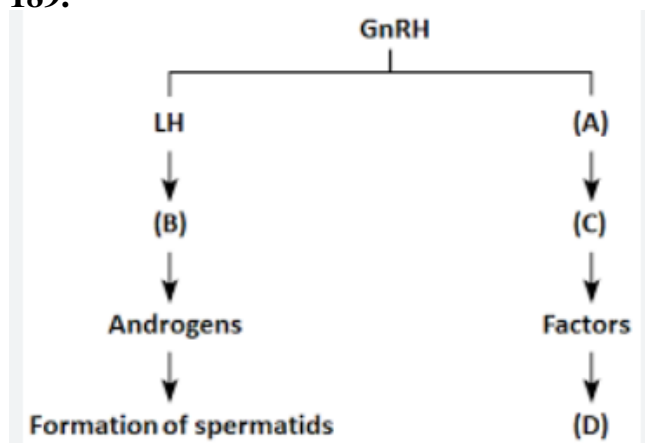
Solution: Step 1: Analyze the structure and membranes of organelles. - Statement I: Both mitochondria and chloroplasts are double membrane-bound—correct. - Statement II: The inner membrane of mitochondria is more permeable than that of chloroplast—incorrect.

Conclusion: The correct option is (2).

💡 Quick Tip

Focus on the structural differences between mitochondria and chloroplasts for conceptual clarity.

189.



Identify the correct option (A), (B), (C), (D) with respect to spermatogenesis:

- (1) ICSH, Interstitial cells, Leydig cells, spermiogenesis
- (2) FSH, Sertoli cells, Leydig cells, spermatogenesis
- (3) ICSH, Leydig cells, Sertoli cells, spermatogenesis
- (4) FSH, Leydig cells, Sertoli cells, spermiogenesis

Correct Answer: (1) ICSH, Interstitial cells, Leydig cells, spermiogenesis

Solution: Step 1: Identify the hormones and cell types involved in spermatogenesis. - ICSH: Acts on Leydig cells. - Leydig cells: Produce testosterone. - Sertoli cells: Provide nourishment during spermatogenesis. - Spermiogenesis: Transformation of spermatids to spermatozoa.

Conclusion: The correct option is (1).

💡 Quick Tip

Understand hormonal regulation and cellular roles in spermatogenesis for accuracy.

190. Given below are two statements: Statement I: Bone marrow is the main lymphoid organ where all blood cells, including lymphocytes, are produced.

Statement II: Both bone marrow and thymus provide microenvironments for the development and maturation of T-lymphocytes.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect

- (3) Statement I is incorrect but Statement II is correct
(4) Both Statement I and Statement II are correct

Correct Answer: (4) Both Statement I and Statement II are correct

Solution: Step 1: Analyze the roles of bone marrow and thymus. - Statement I: Bone marrow produces all blood cells, including lymphocytes—correct. - Statement II: Bone marrow and thymus provide microenvironments for T-lymphocyte maturation—correct.

Conclusion: The correct option is (4).

💡 Quick Tip

Bone marrow and thymus are key lymphoid organs; know their roles in immunity.

191. As per ABO blood grouping system, the blood group of father is B^+ , mother is A^+ , and the child is O^+ . Their respective genotype can be:

- (1) B only
(2) C & B only
(3) D & E only
(4) A only

Correct Answer: (3) D & E only

Solution: Step 1: Analyze the genotypes of the parents. For the child to have the O^+ blood group (ii), both parents must carry at least one i allele. Possible genotypes for the parents include $I^B i$ and $I^A i$.

Step 2: Eliminate incorrect options based on genotypes. - Option B includes $I^B I^B$, $I^A I^A$, which are not valid for the O^+ child. - Options D and E correctly represent $I^A i$ and $I^B i$, which can produce ii .

Conclusion: The correct option is (3).

💡 Quick Tip

When solving ABO blood group inheritance problems, remember that O blood group requires two i alleles (homozygous recessive).

192. Given below are two statements: Statement I: Gause's competitive exclusion principle states that two closely related species competing for different resources cannot exist indefinitely.

Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are false
(2) Statement I is true but Statement II is false
(3) Statement I is false but Statement II is true
(4) Both Statement I and Statement II are true

Correct Answer: (1) Both Statement I and Statement II are false

Solution: Step 1: Analyze Gause's principle. The principle states that two species competing for the same resources cannot coexist indefinitely—this invalidates the statements as written.

Conclusion: The correct option is (1).

💡 Quick Tip

Gause's principle applies only to species competing for the same resources in a limiting environment.

193. Match List I with List II:

List I	List II
A. Mesozoic Era	III. Birds & Reptiles
B. Proterozoic Era	I. Lower invertebrates
C. Cenozoic Era	IV. Mammals
D. Paleozoic Era	II. Fish & Amphibia

Choose the correct answer from the options given below:

(1) A-III, B-I, C-II, D-IV

(2) A-I, B-II, C-IV, D-III

(3) A-III, B-I, C-IV, D-II

(4) A-II, B-I, C-III, D-IV

Correct Answer: (3) A-III, B-I, C-IV, D-II

Solution: Step 1: Match the correct eras with their characteristics. - Mesozoic Era is known for birds and reptiles. - Proterozoic Era had lower invertebrates. - Cenozoic Era marked the dominance of mammals. - Paleozoic Era saw fish and amphibians.

Conclusion: The correct option is (3).

💡 Quick Tip

Remember the major life forms associated with geological eras for matching questions.

194. Match List I with List II:

List I	List II
A. RNA polymerase III	IV. SnRNAs, tRNA
B. Termination of transcription	III. Rho factor
C. Splicing of Exons	I. snRNPs
D. TATA box	II. Promotor

Choose the correct answer from the options given below:

(1) A-III, B-II, C-IV, D-I

(2) A-III, B-IV, C-I, D-II

(3) A-IV, B-III, C-I, D-II

(4) A-II, B-IV, C-I, D-III

Correct Answer: (4) A-II, B-IV, C-I, D-III

Solution: Step 1: Match the components to their functions. - RNA polymerase III synthesizes snRNAs and tRNAs. - Termination of transcription often involves the Rho factor. - Splicing of exons is facilitated by snRNPs. - TATA box serves as a promoter region in transcription.

Conclusion: The correct option is (4).

💡 Quick Tip

Understand the roles of transcription machinery for matching questions.

195. Regarding the catalytic cycle of an enzyme action, select the correct sequential steps:

- A. Substrate enzyme complex formation.
- B. Free enzyme ready to bind with another substrate.
- C. Release of products.
- D. Chemical bonds of the substrate broken.
- E. Substrate binding to active site.

Choose the correct answer from the options given below:

- (1) A, E, B, D, C
- (2) B, A, C, D, E
- (3) E, D, C, B, A
- (4) E, A, D, C, B

Correct Answer: (4) E, A, D, C, B

Solution: Step 1: Understand the enzyme action sequence. The correct order of events in the catalytic cycle is: 1. Substrate binds to the active site of the enzyme (E). 2. Substrate-enzyme complex is formed (A). 3. Chemical bonds of the substrate are broken (D). 4. Products are released from the enzyme (C). 5. Free enzyme is ready for another substrate (B).

Conclusion: The correct option is (4).

💡 Quick Tip

The enzyme catalytic cycle always begins with substrate binding and ends with the release of products.

196. Match List I with List II:

Choose the correct answer from the options given below:

- (1) A-IV, B-III, C-I, D-II
- (2) A-III, B-IV, C-I, D-II
- (3) A-II, B-I, C-IV, D-III

List I	List II
A. Unicellular glandular epithelium	III. Goblet cells of alimentary canal
B. Compound epithelium	IV. Moist surface of buccal cavity
C. Multicellular glandular epithelium	I. Salivary glands
D. Endocrine glandular epithelium	II. Pancreas

(4) A-II, B-I, C-III, D-IV

Correct Answer: (2) A-III, B-IV, C-I, D-II

Solution: Step 1: Match the epithelial types with their characteristics. - Unicellular glandular epithelium corresponds to goblet cells (A-III). - Compound epithelium is found on moist surfaces like the buccal cavity (B-IV). - Multicellular glandular epithelium includes salivary glands (C-I). - Endocrine glandular epithelium is seen in the pancreas (D-II).

Conclusion: The correct option is (2).

💡 Quick Tip

Epithelial tissues are classified based on their structure and function, aiding in identification.

197. Match List I with List II:

List I	List II
A. Exophthalmic goiter	III. Hyper secretion of thyroid hormone & protruding eyeballs
B. Acromegaly	IV. Excessive secretion of growth hormone
C. Cushing's syndrome	I. Excess secretion of cortisol, moon face & hyperglycemia
D. Cretinism	II. Hypo-secretion of thyroid hormone & stunted growth

Choose the correct answer from the options given below:

- (1) A-IV, B-II, C-I, D-III
- (2) A-III, B-IV, C-II, D-I
- (3) A-III, B-IV, C-I, D-II
- (4) A-I, B-III, C-II, D-IV

Correct Answer: (3) A-III, B-IV, C-I, D-II

Solution: Step 1: Match the disorders to their characteristics. - Exophthalmic goiter is characterized by hyperthyroidism and protruding eyeballs (A-III). - Acromegaly results from excessive growth hormone secretion (B-IV). - Cushing's syndrome is caused by excessive cortisol secretion (C-I). - Cretinism occurs due to hypothyroidism, leading to stunted growth (D-II).

Conclusion: The correct option is (3).

💡 Quick Tip

Recognize hormonal disorders by their distinct symptoms and related glands.

198. Choose the correct statement regarding juxta medullary nephron:

- (1) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.
- (2) Loop of Henle of juxta medullary nephron runs deep into medulla.
- (3) Juxta medullary nephrons outnumber the cortical nephrons.
- (4) Juxta medullary nephrons are located in the columns of Bertini.

Correct Answer: (2) Loop of Henle of juxta medullary nephron runs deep into medulla.

Solution: Step 1: Analyze the structural features of juxta medullary nephrons. - The Loop of Henle in juxta medullary nephrons extends deep into the renal medulla, facilitating concentrated urine formation. - Renal corpuscles are located in the renal cortex, not the medulla. - Juxta medullary nephrons are fewer in number compared to cortical nephrons.

Conclusion: The correct option is (2).

💡 Quick Tip

Juxta medullary nephrons play a crucial role in water conservation by creating a concentrated urine.

199. Match List I with List II related to the digestive system of cockroach:

List I	List II
A. The structures used for storing food	IV. Crop
B. Ring of 6-8 blind tubules at the junction of foregut and midgut	II. Gastric Caeca
C. Ring of 100-150 yellow-colored thin filaments at the junction of midgut and hindgut	III. Malpighian tubules
D. The structures used for grinding the food	I. Gizzard

Choose the correct answer from the options given below:

- (1) A-I, B-II, C-III, D-IV
- (2) A-IV, B-III, C-II, D-I
- (3) A-III, B-II, C-IV, D-I
- (4) A-IV, B-II, C-III, D-I

Correct Answer: (4) A-IV, B-II, C-III, D-I

Solution: Step 1: Understand the digestive structures of a cockroach. - Food is stored in the crop (A-IV). - Gastric caeca are 6-8 blind tubules found at the junction of the foregut and midgut (B-II). - Malpighian tubules are excretory structures at the midgut-hindgut junction (C-III). - Food is ground in the gizzard (D-I).

Conclusion: The correct option is (4).

💡 Quick Tip

In cockroach anatomy, the crop stores food, while the gizzard grinds it for digestion.

200. The following are the statements about non-chordates:

- A. Pharynx is perforated by gill slits.
- B. Notochord is absent.

- C. Central nervous system is dorsal.
- D. Heart is dorsal if present.
- E. Post-anal tail is absent.

Choose the most appropriate answer from the options given below:

- (1) A, B & D only
- (2) B, D & E only
- (3) B, C & D only
- (4) A & C only

Correct Answer: (4) A & C only

Solution: Analyze the characteristics of non-chordates.

- Non-chordates lack a notochord and have a ventral central nervous system.
- Pharyngeal gill slits and a dorsal central nervous system are found in chordates, not non-chordates.
- Therefore, A (Pharynx perforated by gill slits) and C (Dorsal central nervous system) are characteristic of chordates.

Conclusion: The correct option is (4).

 Quick Tip

Differentiate chordates and non-chordates based on their key anatomical features, such as the presence of a notochord and CNS orientation.