NEET 2024 Q3 Question Paper with Solutions

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.
2. The question paper consists of 200 questions out of which 180 MCQs must be answered. The maximum marks are 720.
3. There are four parts in the question paper consisting of Biology, Physics, Chemistry and Mathematics.
4. Each subject will be divided into two sections, A and B which will have 35 and 15 questions respectively. Candidates will have to answer only 10 questions in Section B.
5. 4 marks are awarded for each correct answer and 1 mark is deducted for each wrong answer

PHYSICS

SECTION-A

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

Choose the correct answer from the options given below:

(1) 1/10N

(2) 1/100(N + 1)

(3) 100N

(4) 10(N + 1)

Correct Answer: (2)

Solution: In the vernier caliper, the Vernier constant is given by the formula:

$$\text{Vernier constant} = \frac{1}{100(N+1)}$$

This allows the measurement to be more precise.

Quick Tip

The Vernier constant helps to determine the least count of the instrument, increasing its precision.

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

Choose the correct answer from the options given below:

(1) Interference pattern will disappear.

(2) There will be a central dark fringe surrounded by a few coloured fringes.

(3) There will be a central bright white fringe surrounded by a few coloured fringes.

(4) All bright fringes will be of equal width.

Correct Answer: (3)

Solution: When white light is used in Young's double slit experiment, the central fringe is bright white, and it is surrounded by coloured fringes, as different wavelengths of light create different fringe patterns.

Quick Tip

White light produces a spectrum of colours, leading to a colourful fringe pattern in the experiment.

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

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

The expression for the output Y is:

Choose the correct answer from the options given below:

(1) A.B + A'

(2) A.B' + A'

(3) B'

(4) B

Correct Answer: (3)

Solution: The output Y is 1 when A = 0 and B = 0 or A = 1 and B = 0. Therefore, the expression simplifies to B'.

Quick Tip

Understanding truth tables and Boolean logic is essential for analyzing digital circuits.

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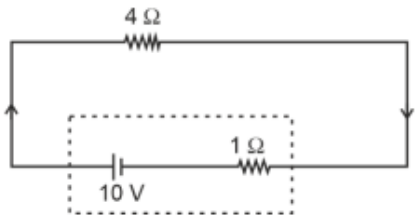
4. The terminal voltage of the battery, whose emf is 10 V and internal resistance 1 ohm , when connected through an external resistance of 4 ohms as shown in the figure is:



Choose the correct answer from the options given below:

(1) 4 V

(2) 6 V

(3) 8 V

(4) 10 V

Correct Answer: (2)

Solution: The terminal voltage is given by:

$$V = \text{emf} - I \cdot r$$

where $I = \frac{\text{emf}}{R+r} = \frac{10}{4+1} = 2\,\text{A}$. Thus, the terminal voltage is $V = 10 - (2 \times 1) = 6\,\text{V}$.

Quick Tip

To find terminal voltage, subtract the voltage drop due to internal resistance from the emf.

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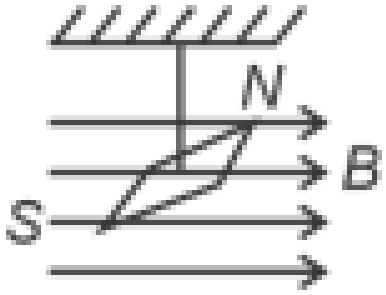
5. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is 9.8 $\times$ 10^{-6} kg m^2. If the magnitude of the magnetic moment of the needle is x $\times$ 10^{-5} Am^2, then the value of 'x' is:



Choose the correct answer from the options given below:

(1) $5\pi^2$

(2) $128\pi^2$

(3) $50\pi^2$

(4) $1280\pi^2$

Correct Answer: (4)

Solution: The formula for the time period of a magnetic needle undergoing oscillations in a magnetic field is given by:

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

where I is the moment of inertia, m is the magnetic moment, and B is the magnetic field. Using the given values, the value of 'x' can be calculated.

Quick Tip

Remember that the moment of inertia and magnetic moment are key factors in determining the oscillation period of a magnetic needle.

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6. A wire of length 'f' and resistance 100 Ω 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:

Choose the correct answer from the options given below:

(1) 26 Ω

(2) 52 Ω

(3) 55 Ω

(4) 60 Ω

Correct Answer: (2)

Solution: First, calculate the resistance of each of the 10 parts, then calculate the combined resistance of the first 5 parts in series and the next 5 parts in parallel. Finally, combine the two results to get the total resistance.

Quick Tip

When combining resistors, remember that resistors in series add directly, while resistors in parallel add according to the formula $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2}$.

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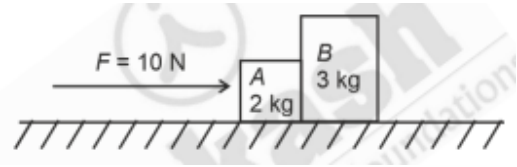
7. A horizontal force 10 N is applied to a block A as shown in the figure. The mass of blocks A and B are 2 kg and 3 kg respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:



Choose the correct answer from the options given below:

(1) Zero

(2) 4 N

(3) 6 N

(4) 10 N

Correct Answer: (3)

Solution: The force exerted by block A on block B can be determined by considering the force distribution and the individual masses of the blocks.

Quick Tip

When two blocks are connected and moved by a force, the interaction force between them can be determined using Newton's second law.

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8. A tightly wound 100 turns coil of radius 10 cm carries a current of 7 A. The magnitude of the magnetic field at the center of the coil is (Take permeability of free space as $\mu_0 = 4\pi \times 10^{-7}$ SI units):

Choose the correct answer from the options given below:

(1) 44 mT

(2) 4.4 T

(3) 4.4 mT

(4) 44 T

Correct Answer: (3)

Solution: The magnetic field at the center of a coil is given by the formula:

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

where N is the number of turns, I is the current, and R is the radius of the coil.

Quick Tip

The magnetic field in a coil is directly proportional to the number of turns and the current, and inversely proportional to the radius of the coil.

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9. In an ideal transformer, the turns ratio is $N_P : N_S = \frac{1}{2}$. The ratio $V_S : V_P$ is equal to (the symbols carry their usual meaning) :

Choose the correct answer from the options given below:

(1) 1 : 2

(2) 2 : 1

(3) 1 : 1

(4) 1 : 4

Correct Answer: (2)

Solution: For an ideal transformer, the voltage ratio is inversely proportional to the turns ratio:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

Given that the turns ratio is 1:2, the voltage ratio will be 2:1.

Quick Tip

In an ideal transformer, the ratio of voltages is equal to the inverse of the ratio of the number of turns.

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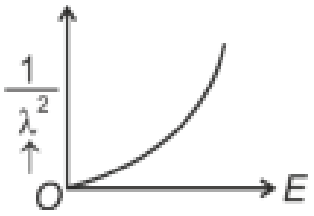
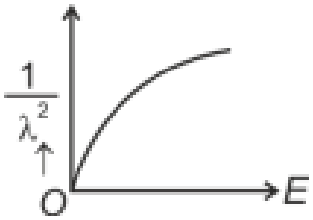
10. The graph which shows the variation of $\frac{1}{\lambda^2}$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle):

Choose the correct answer from the options given below:

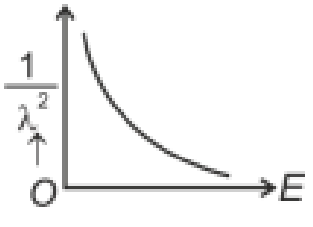
(1)



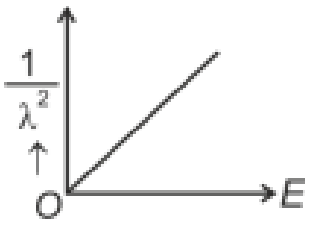
(2)



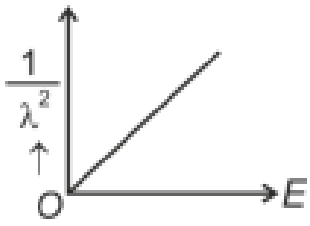
(3)



(4)



Correct Answer: (4)



Solution: The correct graph shows the variation of $\frac{1}{\lambda^2}$ with respect to the kinetic energy, E. The relation between momentum and wavelength is inversely proportional and the kinetic energy is proportional to the square of momentum.

Quick Tip

In de Broglie's hypothesis, the wavelength is inversely related to the momentum of the particle, which helps in understanding the wave-particle duality.

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11. Given below are two statements: Statement I: Atoms are electrically neutral as they contain equal number of positive and negative charges. Statement II: Atoms of each element are stable and emit their characteristic spectrum. In the light of the above statements, choose the most appropriate answer from the options given below:

Choose the correct answer from the options given below:

(1) Both Statement I and Statement II are correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Correct Answer: (3)

Solution: Statement I is true, as atoms are neutral when they have an equal number of protons and electrons. Statement II is false because atoms of an element may not always be stable, and they emit characteristic spectra when they undergo transitions between energy levels.

Quick Tip

Remember that atomic stability and emission spectra depend on various factors including external conditions and the type of atom involved.

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12. 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 speed becomes 2ω while keeping the same radius, the tension in the string becomes:

Choose the correct answer from the options given below:

(1) T

(2) $4T$

(3) $\frac{T}{4}$

(4) $\sqrt{2}T$

Correct Answer: (2)

Solution: The tension in the string is proportional to the square of the speed. Therefore, if the speed is doubled, the tension becomes four times.

Quick Tip

Tension in a string is directly proportional to the square of the velocity in circular motion.

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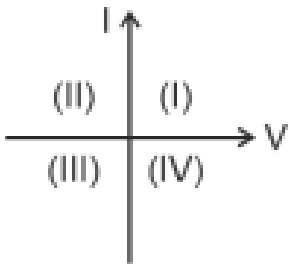
13. Consider the following statements A and B and identify the correct answer:



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.

Choose the correct answer from the options given below:

(1) A is correct but B is incorrect

(2) A is incorrect but B is correct

(3) Both A and B are correct

(4) Both A and B are incorrect

Correct Answer: (3)

Solution: In a solar-cell, the I-V characteristics do lie in the IV quadrant. Additionally, in a reverse biased pn-junction diode, the current measured is due to minority charge carriers, not majority carriers.

Quick Tip
Solar cells are typically operated in the fourth quadrant of an I-V graph, where the current is generated under illumination.

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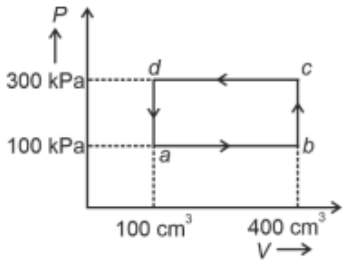
14. A thermodynamic system is taken through the cycle abcd. The work done by the gas along the path bc is:



Choose the correct answer from the options given below:

(1) Zero

(2) 30 J

(3) -90 J

(4) -60 J

Correct Answer: (1)

Solution: Along the path bc, the volume remains constant, so no work is done by the gas. Therefore, the work done is zero.

Quick Tip
In thermodynamics, understanding the relation between work and volume change is fundamental in analyzing cycles and energy transfer.

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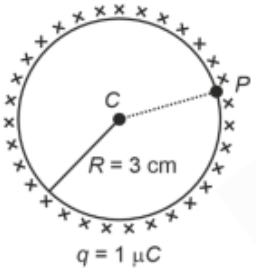
15. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is: (Take $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ SI units)



Choose the correct answer from the options given below:

(1) 3×10^5

(2) 1×10^5

(3) 0.5×10^5

(4) Zero

Correct Answer: (4)

Solution: The potential difference between points on the surface of a uniformly charged spherical shell is zero. This is due to the spherical symmetry and the electric field being zero inside the shell.

Quick Tip

In electrostatics, the potential difference inside a spherical shell is always zero due to the symmetry of the charge distribution.

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16. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2. The length of the 400 g rod is nearly:
Choose the correct answer from the options given below:

(1) 8.5 cm

(2) 17.5 cm

(3) 20.7 cm

(4) 72.0 cm

Correct Answer: (1)

Solution: The moment of inertia of a thin rod about its center is given by the formula $I = \frac{1}{12}ML^2$. Given the moment of inertia and the mass of the rod, we can solve for the length.

Quick Tip

For a rod rotating about its center, the moment of inertia depends on the mass and the square of the length.

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

Choose the correct answer from the options given below:

(1) Constant velocity

(2) Constant acceleration

(3) Constant velocity but varying acceleration

(4) Varying velocity and varying acceleration

Correct Answer: (2)

Solution: In uniform circular motion, the velocity changes direction continuously, but its magnitude remains constant. The particle experiences a centripetal acceleration that is always directed towards the center of the circle.

Quick Tip

In uniform circular motion, while the speed remains constant, the direction of velocity keeps changing, leading to centripetal acceleration.

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18. If c is the velocity of light in free space, the correct statements about photon among the following are:

A. The energy of a photon is $E = hv$.

B. The velocity of a photon is c.

C. The momentum of a photon, $p = \frac{hv}{c}$.

D. In a photon-electron collision, both total energy and total momentum are conserved.

E. Photon possesses positive charge.

Choose the correct answer from the options given below:

(1) A and B only

(2) A, B, C and D only

(3) A, C and D only

(4) A, B, D and E only

Correct Answer: (2)

Solution: The energy of a photon is given by $E = hv$, where h is Planck's constant and v is the frequency. The velocity of a photon is always c, the speed of light in vacuum. The momentum of the photon is $p = \frac{hv}{c}$, and in photon-electron interactions, total energy and momentum are conserved.

Quick Tip

Photons are massless particles that exhibit wave-particle duality and carry energy proportional to their frequency.

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19. At any instant of time t, the displacement of any particle is given by $2t - 1$ (SI unit) under the influence of force of 5N. The value of instantaneous power is (in SI unit):
Choose the correct answer from the options given below:
(1) 10
(2) 5
(3) 7
(4) 6

Correct Answer: (1)

Solution: Power is the rate of doing work. The instantaneous power can be calculated by using the formula $P = Fv$, where v is the velocity. The velocity is the derivative of displacement with respect to time, and hence the power can be calculated as
$P = F \cdot v = 5 \cdot 2 = 10$.

Quick Tip

Power is the product of force and velocity. When velocity increases linearly, the instantaneous power increases proportionally.

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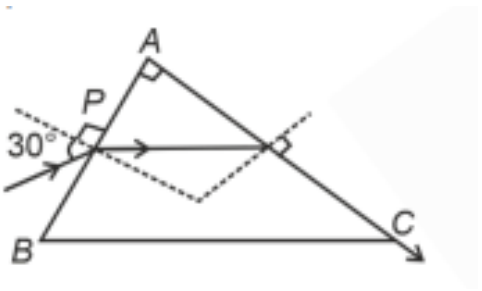
20. A light ray enters through a right-angled prism at point P with the angle of incidence 30° as shown in figure. It travels through the prism parallel to its base BC and emerges along the

face AC. The refractive index of the prism is:



Choose the correct answer from the options given below:

(1) $\frac{\sqrt{5}}{4}$

(2) $\frac{\sqrt{5}}{2}$

(3) $\frac{\sqrt{3}}{4}$

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

Correct Answer: (2)

Solution: Using Snell's Law and geometry of the prism, the refractive index can be calculated by considering the angle of incidence and the prism's geometry.

Quick Tip

When light passes through a medium like a prism, its speed is reduced, and the bending of the light depends on the refractive index.

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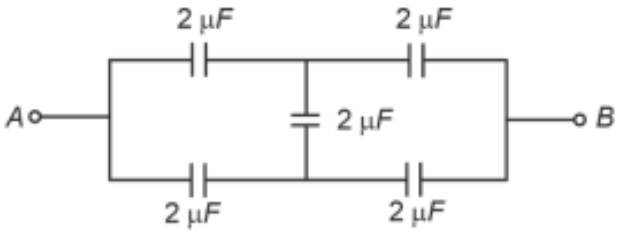
21. In the following circuit, the equivalent capacitance between terminal A and terminal B is:



Choose the correct answer from the options given below:

(1) 2 μF

(2) 1 μF

(3) 0.5 μF

(4) 4 μF

Correct Answer: (1)

Solution: Using the formula for capacitors in series and parallel, we can simplify the equivalent capacitance of the given circuit.

Quick Tip

Capacitance in parallel adds, while in series it behaves as the reciprocal of the sum of reciprocals.

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

- (1) strain and angle
- (2) stress and angle
- (3) strain and arc
- (4) angular speed and stress

Correct Answer: (1)

Solution: Strain and angle both are dimensionless quantities. Strain is a ratio of change in length to original length, and angle is a measure of rotation, both having no units.

Quick Tip

Dimensionless quantities are useful for simplifying physical equations and can be compared without unit conversion.

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23. 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 x 10^8 N m^{-2} and 2 x 10^{11} N m^{-2}, is:

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

Correct Answer: (4)

Solution: The elongation is given by the formula $\Delta L = \frac{FL}{AE}$. Using the given values, we calculate the maximum elongation of the wire.

Quick Tip

The elongation of a wire depends on the force applied, the length of the wire, and the material's Young's modulus.

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24. 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 that in solenoid-2, respectively, are through the directions:

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

Correct Answer: (1)

Solution: As per Lenz's Law, the direction of the induced current in solenoid-1 will oppose the motion of the magnet, and solenoid-2 will have a current in the opposite direction.

Quick Tip

The direction of induced current in a solenoid is always such that it opposes the change causing the current.

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

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

Correct Answer: (4)

Solution: The gravitational acceleration is given by $g = \frac{GM}{R^2}$. Using the given values and simplifying, we find the acceleration due to gravity on the planet.

Quick Tip

Gravitational acceleration is directly proportional to mass and inversely proportional to the square of the radius of the planet.

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26. Match List I with List II:

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

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (3)

Solution: These are transitions for the Balmer series in hydrogen atoms, with each wavelength corresponding to a specific energy level transition.

Quick Tip

The Balmer series lines correspond to transitions where the electron falls from higher energy levels to the second level of the hydrogen atom.

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27. An unpolarised light beam strikes a glass surface at Brewster's angle. Then
Choose the correct answer from the options given below:

(1) The reflected light will be partially polarised.

(2) The refracted light will be completely polarised.

(3) Both the reflected and refracted light will be completely polarised.

(4) The reflected light will be completely polarised but the refracted light will be partially polarised.

Correct Answer: (4)

Solution: At Brewster's angle, the reflected light is completely polarised and the refracted light is partially polarised.

Quick Tip

Brewster's angle occurs when the angle between the refracted and reflected light is 90°.

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28. Match List-I with List-II:

- A. Diamagnetic I. $\chi = 0$
- B. Ferromagnetic II. $0 < \chi \leq -1$
- C. Paramagnetic III. $\chi >> 1$
- D. Non-magnetic IV. $0 < \chi < \epsilon$ (a small positive number)

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (1)

Solution: Diamagnetic materials have $\chi = 0$, ferromagnetic materials have $\chi >> 1$, paramagnetic materials have $0 < \chi < \epsilon$, and non-magnetic materials have $\chi = 0$.

Quick Tip

Diamagnetic materials are repelled by magnetic fields, while paramagnetic and ferromagnetic materials are attracted to them.

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29. 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:

Choose the correct answer from the options given below:

(1) $1 : 2$

(2) $2 : 1$

(3) $4 : 1$

(4) $1 : 4$

Correct Answer: (2)

Solution: In a completely inelastic collision, both bodies move with the same velocity after the collision, and using conservation of momentum, the ratio is $2:1$.

Quick Tip

In an inelastic collision, the total momentum is conserved, but kinetic energy is not.

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30. $290\ \mathrm{X} \rightarrow \mathrm{Y} \rightarrow \mathrm{Z} \rightarrow \mathrm{P} \rightarrow \mathrm{Q}$ In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are:

Choose the correct answer from the options given below:

(1) 280, 81

(2) 286, 80

(3) 288, 82

(4) 286, 81

Correct Answer: (4)

Solution: Using the principle of conservation of mass and atomic numbers, the correct mass number and atomic number of the product Q are 286 and 81.

Quick Tip

In nuclear reactions, the mass number and atomic number must be conserved.

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31. If $x = 5\sin\left(\pi t + \frac{\pi}{3}\right)$ represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion, respectively, are:

Choose the correct answer from the options given below:

(1) 5 cm, 2 s

(2) 5 cm, 1 s

(3) 3 cm, 5 s

(4) 5 m, 1 s

Correct Answer: (1)

Solution: The amplitude of the motion is the coefficient of the sine function, i.e., 5 cm. The time period is given by $T = \frac{2\pi}{\omega}$, and for this equation, $T = 2\,\text{s}$.

Quick Tip

The amplitude is the maximum displacement from the equilibrium position, and the time period is the time taken for one complete oscillation.

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32. 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:

Choose the correct answer from the options given below:

(1) 19.8 mN

(2) 198 N

(3) 1.98 mN

(4) 99 N

Correct Answer: (1)

Solution: The excess force required is given by the formula $F = T \times$ Perimeter, where T is the surface tension and the perimeter is the circumference of the disc.

Quick Tip

Surface tension is a force that acts along the surface of liquids, pulling molecules together.

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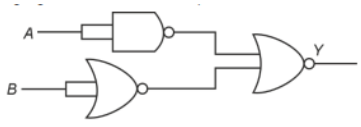
33. The output (Y) of the given logic gate is similar to the output of an/a:



Choose the correct answer from the options given below:

(1) NAND gate

(2) NOR gate

(3) OR gate

(4) AND gate

Correct Answer: (4)

Solution: The logic gate in the diagram behaves like an AND gate, as it outputs true only when both inputs are true.

Quick Tip

AND gates output a high value only when all inputs are high.

---

34. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R. Assertion A: The potential (V) at any axial point, at 2 m distance (r) from the centre of the dipole of dipole moment vector $\overrightarrow{P}$ of magnitude, $4 \times 10^{-6}\, C$ m, is $9 \times 10^{3}\, V$. (Take $\frac{1}{4\pi\epsilon_0} = 9 \times 10^{9}$ SI units)

Reason R: $V = \pm\frac{2P}{4\pi\epsilon_0 r^2}$, where r is the distance of any axial point, situated at 2 m from the centre of the dipole.

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

(1) Both A and R are true and R is the correct explanation of A.

(2) Both A and R are true but R is NOT the correct explanation of A.

(3) A is true but R is false.

(4) A is false but R is true.

Correct Answer: (3)

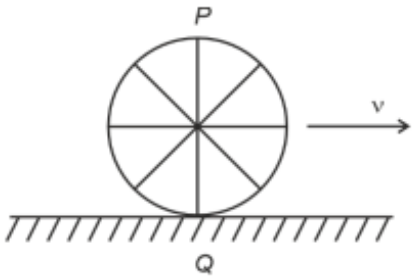
Solution: The potential due to a dipole at an axial point is given by the formula, but Reason R is incorrect as the formula does not match the actual equation for the dipole.

Quick Tip

In dipoles, the potential depends on the distance and dipole moment.

---

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



Choose the correct answer from the options given below:

(1) Point P moves slower than point Q

(2) Point P moves faster than point Q

(3) Both the points P and Q move with equal speed

(4) Point P has zero speed

Correct Answer: (2)

Solution: In rolling motion, the point in contact with the ground (point Q) is at rest while the topmost point (point P) has the highest speed.

Quick Tip

In rolling motion, the point of contact has zero velocity, and the speed increases as we move up to the topmost point.

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:

Choose the correct answer from the options given below:

(1) There is no current

(2) Displacement current of magnitude equal to I flows in the same direction as I

(3) Displacement current of magnitude equal to I flows in a direction opposite to that of I

(4) Displacement current of magnitude greater than I flows but can be in any direction

Correct Answer: (2)

Solution: In a charging capacitor, the displacement current is equal to the current through the circuit, flowing in the same direction.

Quick Tip

The displacement current is related to the rate of change of the electric flux, and it allows the capacitor to charge.

---

37. The property which is not of an electromagnetic wave travelling in free space is that:

Choose the correct answer from the options given below:

(1) They are transverse in nature

(2) The energy density in electric field is equal to energy density in magnetic field

(3) They travel with a speed equal to $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$

(4) They originate from charges moving with uniform speed

Correct Answer: (4)

Solution: Electromagnetic waves are generated by accelerating charges, not charges moving with uniform speed.

Quick Tip

Electromagnetic waves travel at the speed of light and are created by oscillating charges.

---

38. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. The magnifying power of telescope for viewing a distant object is:
Choose the correct answer from the options given below:
(1) 34
(2) 28
(3) 17
(4) 32

Correct Answer: (2)

Solution: The magnifying power M of a telescope is given by $M = \frac{f_{\text{objective}}}{f_{\text{eyepiece}}}$.

Quick Tip

For telescopes, magnification is the ratio of the focal lengths of the objective and eye-piece.

---

39. Two heaters A and B have power rating of 1 kW and 2 kW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is:
Choose the correct answer from the options given below:
(1) 1 : 1
(2) 2 : 9
(3) 1 : 2
(4) 2 : 3

Correct Answer: (2)

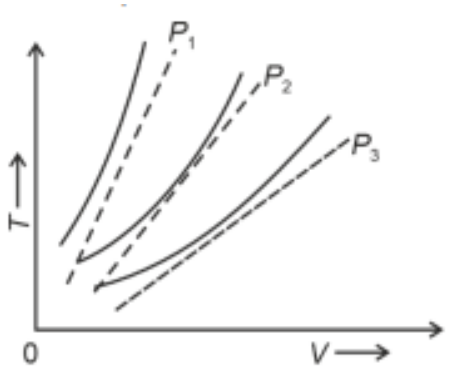
Solution: When connected in series, the power is shared between the two heaters, but in parallel, both heaters work at their maximum power rating.

Quick Tip

In series, the power is divided, while in parallel each heater consumes its full power rating.

---

40. The following graph represents the T-V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1, P_2, and P_3 compared with those of Charles's law represented as dotted lines.



Then the correct relation is:

Choose the correct answer from the options given below:

(1) $P_3 > P_2 > P_1$

(2) $P_1 > P_3 > P_2$

(3) $P_2 > P_1 > P_3$

(4) $P_1 > P_2 > P_3$

Correct Answer: (4)

Solution: From the graph, we observe that for the same volume, pressure is highest for P_1, followed by P_2, and lowest for P_3.

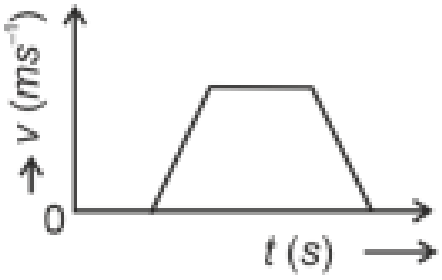
Quick Tip

The relationship between pressure and volume for a gas can be observed using the T-V curve, and higher pressure corresponds to higher temperature for a given volume.

---

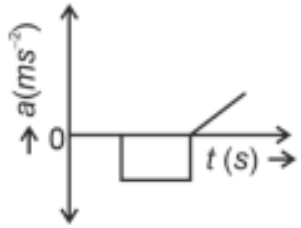
41. The velocity (v) - time (t) plot of the motion of a body is shown below:

The acceleration (a) - time (t) graph that best suits this motion is:

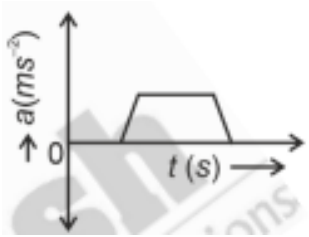


Choose the correct answer from the options given below:

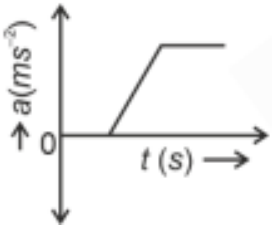
(1)



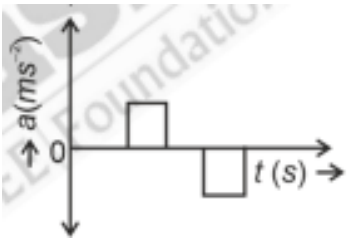
(2)



(3)



(4)



Correct Answer: (3)

Solution: The velocity-time graph indicates a constant motion, which results in zero acceleration during the flat portion and a sudden change in the velocity.

Quick Tip

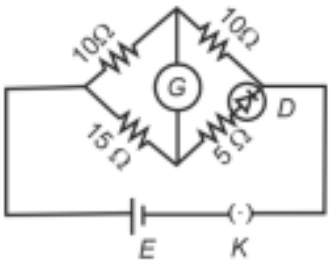
In cases of constant velocity, the acceleration is zero. An abrupt change in velocity leads to a spike in acceleration.

---

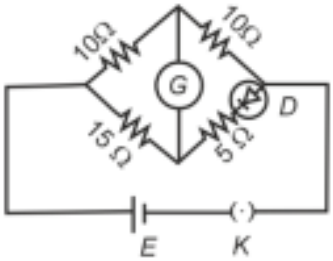
42. Choose the correct circuit which can achieve the bridge balance.

Choose the correct answer from the options given below:

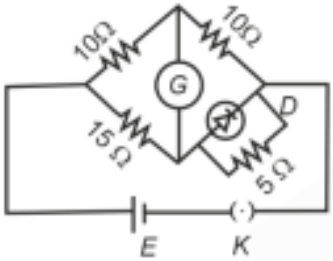
(1)



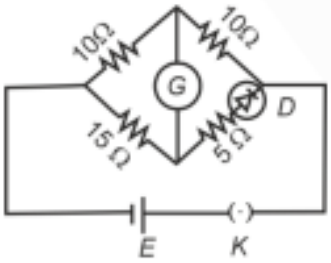
(2)



(3)



(4)



Correct Answer: (1)

Solution: The circuit shown in Option 1 is the correct setup to achieve the bridge balance.

Quick Tip

The bridge balance condition requires the correct configuration of resistances across the arms of the bridge circuit.

---

43. 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 $\frac{x}{2}$ times its original time period. Then the value of x is:

Choose the correct answer from the options given below:

(1) $\sqrt{3}$

(2) $\sqrt{2}$

(3) $2\sqrt{3}$

(4) 4

Correct Answer: (2)

Solution: The time period T of a pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$, where l is the length and g is the acceleration due to gravity. Since the length is halved, the new time period will be $\frac{T}{\sqrt{2}}$.

Quick Tip

For a simple pendulum, the time period depends only on the length of the pendulum and gravity, not the mass of the bob.

---

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

Choose the correct answer from the options given below:

(1) $\frac{5GmM}{6R}$

(2) $\frac{2GmM}{3R}$

(3) $\frac{GmM}{2R}$

(4) $\frac{GmM}{3R}$

Correct Answer: (1)

Solution: The minimum energy required for a satellite to move from the surface of the Earth to an orbit at an altitude $2R$ is derived from the gravitational potential energy and the kinetic energy of the satellite.

Quick Tip

In satellite motion, the minimum energy corresponds to the energy required to overcome the gravitational attraction and reach the circular orbit.

---

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

Choose the correct statement(s) from the options given below: **(1)** B and D only

(2) A and C only

(3) A, C and D only

(4) C only

Correct Answer: (2)

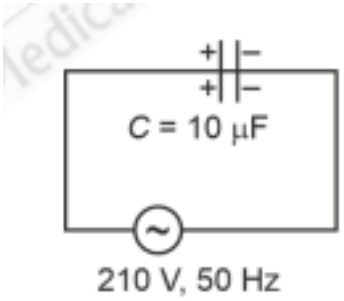
Solution: For the sheet to move, a force must be applied to it based on whether the sheet is magnetic, conducting, non-conducting, or non-polar.

Quick Tip

If the sheet is conducting, the interaction with the magnetic field induces a force on the sheet.

---

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



Choose the correct answer from the options given below:

(1) 0.58 A

(2) 0.93 A

(3) 1.20 A

(4) 0.35 A

Correct Answer: (2)

Solution: The peak current in an AC circuit with a capacitor can be calculated using the formula $I_{\text{peak}} = V_{\text{rms}} \times \omega C$, where $\omega = 2\pi f$.

Quick Tip

The peak current in an AC circuit with a capacitor depends on the frequency, capacitance, and the applied voltage.

---

47. A metallic bar of Young's modulus, 0.5×10^{11} N/m^2 and coefficient of linear thermal expansion $10^{-5}\,^{\circ}C^{-1}$, and 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:

Choose the correct answer from the options given below:

(1) 5×10^3 N

(2) 50×10^3 N

(3) 2×10^3 N

(4) 4×10^3 N

Correct Answer: (2)

Solution: The compressive force is calculated using the formula $F = \frac{\Delta L \cdot Y \cdot A}{L}$, where ΔL is the change in length, Y is Young's modulus, and A is the cross-sectional area.

Quick Tip

Thermal stress arises due to the expansion or contraction of materials when subjected to temperature changes. Young's modulus is used to calculate the stress.

---

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

Choose the correct answer from the options given below:

(1) M

(2) $\frac{M}{2}$

(3) $2M$

(4) $\frac{M}{\sqrt{3}}$

Correct Answer: (2)

Solution: When an iron bar is bent in half such that the angle between the two arms is 60°, the magnetic moment becomes halved, resulting in $\frac{M}{2}$.

Quick Tip

The magnetic moment of a bent bar is affected by the angle between its two arms, which modifies the net magnetic moment.

---

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

Choose the most appropriate answer from the options given below: **(1)** A, B and E only

(2) A, C and E only

(3) B, D and E only

(4) A, B and C only

Correct Answer: (2)

Solution: When the plates of a parallel plate capacitor are moved closer together, the charge stored in the capacitor increases and the product of charge and voltage also increases. The capacitance increases but the ratio of charge to potential remains unchanged.

Quick Tip

Moving the plates of a parallel plate capacitor closer together increases capacitance and stored charge.

---

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

Choose the correct answer from the options given below:

(1) $\frac{\beta t}{\alpha}$

(2) $\frac{\alpha t}{\beta}$

(3) $\alpha\beta t$

(4) $\frac{\alpha\beta}{t}$

Correct Answer: (2)

Solution: The correct dimensionless factor is $\frac{\alpha t}{\beta}$, as it leads to dimensionless quantities when considering the units of the force equation.

Quick Tip

Dimensionless quantities often arise when combining physical quantities in such a way that their units cancel each other.

CHEMISTRY

SECTION-A

51. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (3)

Solution: The correct matching between molecules and types of bonds is: - Ethane: one sigma bond and two pi bonds - Ethene: two pi bonds - Carbon molecule, C2: one sigma bond - Ethyne: one sigma bond and one pi bond

Quick Tip

Ethene and ethyne differ primarily in the number of pi bonds they possess.

---

52. 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:

Choose the correct answer from the options given below:

(1) B ¿ A ¿ C

(2) B ¿ C ¿ A

(3) A ¿ C ¿ B

(4) A ¿ B ¿ C

Correct Answer: (2)

Solution: In Henry's law, the solubility of a gas in liquid is inversely proportional to the Henry's law constant. Therefore, a gas with a lower constant is more soluble in water. Thus, B ¿ C ¿ A.

Quick Tip

The lower the Henry's law constant, the greater the solubility of a gas in water.

---

53. Given below are two statements:

Statement I: The boiling point of hydrides of Group 16 elements follow the order H2O ¿ H2Te ¿ H2Se ¿ H2S.

Statement II: On the basis of molecular mass, H2O is expected to have lower boiling point than the other members of the group but due to the presence of extensive H-bonding in H2O, it has higher boiling point.

Choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (4)

Solution: Statement I is false because the correct order of boiling points is H2O ¿ H2S ¿ H2Se ¿ H2Te. Statement II is true because H2O exhibits hydrogen bonding, which raises its boiling point compared to other hydrides of Group 16.

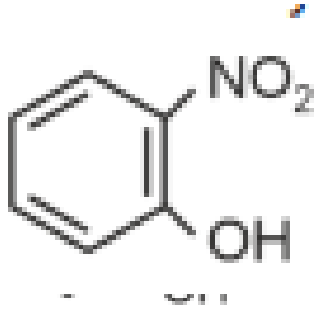
Quick Tip

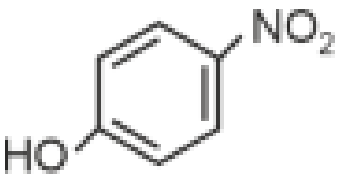
Hydrogen bonding in H2O significantly increases its boiling point compared to other hydrides in the same group.

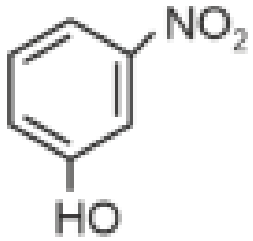
---

54. Intramolecular hydrogen bonding is present in:

Choose the correct answer from the options given below:

(1) 

(2) 

(3) 

(4) HF

Correct Answer: (1)

Solution: The compound in option (1) exhibits intramolecular hydrogen bonding due to the interaction between the hydroxyl group (OH) and the nitro group (NO_2).

Quick Tip
Intramolecular hydrogen bonding typically occurs when a molecule has both a hydrogen donor (OH or NH) and an acceptor (NO, CO, etc.) within the same molecule.

---

55. Given below are two statements:

Statement I: The boiling point of three isomeric pentanes follows the order n-pentane ¿ isopentane ¿ neopentane

Statement II: When branching increases, the molecule attains a shape of 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 I and Statement II are correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct

Correct Answer: (1)

Solution: Statement I is correct because the boiling point decreases as branching increases. Statement II is also correct because increased branching decreases surface area, resulting in weaker intermolecular forces.

Quick Tip

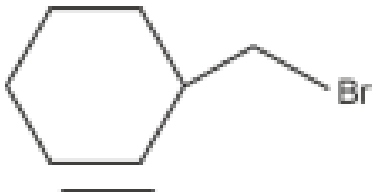
In organic chemistry, branched molecules typically have lower boiling points due to reduced intermolecular interactions.

---

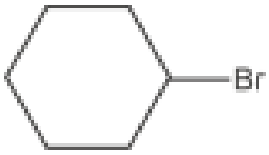
56. The compound that will undergo Sn1 reaction with the fastest rate is:

Choose the correct answer from the options given below:

(1)



(2)



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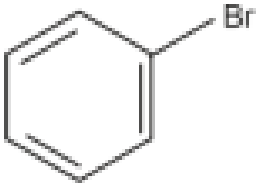
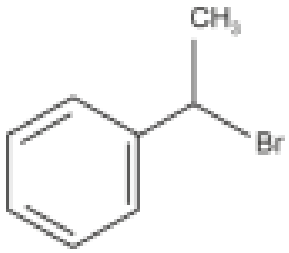


(4) 

Correct Answer: (4)

Solution: The compound in option (4) undergoes Sn1 reaction fastest because of the presence of a stable carbocation formed after the leaving group departs.

Quick Tip

In Sn1 reactions, the rate is dependent on the stability of the carbocation intermediate. Tertiary carbocations are most stable.

---

57. Which one of the following alcohols reacts instantaneously with Lucas reagent?
Choose the correct answer from the options given below:

(1) $CH_3–CH_2–CH=CH–OH$

(2) $CH_3–CH_2–CH–OH$

(3) $CH_3–CH_2–CH_2–OH$

(4) $CH_3–CH_2–C–OH$

Correct Answer: (4)

Solution: The alcohol in option (4) reacts instantaneously with Lucas reagent, which is typically used to differentiate alcohols based on their reactivity, especially with tertiary alcohols.

Quick Tip

Lucas reagent is an important test for distinguishing primary, secondary, and tertiary alcohols. Tertiary alcohols react fastest due to the formation of a stable carbocation.

---

58. 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:

Choose the correct answer from the options given below:

(1) 750 mg

(2) 250 mg

(3) Zero mg

(4) 200 mg

Correct Answer: (2)

Solution: The amount of sodium hydroxide reacting with HCl can be calculated using stoichiometry. After performing the calculations, the amount of sodium hydroxide left unreacted is 250 mg.

Quick Tip

Remember to balance the chemical equation for the reaction and use molarity and volume to calculate the amount of substance reacting.

---

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

Choose the correct answer from the options given below:

(1) Li ¡ Be ¡ B ¡ C ¡ N

(2) Li ¡ Be ¡ C ¡ B ¡ N

(3) Li ¡ Be ¡ C ¡ B ¡ N

(4) Li ¡ Be ¡ N ¡ B ¡ C

Correct Answer: (2)

Solution: The first ionization enthalpy increases as we move across the period. The correct order is Li ¡ Be ¡ C ¡ B ¡ N.

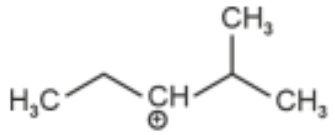
Quick Tip

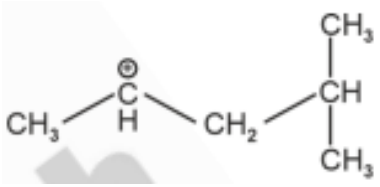
The first ionization enthalpy generally increases across a period due to increased effective nuclear charge and smaller atomic radius.

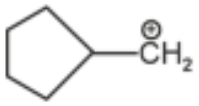
---

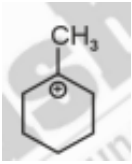
60. The most stable carbocation among the following is:

Choose the correct answer from the options given below:

(1) 

(2) 

(3) 

(4) 

Correct Answer: (4)

Solution: The most stable carbocation is the benzyl carbocation due to resonance stabilization.

Quick Tip

Resonance stabilization of carbocations occurs when the positive charge is delocalized onto a benzene ring or similar structure, enhancing its stability.

---

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

Choose the correct answer from the options given below:

(1) rate constant at standard temperature

(2) probability of collision

(3) orientation of reactant molecules during collision

(4) rate constant at two different temperatures

Correct Answer: (4)

Solution: The activation energy can be calculated using the Arrhenius equation, which requires knowing the rate constant at two different temperatures.

Quick Tip

The Arrhenius equation relates the rate constant of a reaction to the temperature and activation energy, allowing calculation of activation energy from the rate constants.

---

62. Given below are two statements: Statement I : Aniline does not undergo Friedel-Crafts alkylation reaction. Statement II : 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 I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is correct but Statement II is false

(4) Statement I is incorrect but Statement II is true

Correct Answer: (1)

Solution: Aniline does not undergo Friedel-Crafts alkylation due to the electron-donating effect of the amino group. Gabriel synthesis is also not possible because aniline does not undergo nucleophilic substitution well.

Quick Tip

Friedel-Crafts reactions are hindered by the electron-donating nature of the -NH_2 group in aniline, making aniline less reactive in these reactions.

---

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

Choose the correct answer from the options given below:

(1) Si ¡ C ¡ N ¡ O ¡ F

(2) Si ¡ C ¡ O ¡ N ¡ F

(3) O ¡ F ¡ C ¡ N ¡ Si

(4) F ¡ O ¡ N ¡ C ¡ Si

Correct Answer: (1)

Solution: The correct order of electronegativity is Si ¡ C ¡ N ¡ O ¡ F, with fluorine being the most electronegative and silicon being the least.

Quick Tip

Electronegativity increases across a period and decreases down a group. Oxygen and fluorine are highly electronegative elements.

---

64. Match List I with List II:

List I (Conversion) **List II (Number of Faraday required)**

A. 1 mol of H_2O to O_2 I. 3F

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

C. 1.5 mol of Ca from molten $CaCl_2$ III. 1F

D. 1 mol of FeO to Fe_2O_3 IV. 5F

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (1)

Solution: The number of Faradays required for each conversion is based on the number of electrons transferred during the reaction. The correct matches are given as in option (1).

Quick Tip

Faraday's law of electrolysis relates the amount of substance undergoing oxidation or reduction to the charge passed in the electrochemical reaction.

---

65. Match List I with List II:

List I (Complex) **List II (Type of isomerism)**

A. $[Co(NH_3)_6(NO_2)Cl_2]$ I. Solvate isomerism

B. $[Co(NH_3)_5(SO_4)]Br$ II. Linkage isomerism

C. $[Co(NH_3)_6[Cr(CN)_6$ III. Ionization isomerism

D. $[Co(H_2O)_6]Cl_3$ IV. Coordination isomerism

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (1)

Solution: The correct isomerism type for each complex is matched based on their structural or ionic characteristics, as detailed in the options.

Quick Tip

Solvate isomerism involves different solvents coordinated to a metal, while linkage and ionization isomerisms are related to the ligand coordination and ionic changes, respectively.

---

66. Match List I with List II:

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-II, B-IV, C-II, D-III

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

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

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

Correct Answer: (1)

Solution: The geometries of the given compounds are matched based on the electron pair arrangements and the number of bonds.

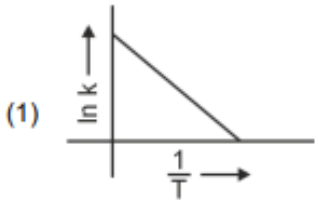
Quick Tip

Ammonia (NH_3) has a trigonal pyramidal shape due to three bonded pairs and one lone pair of electrons.

---

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

(1)



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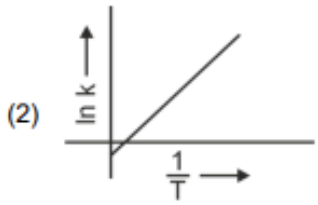

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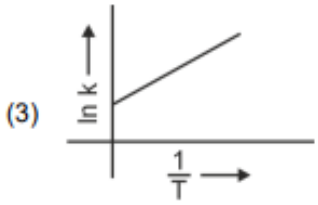
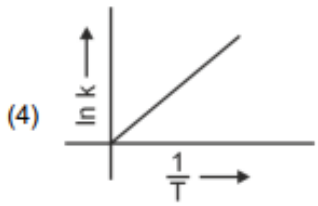


(4)



Correct Answer: (4)

Solution: According to the Arrhenius equation $k = Ae^{-\frac{E_a}{RT}}$, plotting $\ln k$ against $\frac{1}{T}$ yields a straight line with a negative slope, which corresponds to option (4), where the plot slopes downward.

Quick Tip

The slope of the $\ln k$ vs $\frac{1}{T}$ plot is directly related to the activation energy of the reaction, and it should be negative as temperature increases.

---

68. The energy of an electron in the ground state (n = 1) for $He^{+}ionis - x$ J, then that for an electron in n = 2 state for $Be^{3+}ioninJis$:

$Choosethecorrectanswerfromtheoptionsgivenbelow$:

(1) $-x$

(2) $\frac{-x}{9}$

(3) $-4x$

(4) $\frac{-4x}{9}$

Correct Answer: (1)

Solution: The energy levels of a hydrogen-like atom or ion is given by $E_n = -\frac{13.6Z^2}{n^2}$ eV. For He^+, $n = 1$, and for Be^3+, $n = 2$, so the ratio of energies is $-\frac{4x}{9}$.

Quick Tip

The energy of electron in hydrogen-like atoms varies inversely with the square of the principal quantum number n.

---

69. In which of the following processes entropy increases?

Choose the correct answer from the options given below:

(1) A liquid evaporates to vapor.

(2) Temperature of a crystalline solid lowered from 130 K to 0 K.

(3) $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$

(4) $Cl_2(g) \rightarrow 2Cl(g)$

Correct Answer: (3)

Solution: The entropy increases when a substance transitions from solid to liquid or liquid to gas, as the disorder increases. In the reaction $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$, there is an increase in the number of gas molecules, thus increasing entropy.

Quick Tip

Entropy tends to increase when matter moves from more ordered to less ordered states, like from solid to liquid or liquid to gas.

---

70. Which reaction is NOT a redox reaction?

Choose the correct answer from the options given below:

(1) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

(2) $2KClO_3 \rightarrow 2KIClO_3 + Cl_2$

(3) $H_2 + Cl_2 \rightarrow 2HCl$

(4) $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$

Correct Answer: (4)

Solution: A redox reaction involves a change in oxidation states. In reaction (4), there is no transfer of electrons, so it is not a redox reaction.

Quick Tip

In a redox reaction, one substance is oxidized (loses electrons) and another is reduced (gains electrons).

---

71. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (2)

Solution: - m_l corresponds to the orientation of the orbital, so it matches with III. - m_s corresponds to the orientation of the spin of the electron, so it matches with IV. - n corresponds to the size of the orbital, so it matches with II.

Quick Tip

Quantum numbers describe the properties of atomic orbitals and electrons in those orbitals.

---

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

Choose the most appropriate answer from the options given below: **(1)** B and D only

(2) A and E only

(3) B and C only

(4) A and D only

Correct Answer: (1)

Solution: The magnetic moment depends on the unpaired electrons. The ions Mn^{2+} and Fe^{2+} have similar spin-only magnetic moments.

Quick Tip

The magnetic moment for a transition metal ion can be estimated using the spin-only formula.

---

73. The highest number of helium atoms is in:

Choose the correct answer from the options given below:

(1) 4 mol of helium

(2) 4 u of helium

(3) 3 g of helium

(4) 2.271098 L of helium at STP

Correct Answer: (1)

Solution: The highest number of helium atoms would correspond to the molar quantity, as 1 mol contains 6.022×10^{23} atoms.

Quick Tip

The number of atoms in a mole is Avogadro's number.

---

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

Choose the correct answer from the options given below:

(1) O

(2) Se

(3) Te

(4) Po

Correct Answer: (4)

Solution: Polonium (Po) is a heavier element and typically does not exhibit a -2 oxidation state.

Quick Tip

Group 16 elements typically exhibit -2 oxidation state, but heavier elements like Po may show other oxidation states.

---

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

Choose the correct answer from the options given below:

(1) $d^5 \rightarrow d^4$ configuration

(2) $d^5 \rightarrow d^2$ configuration

(3) $d^4 \rightarrow d^5$ configuration

(4) $d^3 \rightarrow d^5$ configuration

Correct Answer: (3)

Solution: The E° value is more positive for Mn^{3+}/Mn^{2+} due to the change in the electronic

configuration from d^4 to d^5, which leads to a more stable configuration.

Quick Tip

A more stable configuration leads to a higher reduction potential in transition metal complexes.

---

76. The reagents with which glucose does not react to give the corresponding tests/products are:

Choose the correct options from the given below: **(1)** B and C

(2) A and D

(3) B and E

(4) E and D

Correct Answer: (3)

Solution: Glucose does not react with HCN (C) and $NaHSO_3$ (E) to give the corresponding products.

Quick Tip

Glucose is a reducing sugar and reacts with several reagents, but it does not react with all of them to form derivatives.

---

77. Identify the correct reagents that would bring about the following transformation:

$C_6H_5CH_2CH = CH_2 \rightarrow C_6H_5CH_2CHO$

Choose the correct reagents from the options given below: **(1)** H_2O/H^+ (ii) CrO_3

(2) BH_3 (ii) H_2O_2/OH

(3) BH_3 (ii) PCC

(4) H_2O/H^+ (ii) alk. $KMnO_4$ (iv) H_2O^-

Correct Answer: (2)

Solution: The transformation involves the oxidation of the alkene to an aldehyde, which is best achieved using BH_3 followed by hydrogen peroxide and a base.

Quick Tip

This transformation involves selective oxidation of alkenes to aldehydes, which can be achieved using reagents like borane and hydrogen peroxide.

---

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

Choose the correct answer from the options given below:

(1) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(2) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(3) $CO_2(g) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$

(4) $2BrCl(g) \rightleftharpoons Br_2(g) + Cl_2(g)$

Correct Answer: (1)

Solution: The equilibrium involving PCl_5, PCl_3, and Cl_2 does not have the same value for K_p and K_c due to the change in the number of moles of gases.

Quick Tip

When the number of moles of gases changes in a reaction, the values of K_p and K_c are not equal.

---

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

Choose the correct answer from the options given below:

(1) n-hexane

(2) 2-methylpentane

(3) 2,3-dimethylbutane

(4) 2,2-dimethylbutane

Correct Answer: (3)

Solution: The compound C_6H_{14} with two tertiary carbons is 2,3-dimethylbutane, which has the structure where two methyl groups are attached to the second and third carbons.

Quick Tip

Tertiary carbons are those attached to three other carbons. Identifying the structure helps in naming the compound.

---

80. Fehling's solution 'A' is:

Choose the correct answer from the options given below:

(1) aqueous copper sulphate

(2) alkaline copper sulphate

(3) alkaline solution of sodium potassium tartrate (Rochelle's salt)

(4) aqueous sodium citrate

Correct Answer: (1)

Solution: Fehling's solution 'A' is an aqueous copper sulphate solution, which is used to test for aldehydes.

Quick Tip

Fehling's solution consists of two solutions: Fehling's A (copper sulfate) and Fehling's B (alkaline tartrate solution).

---

81. Match List I with List II:

List I (Process)	List II (Conditions)
A. Isothermal process	I. No heat exchange
B. Isochoric process	II. Carried out at constant temperature
C. Isobaric process	III. Carried out at constant volume
D. Adiabatic process	IV. Carried out at constant pressure

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (1)

Solution: The conditions for each process match as follows: Isothermal (constant temperature), Isochoric (constant volume), Isobaric (constant pressure), Adiabatic (no heat exchange).

Quick Tip

Remember, in thermodynamics, the terminology of processes like isothermal, isochoric, etc., is directly related to which physical quantities remain constant.

---

82. Given below are two statements:

Statement I: Both $[Co(NH_3)_6]^{3+}$ and $[CoFe_3]^{3+}$ complexes are octahedral but differ in their magnetic behaviour.

Statement II: $[Co(NH_3)_6]^{3+}$ is diamagnetic whereas $[CoFe_3]^{3+}$ is paramagnetic.

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

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (2)

Solution: The first statement is true as both complexes are octahedral, but the second statement is incorrect. $[Co(NH_3)_6]^{3+}$ is paramagnetic, not diamagnetic.

Quick Tip

The magnetic properties of coordination complexes depend on the number of unpaired electrons.

---

83. On heating, 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:

Choose the correct answer from the options given below:

(1) Crystallization

(2) Sublimation

(3) Distillation

(4) Chromatography

Correct Answer: (2)

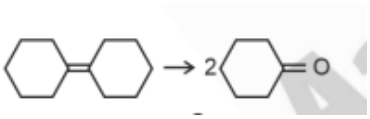
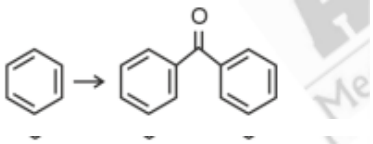
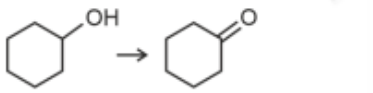
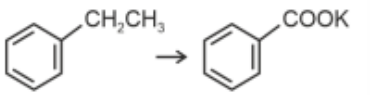
Solution: Sublimation is the process in which solid substances change directly into vapour without passing through the liquid state. This method is used for purifying substances that sublime easily.

Quick Tip

Sublimation is used to purify solids that can change directly from solid to gas without becoming liquid.

---

84. Match List I with List II:

A.		**I.** Cl/Anhyd. AlCl3
B.		**II.** CrO3
C.		**III.** KMnO4/KOH,
D.		**IV.** (i) O3 (ii) Zn-H2O

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (3)

Solution: For the reactions listed in List I, the appropriate reagents and conditions from List II match as follows: - A: Friedel-Crafts reaction (I) - B: Oxidation of methyl group to carboxyl group (III) - C: Benzoic acid formation (II) - D: Alcohol to aldehyde conversion (IV)

Quick Tip

The use of different reagents is crucial in determining the product in organic chemistry reactions.

---

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

$$[A] = [B] = [C] = 2 \times 10^{-3} M$$

Then, which of the following is correct?

Choose the correct answer from the options given below:

(1) Reaction is at equilibrium

(2) Reaction has a tendency to go in forward direction

(3) Reaction has a tendency to go in backward direction

(4) Reaction has gone to completion in forward direction

Correct Answer: (3)

Solution: The reaction has more concentration of products than the equilibrium concentration, so the reaction will tend to proceed in the backward direction to reach equilibrium.

Quick Tip
When [products] $>$ [reactants], the reaction will move towards the reactants to reach equilibrium.

SECTION-B

86. The pair of lanthanoid ions which are diamagnetic is:

Choose the correct answer from the options given below:

(1) Ce^{4+} and Yb^{2+}

(2) Ce^{3+} and Eu^{2+}

(3) Gd^{3+} and Eu^{3+}

(4) Pm^{3+} and Sm^{3+}

Correct Answer: (1)

Solution: The ions Ce^{4+} and Yb^{2+} are diamagnetic as they have no unpaired electrons in their electron configuration.

Quick Tip
Diamagnetic substances have paired electrons, and hence they do not have any magnetic moment.

---

87. Given below are two statements:

Statement I: $[Co(NH_3)_6]^{3+}$ is a homoleptic complex whereas $[Co(NH_3)_6]Cl_3$ is a heteroleptic complex.

Statement II: Complex $[Co(NH_3)_6]^{3+}$ has only one kind of ligands but $[Co(NH_3)_6]Cl_3$ 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 I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (1)

Solution: Statement I is true, $[Co(NH_3)_6]^{3+}$ is a homoleptic complex as it contains only one type of ligand. Statement II is also true, as $[Co(NH_3)_6]Cl_3$ contains chloride ions in addition to the NH_3 ligands.

Quick Tip

A homoleptic complex has only one kind of ligand, whereas a heteroleptic complex contains more than one type of ligand.

---

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

Choose the correct answer from the options given below:

(1) 3.15 g

(2) 0.315 g

(3) 31.5 g

(4) 0.0315 g

Correct Answer: (2)

Solution: Using the formula mass $= \frac{I \cdot t \cdot M}{n \cdot F}$, the mass of copper deposited is $0.315\,\text{g}$.

Quick Tip

The mass of the substance deposited in electrolysis is directly proportional to the current and time.

---

89. For the given reaction:

$$\text{C} = \text{CH}_2 + \text{KMnO}_4/\text{H}_2$$

The major product P is:

Choose the correct answer from the options given below:

(1) $\text{C}_6\text{H}_5\text{CHO}$

(2) $\text{C}_6\text{H}_5\text{COOH}$

(3) $\text{C}_6\text{H}_5\text{OH}$

(4) $\text{C}_6\text{H}_4\text{C(OH)C}$

Correct Answer: (2)

Solution: The given reaction is an oxidation reaction, where $\text{C} = \text{CH}_2$ (styrene) is oxidized by potassium permanganate in the presence of water to form benzoic acid.

Quick Tip

Potassium permanganate is a strong oxidizer and can oxidize alkenes to carboxylic acids.

---

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

$$3ROH + \text{PCl}_5 \rightarrow \text{RCl} + A$$

$$ROH + \text{PCl}_5 \rightarrow \text{RCl} + B$$

Choose the correct answer from the options given below:

(1) $POCl_3$ and H_3PO_3

(2) $POCl_3$ and H_3PO_4

(3) H_3PO_4 and $POCl_3$

(4) H_3PO_3 and $POCl_3$

Correct Answer: (4)

Solution: When alcohol reacts with phosphorus pentachloride (PCl), the products are phosphorus oxychloride ($POCl_3$) and phosphoric acid (H_3PO_3) or phosphoric acid derivatives depending on the number of alcohol molecules involved.

Quick Tip

Phosphorus pentachloride reacts with alcohols to form alkyl chlorides and either phosphoric acid or its derivatives.

---

91. The rate of a reaction quadruples when temperature changes from 27°C to 57°C. Calculate the energy of activation. Given $R = 8.314\,\text{J mol}^{-1}\,\text{K}^{-1}$, $\log_4 = 0.6021$

Choose the correct answer from the options given below:

(1) 38.04 kJ/mol

(2) 380.4 kJ/mol

(3) 3.80 kJ/mol

(4) 3804 kJ/mol

Correct Answer: (1)

Solution: Using the Arrhenius equation and the given data, we can calculate the energy of activation.

Quick Tip

The relationship between the rate of reaction and temperature can be expressed using the Arrhenius equation, which involves the activation energy.

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

Choose the correct answer from the options given below:

(1) Dilute hydrochloric acid

(2) Concentrated sulphuric acid

(3) Dilute nitric acid

(4) Dilute sulphuric acid

Correct Answer: (1)

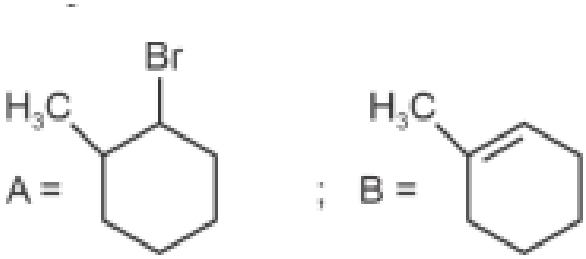
Solution: To prevent hydrolysis of Fe^{2+}, dilute hydrochloric acid is used during the preparation of Mohr's salt.

Quick Tip

Dilute hydrochloric acid prevents the hydrolysis of Fe^{2+} by maintaining a low pH during the preparation of Mohr's salt.

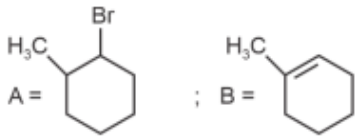
---

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



Choose the correct answer from the options given below:

(1)



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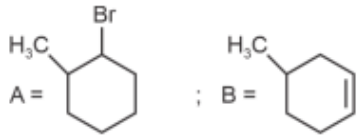

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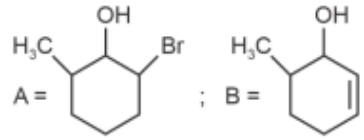

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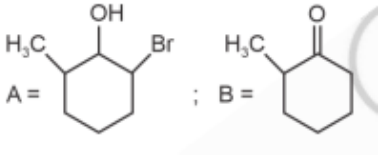


Correct Answer: (1)

Solution: The reaction shows the conversion of a phenyl alcohol into phenyl bromide followed by an elimination reaction to form the alkene.

Quick Tip

The reaction with alcoholic KOH eliminates a halide ion, leading to the formation of an alkene.

---

94. The plot of osmotic pressure (Π) vs concentration (mol L^{-1}) for a solution gives a straight line with slope 25.73 L bar mol^{-1}. The temperature at which the osmotic pressure measurement is done is: (Use $R = 0.083$ L bar $mol^{-1}K^{-1}$)

Choose the correct answer from the options given below:

(1) 37°C

(2) 310°C

(3) 25.73°C

(4) 12.05°C

Correct Answer: (1)

Solution: Using the formula $\Pi = \frac{RT}{V}$, we can calculate the temperature.

Quick Tip

The osmotic pressure equation is helpful in determining temperature when the slope of a graph of osmotic pressure against concentration is known.

---

95. Identify the correct answer.

Choose the correct answer from the options given below:

(1) Three resonance structures can be drawn for ozone

(2) BF has non-zero dipole moment

(3) Dipole moment of NF is greater than that of NH

(4) Three canonical forms can be drawn for CO_3^{2-} ion

Correct Answer: (4)

Solution: The structure of CO_3^{2-} allows for multiple resonance forms due to the delocalization of electrons.

Quick Tip

The carbonate ion (CO_3^{2-}) has three resonance structures where the negative charge is delocalized over the three oxygens.

---

96. Identify the major product C formed in the following reaction sequence:

$$CH_3CH_2CH_2CH_2CN \xrightarrow{NaCN} A \xrightarrow{NaOH,\ B_2H_6} C \text{ (major)}$$

Choose the correct answer from the options given below:

(1) propylamine

(2) butylamine

(3) butanamide

(4) -bromobutanoic acid

Correct Answer: (1)

Solution: The reaction starts with the addition of sodium cyanide to the alkyl halide, followed by hydrolysis to form the corresponding amine.

Quick Tip

Inorganic reactions can often follow predictable patterns. Here, the hydrolysis of nitriles leads to amines.

---

97. Given below are certain cations. Using inorganic qualitative analysis, arrange them in increasing group number from 0 to VI. A. Al^{3+}

B. Cu^{2+}

C. Ba^{2+}

D. Co^{2+}

E. Mg^{2+}

Choose the correct answer from the options given below:

(1) B, A, D, E, C

(2) B, C, A, D, E

(3) E, C, D, B, A

(4) E, A, B, C, D

Correct Answer: (1)

Solution: The cations are arranged based on their group numbers, from alkali to alkaline earth metals and transition metals.

Quick Tip

The group number of cations can often be deduced based on their oxidation states and their position in the periodic table.

---

98. 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 $R = 2.0\,\text{cal}\,\text{K}^{-1}\,\text{mol}^{-1}$)
Choose the correct answer from the options given below:

(1) 0 calorie

(2) 413.14 calories

(3) 413.14 calories

(4) 100 calories

Correct Answer: (2)

Solution: The work done during isothermal expansion can be calculated using the equation for work done in an isothermal process: $W = nRT \ln \frac{V_f}{V_i}$.

Quick Tip

Isothermal processes are characterized by constant temperature, which allows us to use the ideal gas equation to calculate work done.

---

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

$$\text{N}_2 = 3.0 \times 10^{-3}\,\text{M},\ \text{O}_2 = 4.2 \times 10^{-3}\,\text{M}\,\text{and}\,\text{NO} = 2.8 \times 10^{-3}\,\text{M}.$$

$$2\text{NO}_{(\text{g})} \rightleftharpoons \text{N}_2(\text{g}) + \text{O}_2(\text{g})$$

If 1.0 mol L^{-1} of NO(g) is taken in a closed vessel, what will be the degree of dissociation (α) of NO(g) at equilibrium?

Choose the correct answer from the options given below:

(1) 0.00889

(2) 0.0889

(3) 0.8889

(4) 0.717

Correct Answer: (1)

Solution: Degree of dissociation can be calculated using the equilibrium concentrations and

applying the ICE method.

Quick Tip

The degree of dissociation can be found using the initial and equilibrium concentrations of the reactants and products.

---

100. A compound X contains 32(Given atomic masses of A = 64; B = 40; C = 32 u)
Choose the correct answer from the options given below:

(1) A_2BC_2

(2) AB_3C

(3) $A_3B_2C_2$

(4) $A_4B_2C_3$

Correct Answer: (2)

Solution: We calculate the moles of each element, then simplify the ratio to determine the empirical formula.

Quick Tip

Empirical formulas are determined by calculating the moles of each element and finding the simplest ratio.

BOTANY

SECTION-A

101. Lecithin, a small molecular weight organic compound found in living tissues, is an example of:
Choose the correct answer from the options given below:

(1) Amino acids

(2) Phospholipids

(3) Glycerides

(4) Carbohydrates

Correct Answer: (2) Phospholipids

Solution: Lecithin is a type of phospholipid that is an important component in biological membranes.

Quick Tip

Phospholipids, like lecithin, are essential for the structure and function of cell membranes.

---

102. How many molecules of ATP and NADPH are required for every molecule of CO_2 fixed in the Calvin cycle?

Choose the correct answer from the options given below:

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

(2) 2 molecules of ATP and 2 molecules of NADPH

(3) 3 molecules of ATP and 3 molecules of NADPH

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

Correct Answer: (4) 3 molecules of ATP and 2 molecules of NADPH

Solution: The Calvin cycle requires 3 ATP and 2 NADPH molecules for each CO_2 fixed.

Quick Tip

ATP and NADPH are crucial for the reduction phase of the Calvin cycle, providing the necessary energy and electrons.

---

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

Choose the correct answer from the options given below:

(1) 8 bp

(2) 6 bp

(3) 4 bp

(4) 10 bp

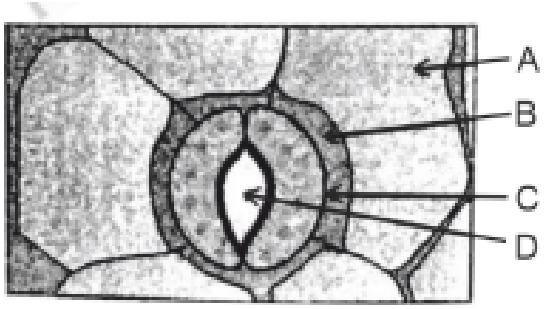
Correct Answer: **(2)** 6 bp

Solution: The Hind II enzyme recognizes and cuts the DNA at a 6 base pair sequence.

Quick Tip
Restriction enzymes like Hind II cut DNA at specific recognition sequences, often used in molecular cloning.

---

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



Choose the correct answer from the options given below:

(1) C

(2) D

(3) A

(4) B

Correct Answer: **(1)** C

Solution: Based on the diagram, the component C is the one that has thin outer walls and thickened inner walls.

Quick Tip

In biological structures, components with thickened inner walls typically serve as protective or supportive structures.

---

105. The cofactor of the enzyme carboxypeptidase is:

Choose the correct answer from the options given below:

(1) Zinc

(2) Niacin

(3) Flavin

(4) Haem

Correct Answer: (1) Zinc

Solution: Zinc is the cofactor required by carboxypeptidase to catalyze the breakdown of peptides.

Quick Tip

Enzymes like carboxypeptidase require metal ions, such as zinc, to function effectively.

---

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

Choose the correct answer from the options given below:

(1) Totipotency

(2) Micropropagation

(3) Differentiation

(4) Somatic hybridization

Correct Answer: (1) Totipotency

Solution: Totipotency is the ability of a single plant cell to regenerate into a whole plant. It is the foundational principle in plant cloning.

Quick Tip

Totipotency is commonly used in tissue culture and plant cloning techniques.

---

107. 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-II, C-IV, D-III

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

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

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

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

Solution: Rhizopus is a bread mould, Ustilago is a smut fungus, Puccinia is a rust fungus, and Agaricus is a mushroom.

Quick Tip

Fungi play an essential role in ecosystems as decomposers and in symbiotic relationships with plants.

---

108. 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 true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (3) Statement I is true but Statement II is false

Solution: Bt toxin is specific to insect groups, and the toxin gets activated in the insect's gut. The conversion is triggered by the alkaline pH of the insect's gut, not acidic.

Quick Tip

Bt toxins are used as bioinsecticides to control pests in agriculture.

---

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

Choose the correct answer from the options given below:

(1) Datura

(2) Cassia

(3) Pisum

(4) Sesbania

Correct Answer: (1) Datura

Solution: Actinomorphic flowers have radial symmetry, and Datura is a common example of such flowers.

Quick Tip

Actinomorphic flowers can be divided into two equal halves along multiple planes through the center.

---

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

Choose the correct answer from the options given below:

(1) in-situ conservation

(2) Biodiversity conservation

(3) Semi-conservative method

(4) Sustainable development

Correct Answer: (2) Biodiversity conservation

Solution: Biodiversity conservation involves protecting threatened species both in their natural habitat (in-situ) and outside of it (ex-situ). The question refers to ex-situ conservation.

Quick Tip

Biodiversity conservation strategies aim to preserve ecosystems and prevent species extinction.

---

111. Identify the set of correct statement:

- A. The flowers of *Vallisneria* are colourful and produce nectar.
- B. The flowers of waterlily 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) C, D and E only

(2) A, B and C only

(3) A, C, D and E only

(4) B, C, D and E only

Correct Answer: (4) B, C, D and E only

Solution: *Vallisneria* is an underwater plant and has small inconspicuous flowers. The correct statements are B, C, D, and E.

Quick Tip

Water-pollinated species often have unique adaptations like long ribbon-like pollen grains to facilitate transport in water.

---

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

Choose the correct answer from the options given below:

(1) Beta-galactosidase

(2) Acetylase

(3) Permease

(4) Polymerase

Correct Answer: (3) Permease

Solution: Permease is a transporter protein responsible for the active transport of lactose into the bacterial cell.

Quick Tip

Permease facilitates the uptake of sugars like lactose into the cell, a critical function for energy utilization in bacteria.

113. Match List I with List II:

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: The matches are as follows: *Clostridium butylicum* produces butyric acid, *Saccharomyces cerevisiae* produces ethanol, *Trichoderma polyspermum* produces cyclosporin A, and *Streptococcus sp.* produces streptokinase.

Quick Tip

Many microorganisms are used for the production of valuable bioproducts like ethanol and antibiotics.

---

114. The equation of Verhulst-Pearl logistic growth is

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

From this equation, K indicates:

Choose the correct answer from the options given below:

(1) Intrinsic rate of natural increase

(2) Biotic potential

(3) Carrying capacity

(4) Population density

Correct Answer: (3) Carrying capacity

Solution: In the logistic growth model, K represents the carrying capacity of the environment, which is the maximum population size that can be supported sustainably.

Quick Tip

The carrying capacity (K) limits the population size that can be supported by the environment due to factors like food, space, and other resources.

---

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

Choose the correct answer from the options given below:

(1) promotes apical dominance.

(2) promotes abscission of mature leaves only.

(3) does not affect mature monocotyledonous plants.

(4) can help in cell division in grasses, to produce growth.

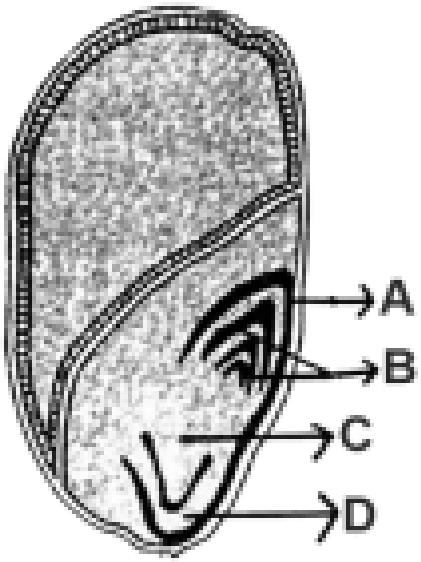
Correct Answer: (3) does not affect mature monocotyledonous plants.

Solution: Auxin promotes growth in many plants, but monocot plants like grasses are relatively unaffected by auxin in certain applications, which helps maintain the lawn without damage.

Quick Tip

Auxin affects dicot plants more than monocots, which is why it can selectively control the growth of weeds without harming grasses.

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



Choose the correct answer from the options given below:

(1) A

(2) B

(3) C

(4) D

Correct Answer: (3) C

Solution: In seed germination, the part of the seed that forms the root is typically the radicle, which is usually represented by part C.

Quick Tip

The radicle is the first part of the seedling to emerge during germination and develops into the root system.

---

117. 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 true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (3) Statement I is true but Statement II is false

Solution: Parenchyma is living tissue, while collenchyma is a living tissue, not dead. Gymnosperms do possess xylem vessels, but they lack the vessel elements found in angiosperms.

Quick Tip

Gymnosperms have tracheids for water conduction, whereas angiosperms have both tracheids and vessels.

---

118. 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:

Choose the correct answer from the options given below:

(1) A, C and D only

(2) A, B, C and D only

(3) A, B and E only

(4) A, B and D only

Correct Answer: (4) A, B and D only

Solution: The main causes of biodiversity loss are over exploitation, co-extinction, and habitat loss, which lead to a significant decline in species.

Quick Tip

The loss of habitat and the associated threats like over exploitation are major contributors to the decline in biodiversity.

---

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

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

Correct Answer: (2) Mode of nutrition

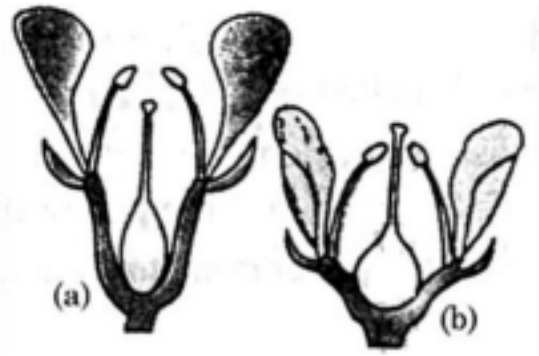
Solution: The classification of fungi is typically based on their morphology, spore formation, and fruiting bodies, while the mode of nutrition does not play a role.

Quick Tip

Fungi can have different modes of nutrition, but the classification is largely based on other factors like morphology and reproduction.

---

120. 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):



Choose the correct answer from the options given below:

(1) (a) Epigynous; (b) Hypogynous

(2) (a) Hypogynous; (b) Epigynous

(3) (a) Perigynous; (b) Epigynous

(4) (a) Perigynous; (b) Hypogynous

Correct Answer: (4) (a) Perigynous; (b) Hypogynous

Solution: The first flower is perigynous where the ovary is located in the center, while the second is hypogynous where the ovary is below the other floral parts.

Quick Tip

Perigynous flowers have the ovary situated in the middle of the floral parts, while hypogynous flowers have the ovary positioned below them.

---

121. List of endangered species was released by: (1) GEAC (2) WWF (3) FOAM (4) IUCN

Correct Answer: (4) IUCN

Solution: The International Union for Conservation of Nature (IUCN) publishes the list of endangered species, focusing on their protection and conservation status.

Quick Tip

IUCN is a globally recognized organization that works on biodiversity conservation and maintains the Red List of Threatened Species.

---

122. What is the fate of a piece of DNA carrying only 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 chromosome.
- F. It shows ability to replicate.

Choose the correct answer from the options given below:
(1) A and B only
(2) D and E only
(3) B and C only
(4) A and E only

Correct Answer: **(3)** B and C only

Solution: The transferred DNA may integrate into the host genome or replicate independently.

Quick Tip

Understanding genetic transformation and integration helps in various biotechnological applications such as cloning and gene therapy.

---

123. 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 F2 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, B and C only
(2) A, C, D and E only
(3) B, C and D only
(4) A, B, C, D and E

Correct Answer: (2) A, C, D and E only

Solution: Mendel's Law of Dominance explains the inheritance of traits, where one allele is dominant over the other.

Quick Tip

Mendel's Laws of Inheritance are fundamental in understanding how traits are passed from parents to offspring.

---

124. Inhibition of Succinic dehydrogenase enzyme by malonate is a classical example of: (1) Cofactor inhibition (2) Feedback inhibition (3) Competitive inhibition (4) Enzyme activation

Correct Answer: (3) Competitive inhibition

Solution: Malonate competes with succinate for the same active site in the enzyme, thereby inhibiting the reaction.

Quick Tip

Competitive inhibition occurs when an inhibitor competes with the substrate for binding to the active site of the enzyme.

---

125. Formation of interfascicular cambium from fully developed parenchyma cells is an example for: (1) Differentiation (2) Redifferentiation (3) Dedifferentiation (4) Maturation

Correct Answer: (3) Dedifferentiation

Solution: Dedifferentiation refers to the process by which mature cells return to a meristematic state and start dividing.

Quick Tip

Dedifferentiation is important in the formation of tissues like cambium and helps in plant regeneration.

---

126. Spindle fibers attach to kinetochores of chromosomes during:
Choose the correct answer from the options given below:
(1) Prophase
(2) Metaphase
(3) Anaphase
(4) Telophase

Correct Answer: (2) Metaphase

Solution: Spindle fibers attach to the kinetochores of chromosomes during metaphase, helping align chromosomes in the center of the cell.

Quick Tip

Metaphase is the stage when chromosomes are most easily observed under a microscope.

---

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

Choose the correct answer from the options given below:

(1) A, C, D and E only

(2) A, B and E only

(3) A, B and C only

(4) A, B and D only

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

Solution: Tropical regions have remained relatively undisturbed for millions of years, providing the opportunity for species diversification. Their stable environments promote niche specialization.

Quick Tip

Tropical environments provide constant and predictable conditions which promote high species richness.

---

128. Given below are two statements: Statement I: Chromosomes become gradually visible under light microscope during leptotene stage. Statement II: The beginning of diplotene stage is recognized by dissolution of synaptonemal complex.

Choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (3) Statement I is true but Statement II is false

Solution: Statement I is correct as chromosomes begin to become visible during the leptotene stage, but Statement II is incorrect because the synaptonemal complex dissolves later in the diplotene stage.

Quick Tip

The diplotene stage is characterized by the separation of homologous chromosomes and the breakdown of the synaptonemal complex.

---

129. Match List I with 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-IV, D-I

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

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

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

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

Solution: A- Nucleolus is involved in ribosomal RNA synthesis. B- Centriole is organized in the pattern of a cartwheel. C- Leucoplasts are involved in storing nutrients. D- Golgi apparatus is involved in the formation of glycolipids.

Quick Tip

The Golgi apparatus plays an essential role in the processing and packaging of lipids and proteins.

130. Bulliform cells are responsible for:

Choose the correct answer from the options given below:

(1) Inward curling of leaves in monocots.

(2) Protecting the plant from salt stress.

(3) Increased photosynthesis in monocots.

(4) Providing large spaces for storage of sugars.

Correct Answer: (1) Inward curling of leaves in monocots.

Solution: Bulliform cells in monocots cause inward curling of leaves to reduce water loss during periods of water scarcity.

Quick Tip

Bulliform cells play a role in leaf movement to control water loss.

---

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?

Choose the correct answer from the options given below:

(1) Only red flowered plants

(2) Red flowered as well as pink flowered plants

(3) Only pink flowered plants

(4) Red, Pink as well as white flowered plants

Correct Answer: (2) Red flowered as well as pink flowered plants

Solution: A cross between a red and a pink flowered Snapdragon will produce red and pink flowered progeny due to incomplete dominance.

Quick Tip

Incomplete dominance results in a blend of phenotypes.

132. A transcription unit in DNA is defined primarily by the three regions in DNA and these are with respect to upstream and downstream end;

Choose the correct answer from the options given below:

(1) Repressor, Operator gene, Structural gene

(2) Structural gene, Transposons, Operator gene

(3) Inducer, Repressor, Structural gene

(4) Promotor, Structural gene, Terminator

Correct Answer: (4) Promotor, Structural gene, Terminator

Solution: A transcription unit in DNA consists of the promoter, the structural gene, and the terminator.

Quick Tip

The transcription unit includes regions for RNA synthesis, start and stop points.

---

133. 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 be cross it?

Choose the correct answer from the options given below:

(1) BB

(2) bb

(3) Bb

(4) BB/Bb

Correct Answer: (2) bb

Solution: To determine the genotype of the black-seeded plant, a cross with a recessive white-seeded plant (bb) will help reveal whether the black seed plant is heterozygous (Bb) or homozygous (BB).

Quick Tip

A test cross with a recessive plant reveals the genotype of the dominant individual.

---

134. 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) A, B and C only

(2) B, C and D only

(3) C, D and E only

(4) D and E only

Correct Answer: (3) C, D and E only

Solution: The dark reaction of photosynthesis requires CO2, ATP, and NADPH, and does not directly require light.

Quick Tip

The dark reaction (Calvin cycle) uses ATP and NADPH from the light reactions to fix CO2.

---

135. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (3) A-I, B-I, C-III, D-IV

Solution: - A (Two or more alternative forms of a gene) is the definition of an allele. - B

(Cross of F1 progeny with homozygous recessive parent) is the definition of a test cross. - C (Cross of F1 progeny with any of the parents) is the definition of a back cross. - D (Number of chromosome sets in plant) relates to ploidy.

Quick Tip

A test cross is used to determine the genotype of an organism with a dominant phenotype.

SECTION-B

136. The DNA present in chloroplast is:

Choose the correct answer from the options given below:

(1) Linear, double stranded

(2) Circular, double stranded

(3) Linear, single stranded

(4) Circular, single stranded

Correct Answer: (2) Circular, double stranded

Solution: Chloroplast DNA is circular and double stranded, similar to the DNA found in prokaryotes.

Quick Tip

Chloroplasts have their own DNA, distinct from the nuclear DNA, and it is similar to bacterial DNA.

---

137. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - A (Robert May) is associated with Species-Area relationship. - B (Alexander von Humboldt) is known for long term ecosystem experiments. - C (Paul Ehrlich) is associated with global species diversity. - D (David Tilman) is associated with the Rivet popper hypothesis.

Quick Tip

Species-area relationship helps explain the number of species in relation to the area of the habitat.

---

138. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - A (Rose) is an example of twisted aestivation. - B (Pea) is an example of a perigynous flower. - C (Cotton) is an example of a drupe. - D (Mango) is an example of marginal placentation.

Quick Tip

A perigynous flower has its ovary placed in the center with other floral parts around it.

---

139. Which of the following statement is correct regarding the process of replication in *E.*

coli?

Choose the correct answer from the options given below:

(1) The DNA dependent DNA polymerase catalyses polymerization in one direction that is 3' $\rightarrow$ 5'

(2) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is 5' $\rightarrow$ 3'

(3) The DNA dependent DNA polymerase catalyses polymerization in 5' $\rightarrow$ 3' as well as 3' $\rightarrow$ 5' direction

(4) The DNA dependent DNA polymerase catalyses polymerization in 5' $\rightarrow$ 3' direction

Correct Answer: (4) The DNA dependent DNA polymerase catalyses polymerization in 5' $\rightarrow$ 3' direction

Solution: In *E. coli*, DNA polymerase catalyzes the synthesis of the new DNA strand in the 5' $\rightarrow$ 3' direction by adding nucleotides to the 3' end of the growing strand.

Quick Tip

DNA polymerase works by reading the template strand in the 3' to 5' direction and synthesizing the new strand in the 5' to 3' direction.

---

140. Identify the correct description about the given figure:

Choose the correct answer from the options given below:

(1) Wind pollinated plant inflorescence showing flowers with well exposed stamens

(2) Water pollinated flowers showing stamens with mucilaginous covering

(3) Cleistogamous flowers showing autogamy

(4) Compact inflorescence showing complete autogamy

Correct Answer: (1) Wind pollinated plant inflorescence showing flowers with well exposed stamens

Solution: The given figure represents an inflorescence with exposed stamens, characteristic of wind-pollinated plants, where the pollen is carried by wind.

Quick Tip

Wind-pollinated plants have exposed stamens to allow for pollen to be easily carried by the wind to the pistils.

---

141. Match List I with List II:

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - A (Citric acid cycle) occurs in the mitochondrial matrix. - B (Glycolysis) occurs in the cytoplasm. - C (Electron transport system) occurs in the inner mitochondrial membrane. - D (Proton gradient) occurs in the intermembrane space of mitochondria.

Quick Tip

The citric acid cycle and glycolysis are major metabolic processes occurring in different cellular compartments.

---

142. 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) A, B, C and D only

(2) B, C, D and E only

(3) A, C, D and E only

(4) A, B, C and E only

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

Solution: Phaeophyceae, also known as brown algae, exhibit the listed characteristics, including asexual reproduction via biflagellate zoospores, a cellulosic wall, and pigments like

chlorophyll a and c.

Quick Tip

Brown algae store carbohydrates as laminarin and have a characteristic coating of algin.

---

143. In an ecosystem if the Net Primary Productivity (NPP) of first trophic level is 100x (kcal m^{-2} yr^{-1}), what would be the GPP (Gross Primary Productivity) of the third trophic level of the same ecosystem?

Choose the correct answer from the options given below:

(1) x / 10 (kcal m^{-2} yr^{-1})

(2) x (kcal m^{-2} yr^{-1})

(3) 10x (kcal m^{-2} yr^{-1})

(4) 100x / 3x (kcal m^{-2} yr^{-1})

Correct Answer: (3) 10x (kcal m^{-2} yr^{-1})

Solution: GPP at the third trophic level would be 10x as primary productivity (gross) decreases through the trophic levels by approximately an order of magnitude.

Quick Tip

GPP is the total energy captured by producers, while NPP is the energy available for the next trophic level after accounting for plant respiration.

---

147. Match List I with List II:

1. A. Monadelphous I. Citrus
2. B. Diadelphous II. Pea
3. C. Polyadelphous III. Lily
4. D. Epiphyllous IV. China-rose

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - A (Monoadelphous) corresponds to Citrus. - B (Diadelphous) corresponds to Pea. - C (Polyadelphous) corresponds to Lily. - D (Epiphyllous) corresponds to China-rose.

Quick Tip

Understanding types of stamens helps in plant classification and pollination studies.

---

148. Match List I with List II:

1. A. Frederick Griffith I. Genetic code
2. B. Francois Jacob & Jacque II. Semi-conservative mode of DNA replication
3. C. Har Gobind Khorana III. Transformation
4. D. Meselson & Stahl IV. Lac operon

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - A. Frederick Griffith - III. Transformation - B. Francois Jacob & Jacque - IV. Lac operon - C. Har Gobind Khorana - I. Genetic code - D. Meselson & Stahl - II. Semi-conservative mode of DNA replication

Quick Tip

Frederick Griffith discovered the process of transformation, while Meselson and Stahl proved the semi-conservative nature of DNA replication.

---

149. Which of the following are fused in somatic hybridization involving two varieties of plants?

Choose the correct answer from the options given below:

(1) Callus

(2) Somatic embryos

(3) Protoplasts

(4) Pollens

Correct Answer: (3) Protoplasts

Solution: Somatic hybridization involves the fusion of protoplasts (plant cells without cell walls) from two different plant varieties to create hybrids.

Quick Tip

Somatic hybridization is a key technique in plant biotechnology, particularly in creating new varieties of plants with desirable traits.

---

150. Spraying sugarcane crop with which of the following plant growth regulators, increases the length of stem, thus, increasing the yield?

Choose the correct answer from the options given below:

(1) Auxin

(2) Gibberellin

(3) Cytokinin

(4) Abscisic acid

Correct Answer: (2) Gibberellin

Solution: Gibberellins are plant hormones that promote stem elongation and are commonly used to increase crop yield, particularly in crops like sugarcane.

Quick Tip

Gibberellins play a vital role in promoting plant growth and are often used in agricultural practices to enhance crop production.

ZOOLOGY

SECTION-A

151. Following are the stages of pathway for conduction of an action potential through the heart:

Choose the correct sequence of pathway from the options given below: **(1)** E-C-A-D-B

(2) A-E-C-B-D

(3) B-D-E-C-A

(4) E-A-D-B-C

Correct Answer: (1) E-C-A-D-B

Solution: The action potential travels through the SA node, AV node, AV bundle, bundle branches, and then reaches the Purkinje fibres.

Quick Tip

Understanding the conduction pathway of the heart is crucial in studying the electrical impulses that regulate heartbeats.

---

152. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on:

Choose the correct answer from the options given below:

(1) 5^{th} segment

(2) 10^{th} segment

(3) 8^{th} and 9^{th} segment

(4) 11^{th} segment

Correct Answer: (2) 10^{th} segment

Solution: Anal cerci are found on the 10^{th} segment of both male and female cockroaches.

Quick Tip

Anal cerci are sensory organs in cockroaches that help them sense vibrations and air movements.

---

153. The flippers of the Penguins and Dolphins are the example of the:

Choose the correct answer from the options given below:

(1) Adaptive radiation

(2) Natural selection

(3) Convergent evolution

(4) Divergent evolution

Correct Answer: (3) Convergent evolution

Solution: Convergent evolution occurs when unrelated species develop similar traits due to adapting to similar environments, like the flippers in penguins and dolphins.

Quick Tip

Convergent evolution highlights how different organisms evolve similar features independently when exposed to similar environmental pressures.

---

154. Which of the following is not a component of Fallopian tube?

Choose the correct answer from the options given below:

(1) Uterine fundus

(2) Isthmus

(3) Infundibulum

(4) Ampulla

Correct Answer: (1) Uterine fundus

Solution: The uterine fundus is part of the uterus, not the Fallopian tube.

Quick Tip

The Fallopian tube is made up of the infundibulum, ampulla, and isthmus, which are involved in the transport of the egg.

---

155. Given below are some stages of human evolution. Arrange them in correct sequence. (Past to Recent)

1. A. Homo habilis
2. B. Homo sapiens
3. C. Homo neanderthalensis
4. D. Homo erectus

Choose the correct sequence of human evolution from the options given below: **(1)** D-A-C-B

(2) B-A-D-C

(3) C-B-D-A

(4) A-D-C-B

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

Solution: The correct sequence of human evolution from past to recent is Homo habilis (A), Homo erectus (D), Homo neanderthalensis (C), and Homo sapiens (B).

Quick Tip

Homo habilis is considered the earliest human species, followed by Homo erectus, then Homo neanderthalensis, and finally Homo sapiens.

---

156. Which of the following is not a steroid hormone?

Choose the correct answer from the options given below:

(1) Cortisol

(2) Testosterone

(3) Progesterone

(4) Glucagon

Correct Answer: (4) Glucagon

Solution: Glucagon is a peptide hormone, whereas cortisol, testosterone, and progesterone are steroid hormones.

Quick Tip

Steroid hormones are derived from cholesterol and include hormones like cortisol, testosterone, and progesterone.

---

157. Match List I with List II:

- A. α -1 antitrypsin I. Cotton bollworm
- B. Cry IAb II. ADA deficiency
- C. Cry IAc III. Emphysema
- D. Enzyme replacement therapy IV. Corn borer

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: α-1 antitrypsin is related to emphysema, Cry proteins are related to insect resistance (Corn borer and Cotton bollworm), and enzyme replacement therapy is associated with ADA deficiency.

Quick Tip

Cry proteins from Bacillus thuringiensis are used for pest control in genetically modified plants.

---

158. 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)** C-E-D-A-B

(2) E-B-D-A-C

(3) B-D-E-A-C

(4) E-C-A-D-B

Correct Answer: (4) E-C-A-D-B

Solution: The correct sequence of cell division stages is Gap 1 phase (E), Synthesis phase (C), Gap 2 phase (A), Karyokinesis (D), and Cytokinesis (B).

Quick Tip

Cell division involves the stages of interphase (G1, S, G2) and mitosis (karyokinesis and cytokinesis).

---

159. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?
Choose the correct answer from the options given below:
(1) Genetic recombination
(2) Genetic drift
(3) Gene migration
(4) Constant gene pool

Correct Answer: (4) Constant gene pool

Solution: The Hardy-Weinberg equilibrium is not affected by a constant gene pool. The equilibrium can be disturbed by mutation, gene flow, genetic drift, or non-random mating.

Quick Tip

For Hardy-Weinberg equilibrium, the population must have no mutation, random mating, and a large gene pool.

---

160. Which of the following are Autoimmune disorders?
Choose the correct answer from the options given below:
(1) A, B and D only
(2) B, C and E only
(3) A, B E only
(4) C, D E only

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

Solution: Rheumatoid arthritis, Gout, and Systemic Lupus Erythematosus (SLE) are autoim-

mune disorders. Myasthenia gravis and Muscular dystrophy are not considered autoimmune disorders.

Quick Tip

Autoimmune disorders occur when the immune system mistakenly attacks the body's own tissues.

---

161. Match List I with List II:

- A. Typhoid I. Fungus
- B. Leishmaniasis II. Nematode
- C. Ringworm III. Protozoa
- D. Filariasis IV. Bacteria

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

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

Solution: Typhoid is caused by bacteria, Leishmaniasis is caused by protozoa, Ringworm is caused by fungus, and Filariasis is caused by nematodes.

Quick Tip

Understanding the causative agents of diseases is important in their prevention and treatment.

---

162. Match List I with List II:

- A. Expiratory capacity I. Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
- B. Functional residual capacity II. Tidal volume + Expiratory reserve volume
- C. Vital capacity III. Tidal volume + Inspiratory reserve volume
- D. Inspiratory capacity IV. Expiratory reserve volume + Residual volume

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: The correct matching of the terms related to lung capacities and volumes are: - Expiratory capacity (A) is Expiratory reserve volume + Tidal volume + Inspiratory reserve volume. - Functional residual capacity (B) is Tidal volume + Expiratory reserve volume. - Vital capacity (C) is Tidal volume + Inspiratory reserve volume. - Inspiratory capacity (D) is Expiratory reserve volume + Residual volume.

Quick Tip

Understanding lung volumes and capacities is essential in respiratory physiology.

---

163. Match List I with List II:

- A. Down's syndrome I. 11^{th} chromosome
- B. α-Thalassemia II. X^{th} chromosome
- C. β-Thalassemia III. 21^{st} chromosome
- D. Klinefelter's syndrome IV. 16^{th} chromosome

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (3) A-II, B-I, C-II, D-III

Solution: - Down's syndrome is associated with the 21^{st} chromosome. - α-Thalassemia is associated with the 16^{th} chromosome. - β-Thalassemia is linked with the X^{th} chromosome. - Klinefelter's syndrome is linked with the 11^{th} chromosome.

Quick Tip

Thalassemia is a genetic disorder affecting hemoglobin production, and chromosome abnormalities lead to various syndromes.

---

164. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R: Assertion A: FSH acts upon ovarian follicles in female and Leydig cells in male. Reason R: Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being. In the light of the above statements, Choose the correct answer from the options given below:

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and R are true but R is NOT the correct explanation of A

(3) A is true but R is false

(4) A is false but R is true

Correct Answer: (4) A is false but R is true

Solution: While FSH does play a role in the development of ovarian follicles in females and Leydig cells in males, the assertion regarding the secretion of estrogen and androgen is true. Therefore, the reason is correct, but the assertion is false because FSH does not directly act

on Leydig cells in the way stated.

Quick Tip

FSH is important in reproductive processes, but it does not act directly on Leydig cells in males.

---

165. Match List I with List II:

- A. Pleurobrachia I. Mollusca
- B. Radula II. Ctenophora
- C. Stomochord III. Osteichthyes
- D. Air bladder IV. Hemichordata

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Pleurobrachia is a type of organism in Hemichordata. - Radula is found in Mollusca. - Stomochord is found in Osteichthyes. - Air bladder is found in Ctenophora.

Quick Tip

Understanding the classification of organisms is essential in biology, especially for differentiating between invertebrates and vertebrates.

---

166. Match List I with List II:

- A. Diakinesis I. Synaptonemal complex formation

- B. Pachytene II. Completion of terminalisation of chiasmata
- C. Zygotene III. Chromosomes look like thin threads
- D. Leptotene IV. Appearance of recombination nodules

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Diakinesis is characterized by synaptonemal complex formation. - Pachytene is the stage when chromosomes appear like thin threads. - Zygotene is when terminalisation of chiasmata occurs. - Leptotene is characterized by the appearance of recombination nodules.

Quick Tip

The stages of prophase I are vital in understanding how meiosis ensures genetic diversity.

---

167. The "Ti plasmid" of *Agrobacterium tumefaciens* stands for: **(1)** Tumour inhibiting plasmid

(2) Tumor independent plasmid

(3) Tumor inducing plasmid

(4) Temperature independent plasmid

Correct Answer: (3) Tumor inducing plasmid

Solution: The "Ti plasmid" from *Agrobacterium tumefaciens* is responsible for inducing tumor formation in plants, specifically causing crown gall disease.

Quick Tip

The Ti plasmid is widely used in genetic engineering, especially in plant biotechnology.

---

168. Match List I with List II:

- A. Cocaine I. Effective sedative in surgery
- B. Heroin II. *Cannabis sativa*
- C. Morphine III. *Erythroxylum*
- D. Marijuana IV. *Papaver somniferum*

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Cocaine is derived from *Erythroxylum*. - Heroin is derived from *Papaver somniferum*. - Morphine is derived from *Cannabis sativa*. - Marijuana is derived from *Cannabis sativa*.

Quick Tip

Understanding the sources of various drugs is essential in pharmacology and drug research.

---

169. Which one is the correct product of DNA dependent RNA polymerase to the given template?

3'TACATGGCAAAATATCCATTCAS5'

Choose the correct answer from the options given below:

(1) 5’ AUGUACCGUUAAUAGGUAAUGUAGU3’

(2) 5’ AUGUAAGGUUUAAUAGGUAAGGAUG3’

(3) 5’ AUGUACCGUUAAUGGAAGGAAGUGAUG3’

(4) 5’ AUGTACCGTTTATAGGTAAAGT3’

Correct Answer: (1) 5’ AUGUACCGUUAAUAGGUAAUGUAGU3’

Solution: This is the product of transcription where RNA polymerase reads the DNA strand and transcribes it into complementary mRNA, changing T to A, C to G, and A to U.

Quick Tip

Understanding the process of transcription and translation is fundamental in genetics.

---

170. Match List I with List II:

- A. Pons I. Provides additional space for Neurons, regulates posture and balance
- B. Hypothalamus II. Controls respiration and gastric secretions.
- C. Medulla III. Connects different regions of the brain.
- D. Cerebellum IV. Neurosecretory cells

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - The Pons connects different regions of the brain. - The Hypothalamus has neurosecretory cells. - The Medulla controls respiration and gastric secretions. - The Cerebellum provides additional space for neurons and regulates posture and balance.

Quick Tip

Understanding the functions of different parts of the brain is crucial in neurobiology.

---

171. Match List I with List II:

- A. Lipase I. Peptide bond
- B. Nuclease II. Ester bond
- C. Protease III. Glycosidic bond
- D. Amylase IV. Phosphodiester bond

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Lipase breaks down ester bonds in fats. - Nuclease breaks down phosphodiester bonds in nucleic acids. - Protease breaks peptide bonds in proteins. - Amylase breaks down glycosidic bonds in carbohydrates.

Quick Tip

Understanding enzyme specificity is important in biochemistry and metabolic processes.

---

172. Which of the following is not a natural/traditional contraceptive method?

Choose the correct answer from the options given below:

(1) Coitus interruptus

(2) Periodic abstinence

(3) Lactational amenorrhea

(4) Vaults

Correct Answer: (4) Vaults

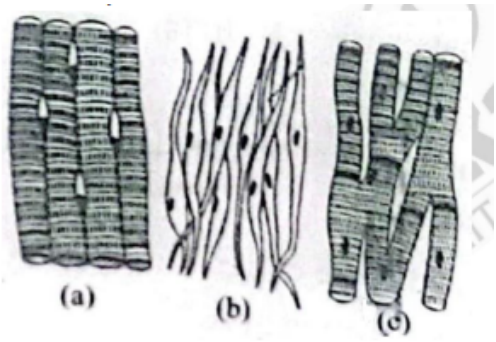
Solution: Vaults are not considered a natural or traditional contraceptive method as they are typically associated with surgical interventions.

Quick Tip

It is important to differentiate between traditional contraceptive methods and modern or surgical methods.

---

173. Three types of muscles are given as a, b and c. Identify the correct matching pair along with their location in human body:



Choose the correct answer from the options given below:

(1) (a) Smooth - Toes, (b) Skeletal - Legs, (c) Cardiac - Heart

(2) (a) Skeletal - Triceps, (b) Smooth - Stomach, (c) Cardiac - Heart

(3) (a) Skeletal - Biceps, (b) Involuntary - Intestine, (c) Smooth - Heart

(4) (a) Involuntary - Nose tip, (b) Skeletal - Bone, (c) Cardiac - Heart

Correct Answer: (2) (a) Skeletal - Triceps, (b) Smooth - Stomach, (c) Cardiac - Heart

Solution: - Skeletal muscle is found in the triceps, a voluntary muscle. - Smooth muscle is found in the stomach, controlling involuntary movements. - Cardiac muscle is found in the heart.

Quick Tip

Understanding the different types of muscles and their locations is essential in human anatomy.

---

174. Which of the following statements is incorrect?

Choose the correct answer from the options given below:

(1) A bio-reactor provides optimal growth conditions for achieving the desired product

(2) Most commonly used bio-reactors are of stirring type

(3) Bio-reactors are used to produce small scale bacterial cultures

(4) Bio-reactors have an agitator system, an oxygen delivery system foam control system

Correct Answer: (3) Bio-reactors are used to produce small scale bacterial cultures

Solution: Bio-reactors are typically used to produce cultures on a larger scale, not just small-scale bacterial cultures. They are essential for large-scale fermentation and industrial applications.

Quick Tip

Bio-reactors play a crucial role in industrial biotechnology for the production of microbial cultures and other biological products.

---

175. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R: Assertion A: Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby. Reason R: Colostrum contains several antibodies absolutely essential to develop resistance for the new born 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 and R is the correct explanation of A

(2) Both A and R are correct but R is NOT the correct explanation of A

(3) A is correct but R is not correct

(4) A is not correct but R is correct

Correct Answer: (1) Both A and R are correct and R is the correct explanation of A

Solution: Breast-feeding provides essential antibodies in colostrum to the infant, which is crucial for developing immunity in the newborn baby, thereby making both Assertion A and Reason R correct.

Quick Tip

Breastfeeding provides both nutrition and immune support to the infant during the initial stages of life.

---

176. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?

Choose the correct answer from the options given below:

(1) High pO and High pCO

(2) High pO and Lesser H concentration

(3) Low pCO and High H concentration

(4) Low pCO and High temperature

Correct Answer: (2) High pO and Lesser H concentration

Solution: Oxyhaemoglobin formation occurs when there is a high concentration of oxygen (pO) and lower concentration of hydrogen ions (H), which favours oxygen binding with hemoglobin in the alveoli.

Quick Tip

Oxygen binding to hemoglobin is most efficient in conditions with high oxygen and low acidity in the blood.

---

177. Match List I with List II:

List I	List II
A.Common cold	I. Plasmodium
B.Haemozoin	II. Typhoid
C.Widal test	III. Rhinoviruses
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-I, B-II, C-I, D-II

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

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

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

Solution: - Common cold is caused by Rhinoviruses (A-III). - Haemozoin is associated with Plasmodium (B-I). - Widal test is used to diagnose Typhoid (C-II). - Allergy is commonly triggered by dust mites (D-IV).

Quick Tip

Match diseases and their causative agents or diagnostic tests for better understanding in microbiology.

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178. Consider the following statements:

- **A:** Annelids are true coelomates
- **B:** Poriferans are pseudocoelomates
- **C:** Nematodes are acoelomates
- **D:** Platyhelminthes are pseudocoelomates

Choose the correct answer from the options given below:

(1) B only

(2) A only

(3) C only

(4) D only

Correct Answer: (3) C only

Solution: - Annelids are true coelomates. - Poriferans are not pseudocoelomates, they are simple organisms with no body cavity. - Nematodes are pseudocoelomates, not acoelomates. - Platyhelminthes are acoelomates, not pseudocoelomates.

Quick Tip

Understanding the classification of animals based on their body cavity is important in studying their evolution and physiology.

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179. Match List I with List II:

List I	List II
A.Non-medicated IUD	I. Multiload 375
B.Copper releasing IUD	II. Progestogens
C.Hormone releasing IUD	III. Lipper loop
D.Implants	IV. LNG-20

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

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

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

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

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

Solution: - Non-medicated IUD is Multiload 375 (A-I). - Copper releasing IUD is LNG-20 (B-I). - Hormone releasing IUD is Progestogens (C-II). - Implants are Lipper loop (D-IV).

Quick Tip

IUDs are widely used for family planning, and different types work via different mechanisms like hormone release or copper release.

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180. 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 true
(2) Both statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

Correct Answer: (2) Both statement I and Statement II are false

Solution: - The descending limb of loop of Henle is permeable to water but not to electrolytes. - The proximal convoluted tubule is lined by cuboidal epithelium with microvilli (not simple columnar), increasing surface area for reabsorption.

Quick Tip

Understanding the structure and function of nephron is crucial for grasping renal physiology.

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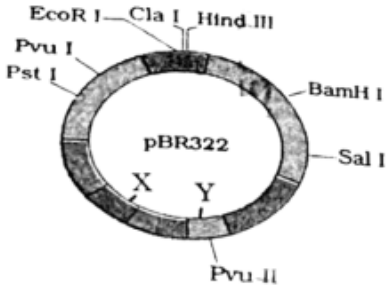
181. The following diagram shows restriction sites in *E. coli* cloning vector pBR322. Find the role of 'X' and 'Y' genes:



(1) The gene 'X' is responsible for resistance to antibiotics and 'Y' for protein involved in the replication of Plasmid.

(2) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.

(3) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.

(4) Gene 'X' is responsible for recognition sites and 'Y' is responsible for antibiotic resistance.

Correct Answer: **(2)** The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.

Solution: - Gene 'X' controls the copy number of the plasmid, ensuring proper replication. - Gene 'Y' is involved in the replication of plasmid.

Quick Tip

Plasmids are commonly used in genetic engineering, and understanding their components and roles is essential in molecular biology.

182. Match List I with List II:

List I	List II
A.Axoneme	I. Centriole
B.Cartwheel pattern	II. Cilia and flagella
C.Crista	III. Chromosome
D.Satellite	IV. Mitochondria

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Axoneme is associated with centrioles (A-I). - Cartwheel pattern is found in cilia and flagella (B-II). - Crista is a structure found in mitochondria (C-IV). - Satellite is found in the chromosome (D-I).

Quick Tip

Understanding cellular structures and their functions helps in grasping cellular biology concepts.

---

183. Match List I with List II:

List I	List II
A.Pterophyllum	I. Hag fish
B.Myxine	II. Saw fish
C.Pristis	III. Angel fish
D.Exocoetus	IV. Flying fish

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Pterophyllum is associated with angel fish (A-III). - Myxine is the hag fish (B-I). - Pristis is the saw fish (C-II). - Exocoetus is the flying fish (D-IV).

Quick Tip

Learn the classification and characteristics of different types of fishes to understand their ecological roles.

---

184. Match List I with List II:

List I	List II
A.Fibrous joints	I. Adjacent vertebrae, limited movement
B.Cartilaginous joints	II. Humerus and Pectoral girdle, rotational movement
C.Hinge joints	III. Skull, don't allow any movement
D.Ball and socket joints	IV. Knee, help in locomotion

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - Fibrous joints are found between adjacent vertebrae, with limited movement (A-I). - Cartilaginous joints are found in the humerus and pectoral girdle, allowing rotational movement (B-II). - Hinge joints are found in the knee, helping in locomotion (C-IV). - Ball and socket joints are found in the skull, not allowing movement (D-III).

Quick Tip

Understanding different types of joints helps in knowing the range of movement they allow.

---

185. 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 light of the above above statements, Choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (3) Statement I is true but Statement II is false

Solution: - The presence or absence of hymen is not a reliable indicator of virginity (Statement I is true). - The hymen is not always torn during the first coitus (Statement II is false).

Quick Tip

Understanding human anatomy and myths associated with it can lead to more informed discussions about biology.

SECTION-B

186. Given below are two statements:

Statement I: Gause's competitive exclusion principle states that two closely related species competing fo

Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This m

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

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is true but Statement II is false

(4) Statement I is false but Statement II is true

Correct Answer: (4) Statement I is false but Statement II is true

Solution: - Statement I is incorrect because Gause's principle is not limited to competition for different resources but also includes the limitation of similar resources (Statement I is false). - Statement II is correct as it accurately reflects Gause's principle that the inferior species will be eliminated in competitive exclusion when resources are limited (Statement II is true).

Quick Tip

Gause's competitive exclusion principle helps explain biodiversity and species competition in ecology.

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187. Match List I with List II related to the digestive system of cockroach.

List-I	List-II
A. The structures used for storing food.	I. Gizzard
B. Ring of 6-8 blind tubules at junction of foregut and midgut.	II. Gastric Caeca
C. Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut.	III. Mal
D. The structures used for grinding the food.	IV. Crop

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: - **A** corresponds to the **Gizzard**, which is used for grinding food. - **B** corresponds to **Gastric Caeca**, a group of blind tubules involved in digestion. - **C** corresponds to the **Malpighian tubules**, excretory structures in cockroaches. - **D** corresponds to the **Crop**, which stores food.

Quick Tip

Understanding the digestive system of cockroaches helps in the study of arthropod physiology.

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188. 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 & C only
(2) A, B & D only
(3) B, D & E only
(4) B, C & D only

Correct Answer: (3) B, D & E only

Solution: Non-chordates lack a notochord, post-anal tail, and have dorsal nerve cords. Thus, the correct statements are B, D, and E.

Quick Tip

Remember, non-chordates are simpler organisms lacking key features like a notochord and post-anal tail, which are present in chordates.

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189. Choose the correct statement given below regarding juxta medullary nephron:

- (1) Juxta medullary nephrons are located in the columns of Bertini.
- (2) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.
- (3) Loop of Henle of juxta medullary nephron runs deep into medulla.
- (4) Juxta medullary nephrons outnumber the cortical nephrons.

Answer: **(3)**

Correct Answer: (3) Loop of Henle of juxta medullary nephron runs deep into medulla.

Solution: The juxta medullary nephron has a long loop of Henle that extends deep into the medulla of the kidney, facilitating water reabsorption.

Quick Tip

Juxta medullary nephrons are key to kidney function as they concentrate urine by a long loop of Henle.

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190. Given below are two statements:

- Statement I: The cerebral hemispheres are connected by 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 correct.

(2) Both Statement I and Statement II are incorrect.

(3) Statement I is correct but Statement II is incorrect.

(4) Statement I is incorrect but Statement II is correct.

Correct Answer: (3) Statement I is correct but Statement II is incorrect.

Solution: Statement I is correct as the cerebral hemispheres are connected by the corpus callosum. However, Statement II is incorrect because the brainstem consists of the medulla oblongata, pons, and midbrain, not cerebrum.

Quick Tip

The brainstem consists of the medulla oblongata, pons, and midbrain, not the cerebrum. The corpus callosum connects the two cerebral hemispheres.

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191. 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 above statements, choose the most appropriate answer from the options given below: **(1)** Both Statement I and Statement II are correct.

(2) Both Statement I and Statement II are incorrect.

(3) Statement I is correct but Statement II is incorrect.

(4) Statement I is incorrect but Statement II is correct.

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

Solution: Bone marrow is the primary lymphoid organ responsible for the production of blood cells, including lymphocytes. The thymus, along with the bone marrow, provides an environment necessary for the development of T-lymphocytes.

Quick Tip

Both the bone marrow and thymus are essential in lymphocyte development and maturation.

---

192. Regarding 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) E, A, D, C, B
(2) A, E, B, D, C
(3) B, A, C, D, E
(4) E, D, C, B, A

Correct Answer: (1) E, A, D, C, B

Solution: The sequence for enzyme catalysis is: first, the substrate binds to the active site (E), then the enzyme-substrate complex forms (A), followed by the breaking of chemical bonds in the substrate (D), release of products (C), and finally the free enzyme is ready for the next substrate (B).

Quick Tip

Enzyme catalysis follows a set pattern from substrate binding to the final product release.

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193. Identify the correct option (A), (B), (C), (D) with respect to spermatogenesis.

- GnRH

- (A) LH (B) Androgens (C) Factors (D) Formation of spermatids
- (A) FSH (B) Leydig cells, Sertoli cells, Spermiogenesis.
- (C) ICSS, Interstitial cells, Leydig cells, Spermatogenesis.
- (D) ICSH, Leydig cells, Sertoli cells, Spermatogenesis.

Choose the correct answer from the options given below:

(1) FSH, Leydig cells, Sertoli cells, Spermiogenesis.

(2) ICSH, Interstitial cells, Leydig cells, spermatogenesis.

(3) FSH, Sertoli cells, Leydig cells, spermatogenesis.

(4) ICSH, Leydig cells, Sertoli cells, spermatogenesis.

Correct Answer: (2) ICSH, Interstitial cells, Leydig cells, spermatogenesis.

Solution: ICSH (Interstitial Cell Stimulating Hormone) stimulates the Leydig cells in the testes to produce androgens, which are involved in spermatogenesis, leading to the formation of spermatids.

Quick Tip

Spermatogenesis involves the interaction of ICSH, Leydig cells, and Sertoli cells in the testes.

---

194. Match List I with List II:

List I	List II
A. Mesozoic Era	I. Lower invertebrates
B. Proterozoic Era	II. Fish & Amphibia
C. Cenozoic Era	III. Birds & Reptiles
D. Paleozoic Era	IV. Mammals

Choose the correct answer from the options given below:

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

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

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

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

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

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195. Match List I with List II:

List I	List II
A. Unicellular epithelial glandular	I. Salivary glands
B. Compound epithelium	II. Pancreas
C. Multicellular epithelial glandular	III. Goblet cells of alimentary cana
D. Endocrine epithelium glandular	IV. Moist surface of buccal cavity

Choose the correct answer from the options given below:

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

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

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

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

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

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196. Match List I with List II:

List I	List II
A. RNA polymerase III	I. snRNPs
B. Termination of transcription	II. Promoter
C. Splicing of Exons	III. Rho factor
D. TATA box	IV. SnRNAs, tRNA

Choose the correct answer from the options given below:

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

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

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

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

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

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197. As per ABO blood grouping system, the blood group of father is B^+, mother is A^+ and child is O^-. Their respective genotype can be:

Choose the most appropriate answer from the options given below: **(1)** I^BI^B / I^O I^O

(2) I^AI^B / I^O I^O

(3) I^BI^B / I^BI^O

(4) I^AI^A / I^BI^B

Correct Answer: (1)

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198. Match List I with List II:

List I	List II
A. P wave	I. Heart muscles are electrically silent.
B. QRS complex	II. Depolarisation of ventricles.
C. T wave	III. Depolarisation of atria.
D. T-P gap	IV. Repolarisation of ventricles.

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (2)

---

199. Given below are two statements: Statement I: Mitochondria and chloroplasts both double membranes bound organelles.

Statement II: Inner membrane of mitochondria is relatively less permeable, as compared 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 correct.

(2) Both Statement I and Statement II are incorrect.

(3) Statement I is correct but Statement II is incorrect.

(4) Statement I is incorrect but Statement II is correct.

Correct Answer: (3)

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200. Match List I with List II :

List I	List II
A. Exophthalmic goiter	I. Excess secretion of cortisol, moon face &
B. Acromegaly	II. Hypo-secretion of thyroid hormone and s
C. Cushing's syndrome	III. Hyper secretion of thyroid hormone & prot
D. Cretinism	IV. Excessive secretion of growth ho

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (4)
