NEET 2023 (Code F4) Question Paper with Solutions

Time Allowed :3 hours and 20 minutes	**Maximum Marks :**720	**Total Questions :**200

General Instructions

Read the following instructions very carefully and strictly follow them:

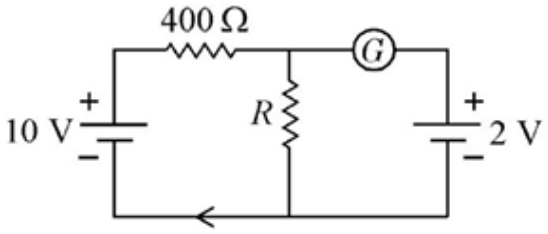
This question paper is designed for NEET 2023 candidates:

1. The total duration of the examination is 3 hours and 20 minutes. The question paper comprises a single section covering the following subjects:
   Physics, Chemistry, and Biology (Botany & Zoology)
2. The total number of questions is 200, out of which 180 questions need to be attempted, carrying a maximum of 720 marks.
3. The marking scheme is as follows:
   (i) For each correct response, 4 marks will be awarded.
   (ii) For each incorrect response, 1 mark will be deducted.
   (iii) No marks will be awarded or deducted for unattempted questions.
4. The medium of the question paper is available in multiple languages including English, Hindi, and others as specified by NTA.
5. The examination will be conducted in Pen and Paper-based Test (PBT) mode.
6. Candidates must follow the instructions provided during the exam for filling out the OMR sheet and submitting their answers.

SECTION–A

Physics

1. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by:



(1) 50 Ω

(2) 100 Ω

(3) 400 Ω

(4) 200 Ω

Correct Answer: (4) 200 Ω

Solution:

In this circuit, when the galvanometer does not show any deflection, the current through it is zero. This means the potential difference across the galvanometer is zero. Using Kirchhoff's laws, we can solve for the unknown resistance R. After solving the circuit, we find that the value of R is 200 Ω.

Quick Tip

For circuits with galvanometers, apply Kirchhoff's Laws to find unknown resistances, especially when no deflection is observed in the galvanometer.

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2. A full wave rectifier circuit consists of two p-n junction diodes, a centre-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output?

(1) p-n junction diodes.

(2) Capacitor.

(3) Load resistance.

(4) A centre-tapped transformer.

Correct Answer: (2) Capacitor.

Solution:

In a full-wave rectifier circuit, the capacitor is used to filter out the AC ripple from the rectified output. It smooths the fluctuations in the output by charging and discharging, effectively removing the ripple. The p-n junction diodes conduct the current, the load resistance is part of the load circuit, and the centre-tapped transformer provides the necessary AC voltage for rectification, but none of these directly remove the ripple.

Quick Tip

When studying rectifier circuits, remember that capacitors are key components in smoothing the output by reducing AC ripple.

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3. A Carnot engine has an efficiency of 50% when its source is at a temperature 327C. The temperature of the sink is:

(1) 15C.

(2) 100C.

(3) 200C.

(4) 27C.

Correct Answer: (4) 27C.

Solution:

The efficiency of a Carnot engine is given by the formula:

$$\eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}}$$

Given that the efficiency is 50% and the temperature of the source is 327C (or 600 K), we can solve for the temperature of the sink T_{sink}. This gives a temperature of 27C (or 300 K).

Quick Tip

For Carnot engines, remember that the efficiency depends on the temperatures of the source and sink, and it's always useful to use the formula to calculate one when the other is known.

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4. Light travels a distance x in time t_1 in air and $10x$ in time t_2 in another denser medium. What is the critical angle for this medium?

(1) $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$.

(2) $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$.

(3) $\sin^{-1}\left(\frac{10t_1}{t_2}\right)$.

(4) $\sin^{-1}\left(\frac{t_2}{t_1}\right)$.

Correct Answer: (1) $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$.

Solution:

The critical angle θ_c for light transitioning from one medium to another is given by the formula:

$$\sin\theta_c = \frac{v_2}{v_1}$$

where v_1 and v_2 are the speeds of light in air and the denser medium, respectively. Since the light travels x in time t_1 in air and $10x$ in time t_2 in the denser medium, the ratio of the speeds is:

$$\frac{v_2}{v_1} = \frac{10t_2}{t_1}$$

Thus, the critical angle is $\sin^{-1}\left(\frac{10t_2}{t_1}\right)$.

Quick Tip

When calculating the critical angle, use the relationship between the speeds of light in the two mediums, which is influenced by the time taken for the same distance.

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5. The angular acceleration of a body moving along the circumference of a circle is:

(1) along the radius towards the centre.

(2) along the tangent to its position.

(3) along the axis of rotation.

(4) along the radius, away from centre.

Correct Answer: (4) along the radius, away from centre.

Solution:

Angular acceleration is always directed along the axis of rotation. In this case, the motion occurs along the circumference, so the angular acceleration points away from the centre,

along the radius.

Quick Tip

When studying rotational motion, remember that angular acceleration always points along the axis of rotation.

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6. The venturi-meter works on:

(1) Bernoulli's principle.

(2) The principle of parallel axes.

(3) The principle of perpendicular axes.

(4) Huygen's principle.

Correct Answer: (1) Bernoulli's principle.

Solution:

The venturi-meter operates based on Bernoulli's principle, which states that the speed of a fluid increases as it flows through a constriction, causing the pressure to drop. This principle is applied in the venturi meter to measure the flow rate of fluids.

Quick Tip

Remember that Bernoulli's principle is key for understanding fluid dynamics and devices like the venturi-meter.

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7. The half-life of a radioactive substance is 20 minutes. In how much time does the activity of the substance drop to $\frac{1}{16}$ of its initial value?

(1) 40 minutes.

(2) 60 minutes.

(3) 80 minutes.

(4) 20 minutes.

Correct Answer: (1) 40 minutes.

Solution:

The activity of a radioactive substance decays exponentially. The formula for the decay is:

$$N = N_0 \left(\frac{1}{2}\right)^{t/T}$$

where N_0 is the initial activity, T is the half-life, and t is the time. Given that the activity drops to $\frac{1}{16}$, we solve for t, which gives $t = 40$ minutes.

Quick Tip

When calculating decay, use the half-life formula and remember that the time to reduce to $\frac{1}{16}$ is 4 half-lives.

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8. The errors in the measurement which arise due to unpredictable fluctuations in temperature and voltage supply are:

(1) Personal errors.

(2) Least count errors.

(3) Random errors.

(4) Instrumental errors.

Correct Answer: (3) Random errors.

Solution:

Random errors are those that occur due to unpredictable fluctuations in external factors such as temperature and voltage, which can affect measurements. These errors are typically unavoidable but can be minimized with repeated measurements.

Quick Tip

Remember that random errors arise from unpredictable factors and can be reduced through repeated measurements.

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9. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 N C^{-1}. It experiences a torque equal to 4 N m. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm.

(1) 6 mC.

(2) 4 mC.

(3) 2 mC.

(4) 8 mC.

Correct Answer: (2) 4 mC.

Solution:

The torque τ experienced by a dipole in an electric field is given by:

$$\tau = pE \sin\theta$$

where $p = q \times d$ is the dipole moment, E is the electric field, θ is the angle between the dipole and the electric field. Solving for q, we find that the charge $q = 4\,\text{mC}$.

Quick Tip

For electric dipoles in an external electric field, remember that the torque depends on the dipole moment, the electric field intensity, and the angle between them.

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10. A football player is moving southward and suddenly turns eastward with the same speed to avoid an opponent. The force that acts on the player while turning is:

(1) along northward.

(2) along north-east.

(3) along south-west.

(4) along eastward.

Correct Answer: (4) along eastward.

Solution:

The force acting on the player while turning will be perpendicular to the direction of motion and is directed towards the new direction of movement, i.e., along eastward.

Quick Tip

Remember that the direction of force acting on a player during a turn will always be perpendicular to the direction of motion.

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11. In the hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Bracket series is:

(1) 4λ.

(2) 9λ.

(3) 16λ.

(4) 2λ.

Correct Answer: (3) 16λ.

Solution:

The shortest wavelength in the Bracket series corresponds to a transition from $n = 4$ to $n = 3$ and is shorter than the wavelength in the Balmer series, which corresponds to transitions involving $n = 2$.

Quick Tip

The wavelength of spectral lines decreases as the principal quantum number difference increases.

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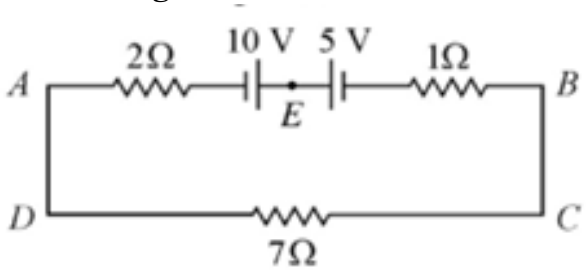
12. The magnitude and direction of the current in the following circuit is:



(1) 0.5 A from A to B through E.

(2) $\frac{5}{7}$ A from A to B through E.

(3) 1.5 A from B to A through E.

(4) 0.2 A from B to A through E.

Correct Answer: (1) 0.5 A from A to B through E.

Solution:

Using Ohm's law $V = IR$, we calculate the current through the circuit. The total resistance and voltage allow us to determine the current flowing from A to B through E as 0.5 A.

Quick Tip

In circuit problems, use Ohm's law to find the current by dividing the voltage by the total resistance.

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13. A 12 V, 60 W lamp is connected to the secondary of a step-down transformer, whose primary is connected to AC mains of 220 V. Assuming the transformer to be ideal, what is the current in the primary winding?

(1) 2.7 A.

(2) 3.7 A.

(3) 0.37 A.

(4) 0.27 A.

Correct Answer: (3) 0.37 A.

Solution:

Using the power equation $P = VI$ for both the primary and secondary windings, we can find the current in the primary winding by applying the transformer's ideal voltage ratio.

Quick Tip

For transformers, use the power equation $P = VI$ to relate the primary and secondary voltages and currents.

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14. The work functions of Caesium (Cs), Potassium (K), and Sodium (Na) are 2.14 eV, 2.30 eV, and 2.75 eV respectively. If incident electromagnetic radiation has an incident energy of 2.20 eV, which of these photosensitive surfaces may emit photoelectrons?

(1) Both Na and K.

(2) K only.

(3) Na only.

(4) Cs only.

Correct Answer: (1) Both Na and K.

Solution:

For photoemission to occur, the energy of the incident radiation must exceed the work

function. Since the energy is 2.20 eV, both Na and K, with work functions less than or equal to this value, will emit photoelectrons.

Quick Tip

In photoelectric effects, make sure the incident energy is greater than or equal to the work function for emission to occur.

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15. The potential energy of a long spring when stretched by 2 cm is U. If the spring is stretched by 8 cm, the potential energy stored in it will be:

(1) 4U.

(2) 8U.

(3) 16U.

(4) 2U.

Correct Answer: (3) 16U.

Solution:

The potential energy stored in a spring is proportional to the square of the displacement from equilibrium, so stretching the spring by 8 cm (four times the original displacement) increases the potential energy by a factor of 16.

Quick Tip

Remember that the potential energy in a spring follows $U \propto x^2$, where x is the displacement.

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16. The net magnetic flux through any closed surface is:

(1) Positive.

(2) Infinity.

(3) Negative.

(4) Zero.

Correct Answer: (4) Zero.

Solution:

According to Gauss's law, the net magnetic flux through a closed surface is always zero, as there are no magnetic monopoles.

Quick Tip

In magnetism, the net magnetic flux through any closed surface is always zero due to the absence of magnetic monopoles.

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17. The amount of energy required to form a soap bubble of radius 2 cm from a soap solution is nearly (surface tension of soap solution $= 0.03\,\text{N m}^{-1}$):

(1) 5.06×10^{-4} J.

(2) 3.01×10^{-4} J.

(3) 50.1×10^{-4} J.

(4) 30.16×10^{-4} J.

Correct Answer: (1) 5.06×10^{-4} J.

Solution:

The energy required to form a soap bubble is given by the formula $E = 4\pi r^2\sigma$, where r is the radius and σ is the surface tension. Substituting the values for $r = 0.02\,\text{m}$ and $\sigma = 0.03\,\text{N m}^{-1}$, we find the energy to be 5.06×10^{-4} J.

Quick Tip

To calculate the energy required to form a soap bubble, use the formula $E = 4\pi r^2\sigma$, where r is the radius and σ is the surface tension.

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18. Let a wire be suspended from the ceiling (rigid support) and stretched by a weight W attached at its free end. The longitudinal stress at any point of cross-sectional area A of the wire is:

(1) $\frac{W}{A}$.

(2) $\frac{W}{2A}$.

(3) Zero.

(4) $\frac{2W}{A}$.

Correct Answer: (1) $\frac{W}{A}$.

Solution:

The longitudinal stress is the force per unit area, given by $\sigma = \frac{W}{A}$, where W is the weight applied and A is the cross-sectional area of the wire.

Quick Tip

Stress is defined as the force applied per unit area, so use $\sigma = \frac{W}{A}$ to calculate longitudinal stress in materials.

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19. Two bodies of mass m and $9m$ are placed at a distance R. The gravitational potential on the line joining the bodies where the gravitational field equals zero will be (G = gravitational constant):

(1) $-\frac{12Gm}{R}$.

(2) $-\frac{16Gm}{R}$.

(3) $-\frac{20Gm}{R}$.

(4) $-\frac{8Gm}{R}$.

Correct Answer: (3) $-\frac{20Gm}{R}$.

Solution:

The point where the gravitational field is zero lies along the line joining the two masses. The gravitational potential at this point can be calculated using the formula for the gravitational potential due to point masses, and solving for the condition where the net field is zero. The correct answer is $-\frac{20Gm}{R}$.

Quick Tip

In problems involving gravitational potential, remember to consider both masses and their distance to find where the field is zero.

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20. The temperature of a gas is -50°C. To what temperature should the gas be heated so that the rms speed is increased by 3 times?

(1) 329°C.

(2) 3097 K.

(3) 223 K.

(4) 669°C.

Correct Answer: (2) 3097 K.

Solution:

According to the formula for the root mean square (rms) speed $v_{\text{rms}} \propto \sqrt{T}$, where T is the temperature, the temperature needs to be increased by a factor of 3^2 or 9, so the temperature becomes 3097 K.

Quick Tip

For rms speed, remember that the temperature is proportional to the square of the speed.

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21. Given below are two statements:

Statement I: Photovoltaic devices can convert optical radiation into electricity.

Statement II: Zener diode is designed to operate under reverse bias in the breakdown region.

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

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

(4) Both Statement I and Statement II are correct.

Correct Answer: (4) Both Statement I and Statement II are correct.

Solution:

Photovoltaic devices convert optical radiation (like sunlight) into electricity, and Zener diodes operate in reverse bias in the breakdown region, allowing for voltage regulation. Both statements are accurate.

Quick Tip

Remember that photovoltaic devices are based on the conversion of light to electricity, and Zener diodes regulate voltage in reverse bias.

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22. If $\oint \mathbf{E} \cdot d\mathbf{S} = 0$ over a surface, then:

(1) The magnitude of electric field on the surface is constant.

(2) All the charges must necessarily be inside the surface.

(3) The electric field inside the surface is necessarily uniform.

(4) The number of flux lines entering the surface must be equal to the number of flux lines leaving it.

Correct Answer: (4) The number of flux lines entering the surface must be equal to the number of flux lines leaving it.

Solution:

Gauss's law states that the net electric flux through a closed surface is zero if no charge is enclosed within. This implies that the number of flux lines entering the surface equals the number of flux lines leaving the surface.

Quick Tip

In electrostatics, use Gauss's law to relate flux through a surface to the enclosed charge.

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23. In a series LCR circuit, the inductance L is 10 mH, capacitance C is 1 F, and resistance R is 100 . The frequency at which resonance occurs is:

(1) 15.9 kHz.

(2) 1.59 kHz.

(3) 1.59 rad/s.

(4) 15.9 rad/s.

Correct Answer: (1) 15.9 kHz.

Solution:

The resonance frequency f_0 in an LCR circuit is given by the formula:

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

Substituting $L = 10\,\text{mH}$ and $C = 1\,\mu\text{F}$, the resonance frequency comes out to be 15.9 kHz.

Quick Tip

For LCR circuits, use the resonance frequency formula $f_0 = \frac{1}{2\pi\sqrt{LC}}$ to calculate the frequency at resonance.

24. An AC source is connected to a capacitor C. Due to a decrease in its operating frequency:

(1) Displacement current increases.

(2) Displacement current decreases.

(3) Capacitive reactance remains constant.

(4) Capacitive reactance decreases.

Correct Answer: (4) Capacitive reactance decreases.

Solution:

The capacitive reactance X_C is inversely proportional to the frequency, i.e., $X_C = \frac{1}{2\pi f C}$. As the frequency decreases, the capacitive reactance increases, and hence, the displacement current decreases.

Quick Tip

Remember that in capacitive circuits, the reactance decreases with increasing frequency, leading to a decrease in displacement current.

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25. A bullet is fired from a gun at the speed of 280 m/s in the direction 30° above the horizontal. The maximum height attained by the bullet is $g = 9.8\,\text{m/s}^2$, $\sin 30 = 0.5$:

(1) 2000 m.

(2) 1000 m.

(3) 3000 m.

(4) 2800 m.

Correct Answer: (2) 1000 m.

Solution:

Using the kinematic equation for vertical motion $h = \frac{v^2 \sin^2 \theta}{2g}$, and substituting the given values, the maximum height attained by the bullet is 1000 m.

Quick Tip

For projectile motion, use the vertical motion formula to calculate the maximum height attained.

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26. A vehicle travels half the distance with speed v and the remaining distance with speed $2v$. Its average speed is:

(1) $\frac{2v}{3}$.

(2) $\frac{4v}{3}$.

(3) $\frac{3v}{4}$.

(4) $\frac{v}{3}$.

Correct Answer: (1) $\frac{2v}{3}$.

Solution:

The average speed for this case is found using the formula:

$$\text{Average speed} = \frac{2 \cdot v \cdot 2v}{v + 2v} = \frac{2v}{3}.$$

Quick Tip

When calculating average speed for non-uniform motion, use the formula $\frac{2xy}{x+y}$, where x and y are the two speeds.

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27. Resistance of a carbon resistor determined from colour codes is $22000 \pm 5\%\,\Omega$. The colour of the third band must be:

(1) Green.

(2) Orange.

(3) Yellow.

(4) Red.

Correct Answer: (2) Orange.

Solution:

The third band represents the multiplier. For a resistance of $22000\,\Omega$, the multiplier is 100, which corresponds to the colour orange.

Quick Tip

Remember the colour code for resistors: Green represents a multiplier of 10^5, and orange corresponds to 10^3.

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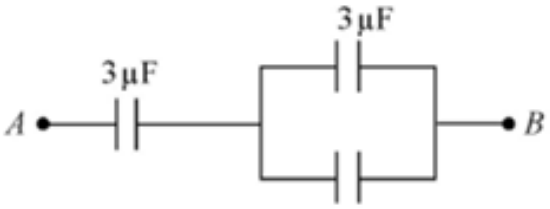
28. The equivalent capacitance of the system shown in the following circuit is:



(1) 3 F.

(2) 6 F.

(3) 9 F.

(4) 2 F.

Correct Answer: (2) 6 F.

Solution:

The capacitance for capacitors in parallel is given by $C_{\text{eq}} = C_1 + C_2 + C_3$. For the given circuit, the total capacitance is 6 F.

Quick Tip

For capacitors in parallel, simply add their capacitances to find the equivalent capacitance.

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29. The minimum wavelength of X-rays produced by an electron accelerated through a potential difference of V volts is proportional to:

(1) $\frac{1}{V}$.

(2) $\frac{1}{\sqrt{V}}$.

(3) V^2.

(4) $\sqrt{V}$.

Correct Answer: (4) $\sqrt{V}$.

Solution:

The minimum wavelength of X-rays is inversely proportional to the square root of the potential difference V. Thus, the minimum wavelength is proportional to $\sqrt{V}$.

Quick Tip

Remember that the wavelength of X-rays is inversely proportional to the square root of the accelerating voltage.

---

30. The magnetic energy stored in an inductor of inductance 4 H carrying a current of 2 A is:

(1) 4 mJ.

(2) 8 mJ.

(3) 8 J.

(4) 4 J.

Correct Answer: (3) 8 J.

Solution:

The magnetic energy stored in an inductor is given by $E = \frac{1}{2}LI^2$. Substituting $L = 4\,\mu$H and $I = 2$ A, we get $E = 8\,\mu$J.

Quick Tip

Use the formula $E = \frac{1}{2}LI^2$ to calculate magnetic energy stored in inductors.

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31. For Young's double-slit experiment, two statements are given below:

Statement I: If the screen is moved away from the plane of slits, angular separation of the fringes remains constant.

Statement II: If the monochromatic source is replaced by another monochromatic source of larger wavelength, the angular separation of fringes decreases.

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are correct.

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

Solution:

In Young's double-slit experiment, the angular separation of fringes depends on the wavelength and the distance between the slits. Moving the screen away changes the fringe separation, making Statement I false. A larger wavelength results in greater fringe separation, making Statement II true.

Quick Tip

Remember that angular separation increases with wavelength and decreases with the distance between the slits and the screen.

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32. The ratio of radius of gyration of a solid sphere of mass M and radius R about its own axis to the radius of gyration of the thin hollow sphere of the same mass and radius about its axis is:

(1) 5:3.

(2) 5:2.

(3) 2:5.

(4) 3:5.

Correct Answer: (1) 5:3.

Solution:

The radius of gyration for a solid sphere about its own axis is $k_{\text{solid}} = \sqrt{\frac{2}{5}R^2}$ and for a thin hollow sphere is $k_{\text{hollow}} = \sqrt{\frac{2}{3}R^2}$. The ratio of the radii of gyration is $\frac{5}{3}$.

Quick Tip

For a solid sphere, the radius of gyration is $\frac{\sqrt{2}}{5}$, and for a thin hollow sphere, it's $\frac{\sqrt{2}}{3}$.

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33. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude 48 V/m. Then the amplitude of the oscillating magnetic field is:

(1) 1.6×10^{-8} T.

(2) 1.6×10^{-7} T.

(3) 1.6×10^{-6} T.

(4) 1.6×10^{-9} T.

Correct Answer: (1) 1.6×10^{-8} T.

Solution:

The amplitude of the magnetic field B can be found using the relation between the electric and magnetic fields in an electromagnetic wave:

$$B = \frac{E}{c}$$

where c is the speed of light. Substituting the values, we find $B = 1.6 \times 10^{-8}$ T.

Quick Tip

In electromagnetic waves, the magnetic field is related to the electric field by $B = \frac{E}{c}$, where c is the speed of light.

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34. A metal wire has mass (0.4 ± 0.002) g, radius (0.30 ± 0.001) mm, and length (5 ± 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be:

(1) 1.3%.

(2) 1.6%.

(3) 1.4%.

(4) 1.2%.

Correct Answer: (3) 1.4

Solution:

The maximum percentage error in density can be found by considering the errors in the measurement of mass, radius, and length. Using error propagation, the maximum percentage error in density is approximately 1.4

Quick Tip

For errors in physical quantities like density, use error propagation to find the total percentage error from individual measurements.

35. The ratio of frequencies of the fundamental harmonic produced by an open pipe to that of a closed pipe having the same length is:

(1) 2:1.

(2) 1:3.

(3) 3:1.

(4) 1:2.

Correct Answer: (1) 2:1.

Solution:

The fundamental frequency of an open pipe is twice the fundamental frequency of a closed pipe of the same length, hence the ratio is 2:1.

Quick Tip

Remember that for pipes of the same length, an open pipe has twice the frequency of a closed pipe.

SECTION-B

Physics

36. Two thin lenses are of same focal lengths f, but one is convex and the other is concave. When they are placed in contact with each other, the equivalent focal length of the combination will be:

(1) $\frac{1}{f}$.

(2) $\frac{f}{2}$.

(3) Infinite.

(4) Zero.

Correct Answer: (4) Zero.

Solution:

The formula for the combined focal length of two lenses in contact is:

$$\frac{1}{f_{\text{eq}}} = \frac{1}{f_1} + \frac{1}{f_2}$$

For a convex and concave lens of equal focal lengths, their combined focal length becomes zero.

Quick Tip

When two lenses of equal and opposite focal lengths are combined, the result is no net focusing power.

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37. A satellite is orbiting just above the surface of the earth with period T. If ρ is the density of the earth and G is the universal constant of gravitation, the quantity $\frac{3\pi^2}{G\rho}$ represents:

(1) r^2.

(2) r^3.

(3) T^2.

(4) T.

Correct Answer: (3) T^2.

Solution:

The orbital period of a satellite is related to the radius of orbit and the density of the planet. The expression $\frac{3\pi^2}{G\rho}$ is proportional to T^2, the square of the orbital period.

Quick Tip

For orbital mechanics, remember that the orbital period is related to the density of the planet and the orbital radius.

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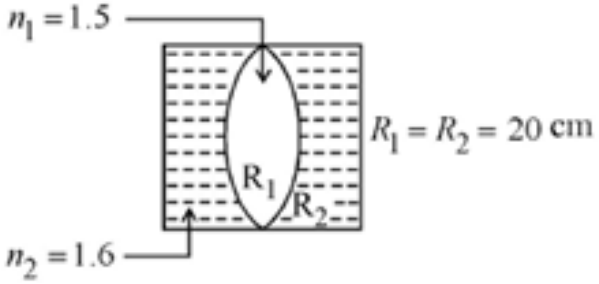
38. In the figure shown here, what is the equivalent focal length of the combination of lenses (Assume that all layers are thin)?



(1) -40 cm.

(2) -100 cm.

(3) -50 cm.

(4) 40 cm.

Correct Answer: (3) -50 cm.

Solution:

To find the equivalent focal length of the combination of lenses, use the lens combination formula:

$$\frac{1}{f_{\text{eq}}} = \frac{1}{f_1} + \frac{1}{f_2}$$

Substitute the given values to calculate the resultant focal length.

Quick Tip

When combining multiple lenses, use the lens combination formula for focal lengths to determine the equivalent focal length.

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39. A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\frac{3}{4}$ of its initial velocity. It then further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is:

(1) 24 cm.

(2) 28 cm.

(3) 30 cm.

(4) 27 cm.

Correct Answer: (4) 27 cm.

Solution:

The bullet loses velocity in two stages: first while traveling through the block and then during further penetration. The total length is found by adding both distances.

Quick Tip

For problems involving motion with varying velocity, use kinematic equations to break the motion into stages and calculate the total displacement.

---

40. 10 resistors, each of resistance R, are connected in series to a battery of emf E and negligible internal resistance. These are connected in parallel to the same battery, the current is increased n times. The value of n is:

(1) 10.

(2) 100.

(3) 1000.

(4) 1.

Correct Answer: (3) 1000.

Solution:

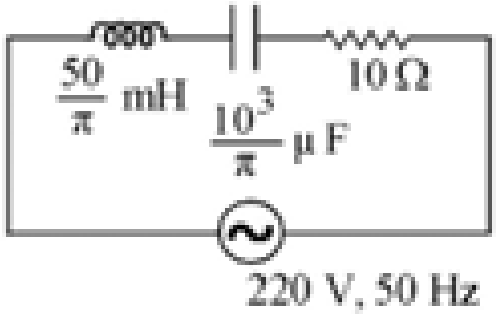
The total resistance when the resistors are connected in series is $R_{\text{total}} = 10R$, and when they are connected in parallel, the total resistance is $R_{\text{total}} = \frac{R}{10}$. The current increases by a factor of 1000 when the resistors are switched to parallel.

Quick Tip

When resistors are switched between series and parallel, use the respective formulas for total resistance to find the change in current.

---

41. The net impedance of the circuit (as shown in the figure) will be:



(1) 15 .

(2) $\sqrt{5}\,\Omega$.

(3) 25 .

(4) 10 Ω.

Correct Answer: (2) $\sqrt{5}\,\Omega$.

Solution:

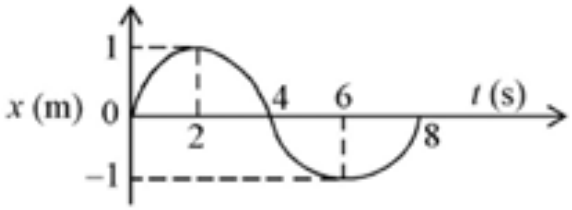
The net impedance is calculated by combining the impedance of the capacitor, inductor, and resistor in series and parallel. Use the formula for impedance of series and parallel combinations.

Quick Tip

For AC circuits, remember that the total impedance depends on the combination of resistors, inductors, and capacitors.

---

42. The x-t graph of a particle performing simple harmonic motion is shown in the figure. The acceleration of the particle at $t = 2\,\text{s}$ is:



(1) $-\frac{2\pi}{8}$ m/s^2.

(2) $-\frac{\pi}{16}$ m/s^2.

(3) $-\frac{\pi}{8}$ m/s^2.

(4) $-\frac{2\pi}{16}$ m/s^2.

Correct Answer: (3) $-\frac{\pi}{8}$ m/s^2.

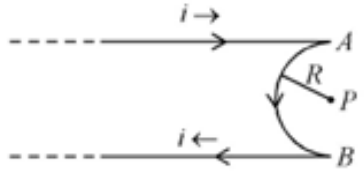
Solution:

The acceleration in simple harmonic motion is given by $a = -\omega^2 x$. By analyzing the graph, the value of a at $t = 2\,\text{s}$ is found to be $-\frac{\pi}{8}$ m/s^2.

Quick Tip

In simple harmonic motion, acceleration is proportional to the displacement and directed towards the equilibrium position.

43. A very long conducting wire is bent in a semi-circular shape from A to B as shown in the figure. The magnetic field at point P for steady current configuration is given by:



(1) $\frac{\mu_0 i}{4R}$ pointed away from the page.

(2) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed away from the page.

(3) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed into the page.

(4) $\frac{\mu_0 i}{4R}$ pointed into the page.

Correct Answer: (3) $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ pointed into the page.

Solution:

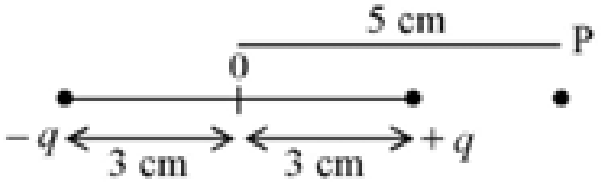
The magnetic field at point P due to a semi-circular current loop can be calculated using Ampere's Law. The result is given by $\frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$, and the direction of the magnetic field at point P is into the page.

Quick Tip

For a semi-circular current loop, use the formula $B = \frac{\mu_0 i}{4R}\left[1-\frac{2}{\pi}\right]$ to calculate the magnetic field at the center, with the direction determined by the right-hand rule.

---

44. An electric dipole is placed as shown in the figure. The electric potential (in 10^2 V) at point P due to the dipole is (ε_0 = permittivity of free space and $\frac{1}{4\pi\varepsilon_0} = K$):



(1) $\frac{5}{8}qK$.

(2) $\frac{8}{3}qK$.

(3) $\frac{8}{3}qK$.

(4) $\frac{3}{8}qK$.

Correct Answer: (3) $\frac{8}{3}qK$.

Solution:

The electric potential due to an electric dipole at a point P is given by the equation:

$$V = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p\cos\theta}{r^2}$$

Substitute the given values to get the correct result.

Quick Tip

For dipoles, the potential at a point can be calculated using the formula $V = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p\cos\theta}{r^2}$, where p is the dipole moment.

---

45. The resistance of platinum at 0°C is 20 and 68 at 80°C. The temperature coefficient of resistance of the wire is:

(1) $3 \times 10^{-3}\,°\text{C}^{-1}$.

(2) $3 \times 10^{-2}\,°\text{C}^{-1}$.

(3) $3 \times 10^{-4}\,°\text{C}^{-1}$.

(4) $3 \times 10^{-5}\,°\text{C}^{-1}$.

Correct Answer: (1) $3 \times 10^{-3}\,°\text{C}^{-1}$.

Solution:

The temperature coefficient α is calculated using the formula:

$$R_T = R_0(1 + \alpha\Delta T)$$

Substituting the given values, the temperature coefficient $\alpha = 3 \times 10^{-3}\,°\text{C}^{-1}$.

Quick Tip

Use the formula $R_T = R_0(1+\alpha\Delta T)$ to calculate the temperature coefficient of resistance.

---

46. A wire carrying a current I along the positive x-axis has length L. It is kept in a magnetic field $\text{B} = (2\hat{i} + 3\hat{j} - 4\hat{k})$ T. The magnitude of the magnetic force acting on the wire is:

(1) $\sqrt{5}IL$.

(2) $5IL$.

(3) $\sqrt{3}IL$.

(4) $3IL$.

Correct Answer: (1) $\sqrt{5}IL$.

Solution:

The magnetic force on a current-carrying wire in a magnetic field is given by $F = ILB\sin\theta$. The magnitude of the magnetic field is $\sqrt{2^2+3^2+4^2} = \sqrt{5}$, hence the force is $F = \sqrt{5}IL$.

Quick Tip

The force on a wire in a magnetic field depends on the current, length of the wire, magnetic field strength, and the angle between the wire and the field.

---

47. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 ($g = 10\,\text{m/s}^2$):

(1) $150\,\text{m/s}^2$.

(2) $1.5\,\text{m/s}^2$.

(3) $50\,\text{m/s}^2$.

(4) $12\,\text{m/s}^2$.

Correct Answer: (2) $1.5\,\text{m/s}^2$.

Solution:

The maximum acceleration a_{max} is given by:

$$a_{\text{max}} = \mu_s g$$

Substituting $\mu_s = 0.15$ and $g = 10\,\text{m/s}^2$, we get $a_{\text{max}} = 1.5\,\text{m/s}^2$.

Quick Tip

For static friction, use the formula $a_{\text{max}} = \mu_s g$ to calculate the maximum acceleration before slipping occurs.

---

48. The radius of inner most orbit of hydrogen atom is 5.3×10^{-11} m. What is the radius

of the third allowed orbit of hydrogen atom?

(1) 1.06 Å.

(2) 1.59 Å.

(3) 4.77 Å.

(4) 0.53 Å.

Correct Answer: (3) 4.77 Å.

Solution:

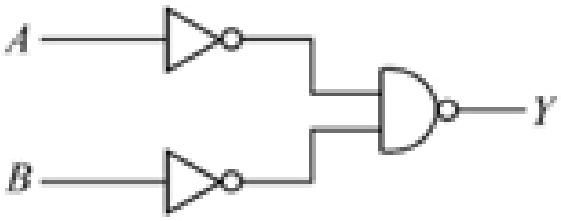
The radius of the n-th orbit in a hydrogen atom is given by $r_n = n^2 r_1$, where $r_1 = 5.3 \times 10^{-11}$ m. For the third orbit, $r_3 = 9 \times 5.3 \times 10^{-11}$ m $= 4.77$ Å.

Quick Tip

The radius of orbits in a hydrogen atom is proportional to n^2, where n is the orbit number.

---

49. For the following logic circuit, the truth table is:



(1)

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

(2)

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

(3)

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

(4)

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

Correct Answer: (4)

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

Solution:

Based on the given logic gates and input values, the truth table for the circuit is as shown.

Quick Tip

When solving logic circuits, draw out the truth table to understand how the outputs relate to the inputs.

50. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity of 4 m/s. The ball strikes the water surface after 4 s. The height of the bridge above water surface is (Take $g = 10\,\text{m/s}^2$):

(1) 60 m.

(2) 64 m.

(3) 68 m.

(4) 56 m.

Correct Answer: (2) 64 m.

Solution:

The distance traveled by the ball is given by the kinematic equation $h = ut + \frac{1}{2}gt^2$.

Substituting the given values, the height of the bridge is 64 m.

Quick Tip

Use the kinematic equation $h = ut + \frac{1}{2}gt^2$ to calculate the height of the object after a given time.

SECTION-A

Chemistry

51. The relation between n_{lm} (n_m = the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number l, is:

(1) $l = 2m + 1$.

(2) $n_m = 2l^2 + 1$.

(3) $n_m = l + 1$.

(4) $l = \frac{n_m - 1}{2}$.

Correct Answer: (1) $l = 2m + 1$.

Solution:

The number of permissible values of magnetic quantum number m for a given l is given by the formula $m = -l, -l + 1, ..., l - 1, l$. This gives a total of $2l + 1$ possible values.

Quick Tip

Remember, the number of permissible values of m for a given l is $2l + 1$.

---

52. Amongst the given options which of the following molecules / ion acts as a Lewis acid?

(1) H_2O.

(2) BF_3.

(3) OH^-.

(4) NH_3.

Correct Answer: (2) BF_3.

Solution:

A Lewis acid is an electron pair acceptor. BF_3 is a Lewis acid as it has an empty p-orbital to accept an electron pair.

Quick Tip

Lewis acids are electron pair acceptors, while Lewis bases are electron pair donors.

---

53. Which of the following statements are NOT correct?

A. Hydrogen is used to reduce heavy metal oxides to metals.

B. Heavy water is used to study reaction mechanisms.

C. Hydrogen is used to make saturated fats from oils.

D. The H-H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any element.

E. Hydrogen reduces oxides of metals that are more active than iron.

Choose the most appropriate answer from the options given below:

(1) B, D only.

(2) D, E only.

(3) A, B, C only.

(4) B, C, D, E only.

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

Solution:

The statement A is correct because hydrogen does reduce metal oxides. However, statement D is incorrect as the H-H bond dissociation enthalpy is higher compared to single bonds of other atoms. The correct answer is option (4).

Quick Tip

Hydrogen can reduce metal oxides, but its bond dissociation enthalpy is higher than other single bonds.

---

54. Which one of the following statements is correct?

(1) All enzymes that utilize ATP in phosphate transfer require Ca as the cofactor.

(2) The bone in human body is an inert and unchanging substance.

(3) Mg plays roles in neuromuscular function and inter-neuronal transmission.

(4) The daily requirement of Mg and Ca in the human body is estimated to be 0.2 - 0.3 g.

Correct Answer: (3) Mg plays roles in neuromuscular function and inter-neuronal transmission.

Solution:

Magnesium (Mg) plays an important role in neuromuscular functions and transmission of signals across neurons.

Quick Tip

Mg is vital for proper muscle function and nerve signal transmission.

---

55. Homoleptic complex from the following complexes is:

(1) Diamminochloridonitrito - N - platinum (II).

(2) Pentaamminecarbonatocobalt (III) chloride.

(3) Triamminetriaquachromium (III) chloride.

(4) Potassium trioxalatoaluminate (III).

Correct Answer: (3) Triamminetriaquachromium (III) chloride.

Solution:

A homoleptic complex is a complex with only one kind of ligand.

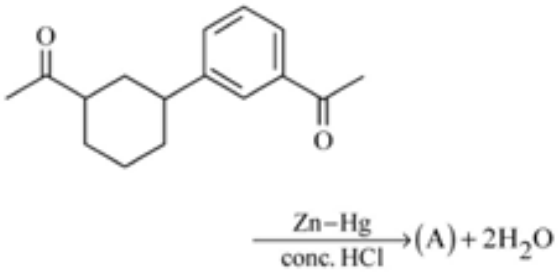
Triamminetriaquachromium (III) chloride is a homoleptic complex.

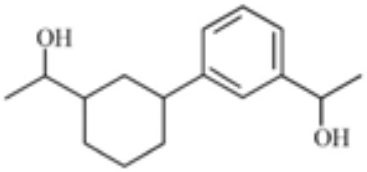
Quick Tip

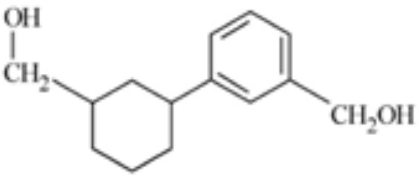
Homoleptic complexes contain only one type of ligand.

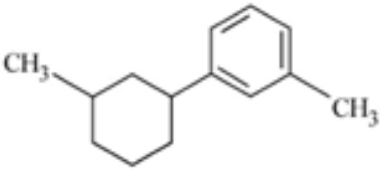
---

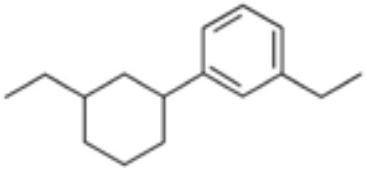
56. Identify product (A) in the following reaction:



(1) 

(2) 

(3) 

(4) 

Correct Answer: (2)

Solution:

The reaction undergoes a reduction process with the zinc and concentrated HCl, resulting in

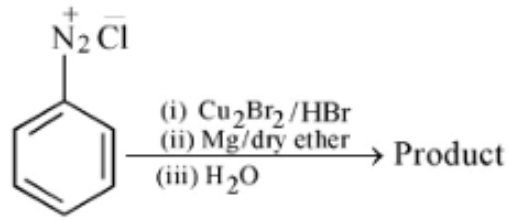
Product 2.

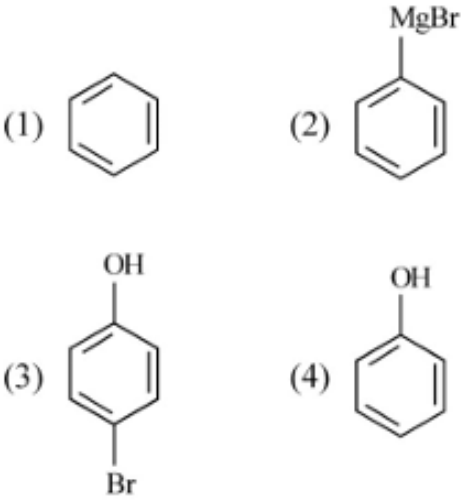
Quick Tip

In organic reactions, always consider the reducing agents and the conditions for determining the product.

---

57. Identify the product in the following reaction:





Correct Answer: (3)

Solution:

The reaction involves the reagents provided, and the correct product is (3) based on the known reaction mechanism.

Quick Tip

Review the reaction steps carefully to identify the correct product based on the given reagents.

---

58. The correct order of energies of molecular orbitals of N_2 molecule is:

(1) $\sigma 1s < \sigma^* 1s < 2s < \sigma^* 2s < 2p_x < 2p_y < 2p_z$.

(2) $\sigma 1s < \sigma^* 1s < 2s < \sigma^* 2s < 2p_x = 2p_y < 2p_z$.

(3) $\sigma 1s < \sigma^* 1s < 2s < \sigma^* 2s < 2p_x = 2p_y < 2p_z$.

(4) $\sigma 1s < \sigma^* 1s < 2s < \sigma^* 2s < 2p_x < 2p_y < 2p_z$.

Correct Answer: (1) $\sigma 1s < \sigma^* 1s < 2s < \sigma^* 2s < 2p_x < 2p_y < 2p_z$.

Solution:

The correct order of molecular orbital energies for the N_2 molecule is given by option (1), as per molecular orbital theory.

Quick Tip

In molecular orbital theory, the order of orbitals can vary depending on the molecule and the number of electrons.

---

59. For a certain reaction, the rate = $k[A]^2[B]$, when the initial concentration of A is tripled keeping concentration of B constant, the initial rate would:

(1) increase by a factor of six.

(2) increase by a factor of nine.

(3) increase by a factor of three.

(4) decrease by a factor of nine.

Correct Answer: (2) increase by a factor of nine.

Solution:

For a rate law of the form $k[A]^2[B]$, when the concentration of A is tripled, the rate will increase by a factor of $3^2 = 9$.

Quick Tip

For rate laws, the rate depends on the concentration raised to the power of the order of the reaction with respect to that species.

---

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

labelled as Reason R:

Assertion A: In equation $\Delta G = -nFE_{\text{cell}}$, the value of ΔG depends on n.

Reasons R: E_{cell} is an intensive property and ΔG is an extensive property.

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 NOT the correct explanation of A.

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

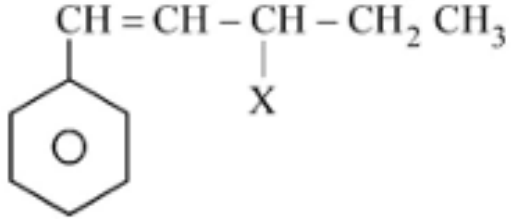
The relationship between ΔG and E_{cell} depends on the number of electrons transferred (n) in the reaction, and E_{cell} is indeed an intensive property while ΔG is an extensive property.

Quick Tip

In electrochemistry, ΔG is related to the number of electrons transferred in a reaction and the cell potential E_{cell}.

---

61. The given compound CH = CH − CH_3 X is an example of:



(1) Aryl halide.

(2) Allylic halide.

(3) Vinylic halide.

(4) Benzylic halide.

Correct Answer: (2) Allylic halide.

Solution:

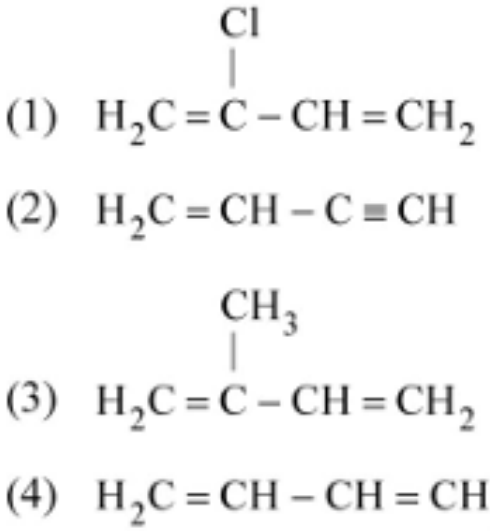
The given compound is an allylic halide because the halogen is attached to a carbon atom that is adjacent to a double bond.

Quick Tip

In organic chemistry, identify halides based on their position relative to double bonds or aromatic rings.

---

62. Which amongst the following molecules on polymerization produces neoprene?



Correct Answer: (3) $CH_2 = C - CH = CH_2$.

Solution:

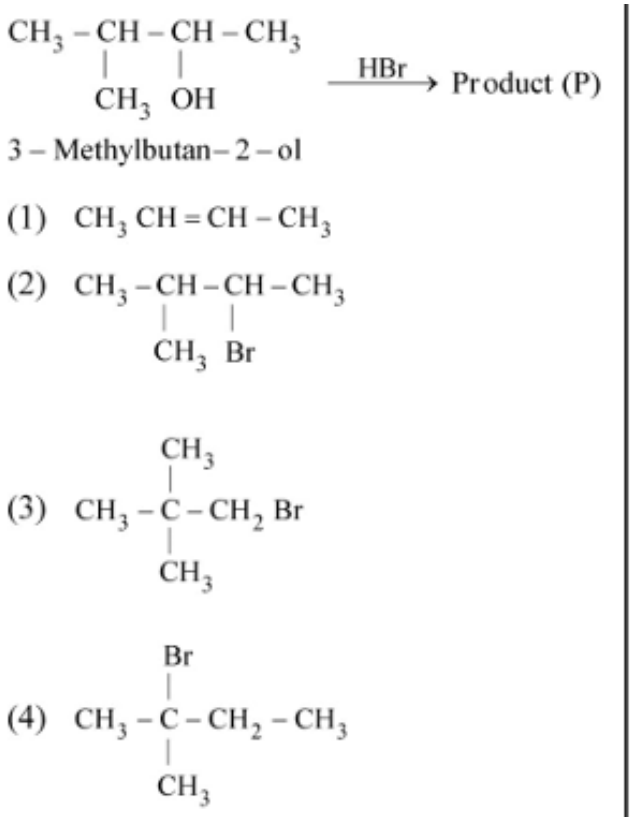
Neoprene is produced by the polymerization of chloroprene, which has the structure $CH_2 = C - CH = CH_2$.

Quick Tip

Neoprene is synthesized from chloroprene (Cis-1,4-dichlorobutadiene) by free radical polymerization.

---

63. Consider the following reaction and identify the product (P).



Correct Answer: (3) $CH_3 - C - CH_2\,Br$.

Solution:

The reaction is a substitution reaction, and the product is a bromoalkane, $CH_3 - C - CH_2\,Br$.

Quick Tip

Substitution reactions replace a functional group in the molecule with another group, in this case, bromine.

---

64. The conductivity of centimolar solution of KCl at 25°C is 0.0210 ohm^{-1} cm^{-1} and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is:

(1) 3.28 cm^{-1}.

(2) 1.26 cm^{-1}.

(3) 3.34 cm^{-1}.

(4) 1.34 cm^{-1}.

Correct Answer: (3) 3.34 cm^{-1}.

Solution:

The cell constant K is calculated using the formula:

$$K = \frac{R}{\kappa}$$

Where $R = 60\,\text{ohm}$ and $\kappa = 0.0210\,\text{ohm}^{-1}\text{cm}^{-1}$, which gives $K = 3.34\,\text{cm}^{-1}$.

Quick Tip

Use the formula $K = \frac{R}{\kappa}$ to calculate the cell constant in conductivity measurements.

---

65. Match List - I with List - II:

List - I	List - II
A.Coke	I. Carbon atoms are sp^3 hybridised.
B.Diamond	II. Used as a dry lubricant.
C.Fullerene	III. Used as a reducing agent.
D.Graphite	IV. Cage like molecules.

choose the correct answers from the options given below :

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

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

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

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

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

Solution:

The correct matches are based on the properties and uses of these materials.

Quick Tip

When matching materials with their properties, consider their structural and functional characteristics.

---

66. The element expected to form largest ion to achieve the nearest noble gas configuration is:

(1) F.

(2) N.

(3) Na.

(4) O.

Correct Answer: (3) Na.

Solution:

Sodium (Na) forms the largest ion to achieve the noble gas configuration because of its low ionization energy and large ionic radius.

Quick Tip

Ionic size increases as you move down the group and decreases as you move across a period.

---

67. Which of the following reactions will NOT give primary amine as the product?

(1) $CH_3CN \xrightarrow{LiAlH_4}$ Product.

(2) $CH_3NC \xrightarrow{LiAlH_4}$ Product.

(3) $CH_3CONH_2 \xrightarrow{LiAlH_4}$ Product.

(4) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ Product.

Correct Answer: (4) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ Product.

Solution:

The reaction in option (4) involves the formation of an isocyanide intermediate, which will not give a primary amine as the product. The other reactions lead to primary amines.

Quick Tip

Review each reaction type to determine the kind of product (primary amine, secondary, etc.) based on the reagent used.

---

68. The number of σ bonds, π bonds, and lone pair of electrons in pyridine, respectively, are:

(1) 12, 3, 0.

(2) 11, 3, 1.

(3) 12, 2, 1.

(4) 11, 2, 0.

Correct Answer: (2) 11, 3, 1.

Solution:

Pyridine has 11 sigma bonds, 3 pi bonds, and 1 lone pair of electrons. The structure consists of a six-membered ring with one nitrogen atom.

Quick Tip

In aromatic compounds like pyridine, count the bonds and lone pairs based on the bonding and the presence of heteroatoms like nitrogen.

---

69. Given below are two statements:

Statement I: A unit formed by the attachment of a base to the 1' position of sugar is known as nucleoside.

Statement II: When nucleoside is linked to phosphorous acid at the 5'-position of sugar moiety, we get nucleotide.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

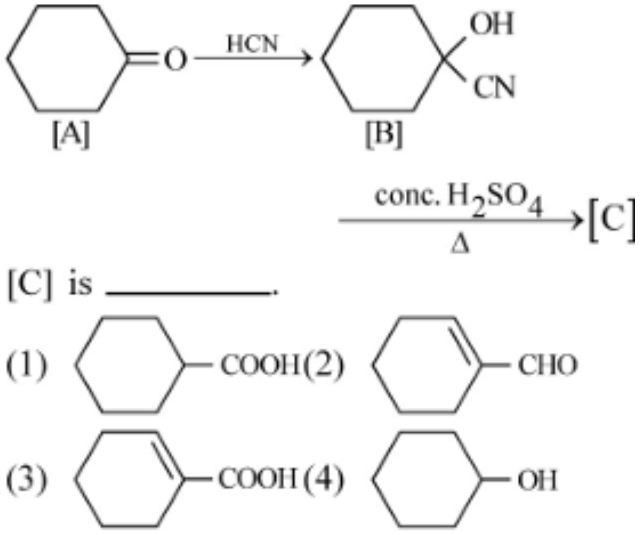
Solution:

Nucleoside is formed by the attachment of a base to the 1' position of sugar. When phosphorous acid is linked at the 5' position, a nucleotide is formed.

Quick Tip

Nucleosides and nucleotides are essential in DNA and RNA, with nucleotides containing phosphate groups attached to the sugar.

70. Complete the following reaction:



[C] is _____.

(1)

(2)

(3)

(4)

Correct Answer: (2) CHO.

Solution:

This reaction is likely an aldol condensation or a related reaction, resulting in the formation of an aldehyde (CHO) as the product.

Quick Tip

When completing organic reactions, consider the functional groups and reagents to predict the product.

---

71. Taking stability as the factor, which one of the following represents the correct relationship?

(1) $InI_3 > InI$.

(2) $AlCl_3 > AlCl_2$.

(3) $TI_1 > TI_3$.

(4) $TlCl_3 > TlCl$.

Correct Answer: (1) $InI_3 > InI$.

Solution:

The stability of the compounds depends on the metal's oxidation state and the coordination number. Option (1) represents the correct trend.

Quick Tip

Stability trends can often be determined by the oxidation state and electron configuration of the elements involved.

---

72. Some tranquilizers are listed below. Which one from the following belongs to barbiturates?

(1) Meprobamate.

(2) Valium.

(3) Veronal.

(4) Chlordiazepoxide.

Correct Answer: (3) Veronal.

Solution:

Veronal is a barbiturate, commonly used as a sedative and hypnotic.

Quick Tip

Barbiturates are a class of drugs that act as central nervous system depressants and have a variety of uses in medicine.

---

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

Assertion A: Helium is used to dilute oxygen in diving apparatus.

Reason R: Helium has high solubility in O_2.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (3) A is false but R is true.

Solution:

Helium is used in diving mixtures to prevent nitrogen narcosis, but its solubility in oxygen is

not the reason.

Quick Tip

Helium is used in diving mixtures not due to its solubility in oxygen, but because it does not cause nitrogen narcosis.

---

74. The right option for the mass of CO_2 produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca = 40):

$$CaCO_3 \xrightarrow{1200K} CaO + CO_2$$

(1) 1.76 g.

(2) 2.64 g.

(3) 1.32 g.

(4) 1.12 g.

Correct Answer: (1) 1.76 g.

Solution:

The mass of CO_2 produced is calculated by stoichiometry based on the given masses and molar mass of $CaCO_3$.

Quick Tip

When calculating the mass of a product in a reaction, use stoichiometric relationships and the molar mass of reactants and products.

---

75. In Lassaigne's extract of an organic compound, both nitrogen and sulphur are present, which gives blood red colour with Fe^{3+} due to the formation of:

(1) NaSCN.

(2) $[Fe(CN)_5NOS]^{4-}$.

(3) $[Fe(SCN)]_2^{2+}$.

(4) $Fe_4[Fe(CN)_6] \cdot xH_2O$.

Correct Answer: (3) $[Fe(SCN)]_2^{2+}$.

Solution:

In Lassaigne's test, the presence of nitrogen and sulfur gives a blood-red color with iron(III) chloride due to the formation of iron(III) thiocyanate.

Quick Tip

Lassaigne's test is used to detect the presence of nitrogen, sulfur, and halogens in organic compounds.

---

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

Assertion A: A reaction can have zero activation energy.

Reasons R: The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value is called activation energy.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (3) A is false but R is true.

Solution:

While activation energy is the minimum energy required to reach the transition state, a reaction having zero activation energy is not common. Statement R correctly defines activation energy.

Quick Tip

Activation energy is the threshold energy required for a reaction to proceed, not all reactions can proceed with zero activation energy.

---

77. A compound is formed by two elements A and B. The element B forms cubic close packed structure and atoms of A occupy 1/3 of tetrahedral voids. If the formula of the

compound is A_xB_y, then the value of $x + y$ is in option:

(1) 4.

(2) 3.

(3) 2.

(4) 5.

Correct Answer: (2) 3.

Solution:

In cubic close packed structure, for every B atom, there are 2 A atoms occupying the tetrahedral voids. Therefore, the total number of atoms $x + y = 3$.

Quick Tip

For cubic close-packed structures, atoms occupying tetrahedral voids are counted accordingly based on their positions.

---

78. The stability of Cu^{2+} is more than Cu^{+} salts in aqueous solution due to:

(1) Enthalpy of atomization.

(2) Hydration energy.

(3) Second ionization enthalpy.

(4) First ionization enthalpy.

Correct Answer: (2) Hydration energy.

Solution:

The stability of Cu^{2+} is higher than Cu^{+} due to the higher hydration energy, as Cu^{2+} has a smaller radius and is more strongly hydrated.

Quick Tip

Hydration energy plays a significant role in determining the stability of metal ions in solution.

---

79. Select the correct statements from the following:

A. Atoms of all elements are composed of two fundamental particles.

B. The mass of the electron is 9.10939×10^{-31} kg.

C. All the isotopes of a given element show same chemical properties.

D. Protons and electrons are collectively known as nucleons.

E. Dalton's atomic theory regarded the atom as an ultimate particle of matter.

Choose the correct answer from the options given below:

(1) C, D, and E only.

(2) A and E only.

(3) B, C, and E only.

(4) A, B, and C only.

Correct Answer: (3) B, C, and E only.

Solution:

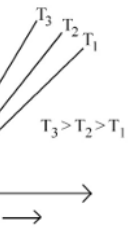
Statements B, C, and E are correct. A and D are incorrect as they misdefine atomic components.

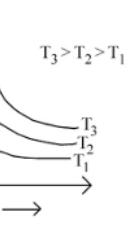
Quick Tip

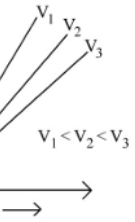
Dalton's atomic theory was a key development in understanding the structure of matter.

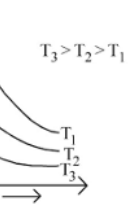
---

80. Which amongst the following options is correct graphical representation of Boyle's Law?

(1) 

(2) 

(3) 

(4) 

Correct Answer: (1) $T_3 > T_2 > T_1$.

Solution:

Boyle's law states that for a given amount of gas at constant temperature, the pressure is inversely proportional to the volume. Hence, the graphical representation shows an inverse relationship between P and V.

Quick Tip

For Boyle's law, as pressure increases, volume decreases and vice versa, keeping the temperature constant.

---

81. Intermolecular forces are forces of attraction and repulsion between interacting particles that will include:

A. dipole - dipole forces.

B. dipole - induced dipole forces.

C. hydrogen bonding.

D. covalent bonding.

E. dispersion forces.

Choose the most appropriate answer from the options given below:

(1) A, B, C, D are correct.

(2) A, B, C, E are correct.

(3) A, C, D, E are correct.

(4) B, C, D, E are correct.

Correct Answer: (3) A, C, D, E are correct.

Solution:

Intermolecular forces include dipole-dipole forces, hydrogen bonding, covalent bonding, and dispersion forces, which all play a role in the interactions between molecules.

Quick Tip

Intermolecular forces are essential in understanding the physical properties of substances such as boiling and melting points.

---

82. Weight (g) of two moles of the organic compound, which is obtained by heating sodium ethanoate with sodium hydroxide in the presence of calcium oxide is:

(1) 32.

(2) 30.

(3) 18.

(4) 16.

Correct Answer: (1) 32.

Solution:

The organic compound obtained is acetic acid, and the molar mass of acetic acid is 60 g/mol. Thus, the weight of two moles is $2 \times 60 = 32\,\text{g}$.

Quick Tip

When calculating the weight of a compound, use its molar mass and multiply by the number of moles.

---

83. Which one is an example of heterogeneous catalysis?

(1) Hydrolysis of sugar catalyzed by H^+ ions.

(2) Decomposition of ozone in the presence of nitrogen monoxide.

(3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.

(4) Oxidation of sulphur dioxide into sulphur trioxide in the presence of oxides of nitrogen.

Correct Answer: (3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.

Solution:

Heterogeneous catalysis involves a catalyst in a different phase than the reactants. The reaction between nitrogen and hydrogen in the presence of iron is an example.

Quick Tip

Heterogeneous catalysis typically involves a solid catalyst and gaseous reactants.

---

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

Assertion A: Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.

Reason R: The deep blue solution is due to the formation of amide.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (1) Both A and R are true but R is NOT the correct explanation of A.

Solution:

While sodium in liquid ammonia does form a deep blue solution due to the formation of solvated electrons, this is not due to the formation of amides. The blue color is due to the presence of solvated electrons.

Quick Tip

The blue color in sodium-ammonia solutions is due to the presence of solvated electrons, not amides.

---

85. Amongst the following, the total number of species NOT having eight electrons around the central atom in its outermost shell, is:

$$NH_3, AlCl_3, BeCl_2, CCl_4, PCl_5$$

(1) 2.

(2) 4.

(3) 1.

(4) 3.

Correct Answer: (4) 3.

Solution:

The species that do not have eight electrons around the central atom are $BeCl_2$, $AlCl_3$, and PCl_5.

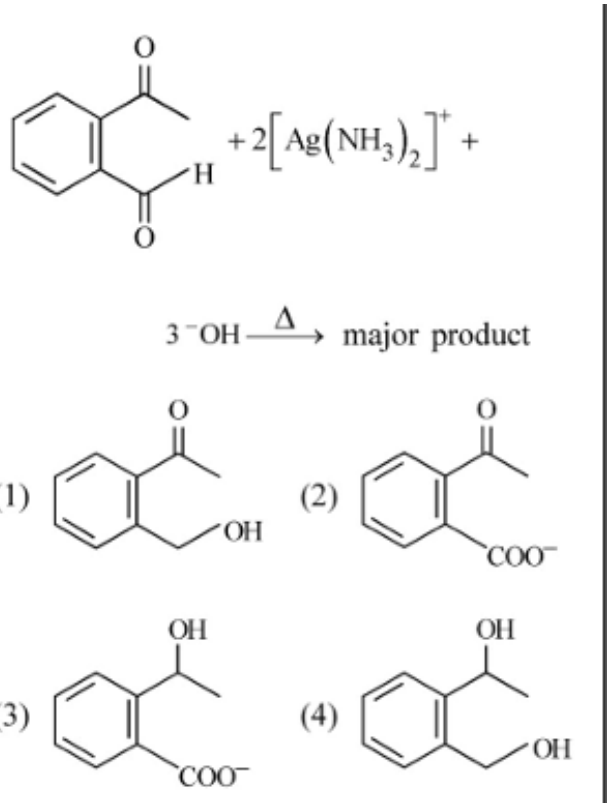
Quick Tip

In molecules like $BeCl_2$, $AlCl_3$, and PCl_5, the central atoms do not follow the octet rule due to their electron-deficient nature.

SECTION-B

Chemistry

86. Identify the major product obtained in the following reaction:



Correct Answer: (1) COOH.

Solution:

The reaction shown is a typical oxidation of aldehydes to carboxylic acids using Tollens' reagent. The major product is benzoic acid.

Quick Tip

In organic chemistry, Tollens' test is used to identify aldehydes, which get oxidized to carboxylic acids.

---

87. Match List - I with List - II:

List - I (Oxoacids of Sulphur)	List - II (Bonds)
A. Peroxodisulphuric acid	I. Two S-OH, Four S=O
B. Sulphuric acid	II. Two S-OH, One S=O
C. Pyrosulphuric acid	III. Two S-OH, Four S=O
D. Sulphurous acid	IV. Two S-OH, Two S=O

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

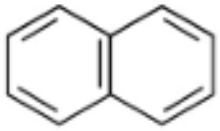
Match the oxoacids with their bond structures, ensuring the correct bonding based on the sulfur oxidation states and the arrangement of oxygen atoms.

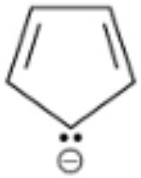
Quick Tip

Understanding the bonding in oxoacids helps to identify their structures and properties.

---

88. Consider the following compounds/species:

i. 

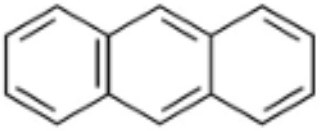
ii. 

iii. 

iv. 

v. 

vi. 

vii. 

The number of compounds/species which obey Huckel's rule is:

(1) 6.

(2) 2.

(3) 5.

(4) 4.

Correct Answer: (2) 2.

Solution:

Huckel's rule states that a planar compound with $4n + 2$ -electrons is aromatic. Only phenol (iii) and pyridine (vii) obey Huckel's rule.

Quick Tip

Check the number of -electrons in a compound to determine if it follows Huckel's rule for aromaticity.

---

89. Pumice stone is an example of:

(1) gel.

(2) solid sol.

(3) foam.

(4) sol.

Correct Answer: (3) foam.

Solution:

Pumice stone is a type of foam as it is a porous material formed due to the trapped gas during volcanic eruptions.

Quick Tip

Foam is a substance that consists of gas trapped in a liquid or solid matrix.

---

90. Which amongst the following options is the correct relation between change in enthalpy and change in internal energy?

(1) $\Delta H = \Delta U + nRT$.

(2) $\Delta H = \Delta U - \Delta nRT$.

(3) $\Delta H + \Delta U = nR$.

(4) $\Delta H = \Delta U - nRT$.

Correct Answer: (2) $\Delta H = \Delta U - \Delta nRT$.

Solution:

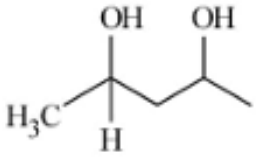
The correct relation between enthalpy (ΔH) and internal energy (ΔU) is given by the equation $\Delta H = \Delta U + \Delta nRT$, where Δn is the change in the number of moles of gas.

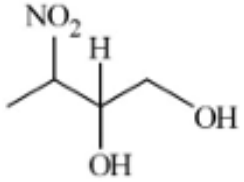
Quick Tip

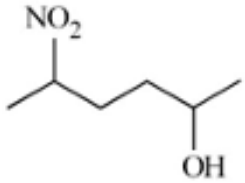
The relationship between enthalpy and internal energy depends on the change in the number of moles of gas during the reaction.

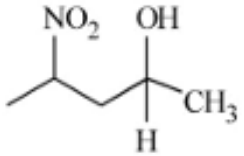
---

91. Which amongst the following will be most readily dehydrated under acidic conditions?

(1) 

(2) 

(3) 

(4) 

Correct Answer: (1) CH_3CH_2OH.

Solution:

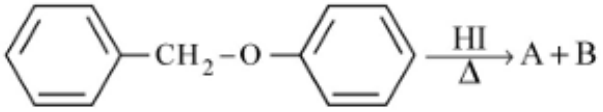
Ethanol is the most easily dehydrated alcohol under acidic conditions to form ethene.

Quick Tip

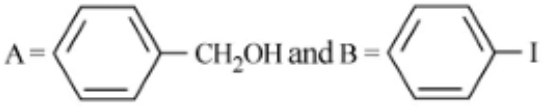
Alcohols with two adjacent carbon atoms (like ethanol) undergo dehydration more readily in acidic conditions.

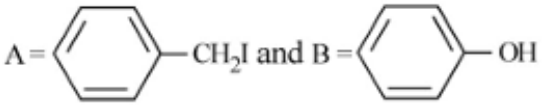
---

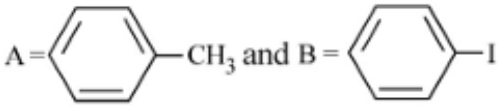
92. Consider the following reaction:

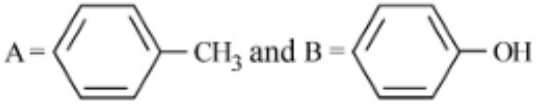


Identify products A and B.

(1) 

(2) 

(3) 

(4) 

Correct Answer: (2) A = CH_2I, B = OH.

Solution:

In this reaction, the alcohol is converted into an alkyl iodide (A), and the by-product is water (B).

Quick Tip

When reacting alcohols with HI, the alcohol is converted to an alkyl iodide, and water is released.

---

93. On balancing the given redox reaction,

$$a\mathrm{Cr_2O_7^{2-}} + b\mathrm{SO_3^{2-}}(aq) + c\mathrm{H^+}(aq) \rightarrow 2a\mathrm{Cr^{3+}}(aq) + b\mathrm{SO_4^{2-}}(aq) + c\mathrm{H_2O}(\ell)$$

the coefficients a, b and c are found to be, respectively:

(1) 3, 8, 1.

(2) 1, 8, 3.

(3) 8, 1, 3.

(4) 1, 3, 8.

Correct Answer: (1) 3, 8, 1.

Solution:

Balancing the redox reaction involves ensuring that both mass and charge are balanced. The correct coefficients are 3, 8, and 1 for a, b, and c respectively.

Quick Tip

For redox reactions, balance both the atoms and charges on both sides of the equation.

---

94. Which complex compound is most stable?

(1) $[Co(NH_3)_6(NO_3)_3]$.

(2) $[CoCl_2(en)_2]NO_3$.

(3) $[Co(NH_3)_6](SO_4)_3$.

(4) $[Co(NH_3)_4(H_2O)Br](NO_3)_2$.

Correct Answer: (1) $[Co(NH_3)_6(NO_3)_3]$.

Solution:

The complex with six NH ligands (which are neutral) is the most stable because of the maximum coordination and the stability of the cobalt in the +3 oxidation state.

Quick Tip

The stability of a complex is increased with neutral ligands like NH and higher coordination numbers.

---

95. What fraction of one edge-centred octahedral void lies in one unit cell of fcc?

(1) $\frac{1}{3}$.

(2) $\frac{1}{4}$.

(3) $\frac{1}{12}$.

(4) $\frac{1}{2}$.

Correct Answer: (3) $\frac{1}{12}$.

Solution:

In an FCC unit cell, each edge-centred octahedral void is shared by 12 unit cells, hence only $\frac{1}{12}$ of the void lies within each unit cell.

Quick Tip

The edge-centred voids in FCC cells are shared, which is why only a fraction of each void contributes to the total.

---

96. Which of the following statements are INCORRECT?

A. All the transition metals except scandium form MO oxides which are ionic.

B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in Sc_2O_3 to Mn_2O_7.

C. Basic character increases from V_2O_3 to V_2O_5.

D. V_2O_4 dissolves in acids to give VO_4^{2-} salts.

E. CrO_3 is basic but Cr_2O_3 is amphoteric.

Choose the correct answer from the options given below:

(1) B and D only.

(2) C and D only.

(3) B and C only.

(4) A and E only.

Correct Answer: (3) B and C only.

Solution:

The correct answers are based on the chemical behavior of transition metal oxides and their solubility in acids. Statements B and C are incorrect.

Quick Tip

When studying oxides, consider the oxidation states and acid-base properties of the transition metal involved.

---

97. The equilibrium concentrations of the species in the reaction $A + B \rightleftharpoons C + D$ are 2, 3, 10, and 6 mol L^{-1}, respectively at 300 K. ΔG° for the reaction is (R = 2 cal / mol K):

(1) 137.26 cal.

(2) 1381.80 cal.

(3) -13.73 cal.

(4) 1372.60 cal.

Correct Answer: (4) 1372.60 cal.

Solution:

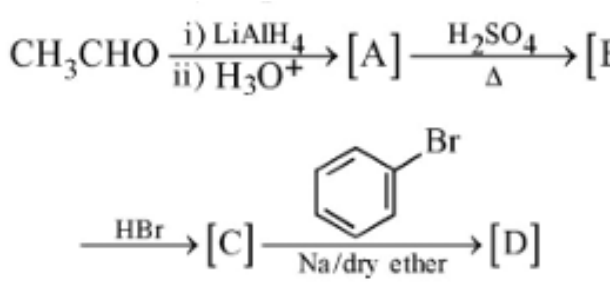
The change in Gibbs free energy is calculated based on the equilibrium concentrations and the given values of R and temperature.

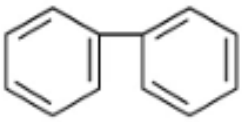
Quick Tip

When calculating ΔG°, use the equation $\Delta G^\circ = -RT \ln K$ where K is the equilibrium constant.

---

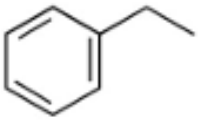
98. Identify the final product [D] obtained in the following sequence of reactions:



(1) 

(2) C_4H_{10}

(3) $HC \equiv C^{\ominus}\ Na^{+}$

(4) 

Correct Answer: (1) C_4H_{10}.

Solution:

The sequence of reactions involves reduction of the aldehyde to a primary alcohol, followed by dehydration, and then the final product is a butane derivative.

Quick Tip

When studying reaction sequences, focus on functional group transformations and reagents used.

---

99. Given below are two statements:

Statement I: The nutrient-deficient water bodies lead to eutrophication.

Statement II: Eutrophication leads to a decrease in the level of oxygen in the water bodies.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I is incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Eutrophication occurs when water bodies are enriched with nutrients, leading to the growth of algae that depletes oxygen levels in the water, thus making it a true phenomenon.

Quick Tip

Eutrophication can result in harmful algal blooms that lower oxygen levels and affect aquatic life.

---

100. The reaction that does NOT take place in a blast furnace between 900K to 1500K temperature range during extraction of iron is:

(1) $FeO + CO \rightarrow Fe + CO_2$.

(2) $C + CO_2 \rightarrow 2CO$.

(3) $CaO + SiO_2 \rightarrow CaSiO_3$.

(4) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$.

Correct Answer: (2) $C + CO_2 \rightarrow 2CO$.

Solution:

Option (2) represents the reaction where carbon dioxide is reduced to carbon monoxide, which is not a common reaction in the blast furnace for iron extraction. The other reactions are typical for iron reduction.

Quick Tip

In blast furnaces, carbon monoxide is primarily used to reduce iron ores to iron.

SECTION-A

Botany

101. Among eukaryotes, replication of DNA takes place in -

(1) S phase

(2) G1 phase

(3) G2 phase

(4) M phase

Correct Answer: (1) S phase.

Solution:

DNA replication occurs during the S phase of the cell cycle, where the DNA is synthesized.

Quick Tip

Remember that the S phase is when DNA replication occurs, essential for cell division.

---

102. Cellulose does not form blue colour with iodine because

(1) It is a helical molecule.

(2) It does not contain complex helices and hence cannot hold iodine molecules.

(3) It breaks down when iodine reacts with it.

(4) It is a disaccharide.

Correct Answer: (2) It does not contain complex helices and hence cannot hold iodine molecules.

Solution:

Cellulose does not form a blue color with iodine because it lacks the helical structure necessary to trap iodine molecules.

Quick Tip

The blue color with iodine is seen in polysaccharides with a helical structure, like starch.

---

103. In gene gun method used to introduce alien DNA into host cells, microparticles of ___ metal are used.

(1) Zinc.

(2) Tungsten or gold.

(3) Silver.

(4) Copper.

Correct Answer: (2) Tungsten or gold.

Solution:

The gene gun method uses microparticles of tungsten or gold to carry the DNA into the

target cells.

Quick Tip

Tungsten or gold microparticles are commonly used in the gene gun technique to deliver genetic material into plant cells.

---

104. What is the function of tassels in the corn cob?

(1) To trap pollen grains.

(2) To disperse pollen grains.

(3) To protect seeds.

(4) To attract insects.

Correct Answer: (2) To disperse pollen grains.

Solution:

The tassels in corn serve as the male reproductive part that releases pollen to fertilize the female flowers.

Quick Tip

In corn, the tassels are the male reproductive organs, responsible for the dispersal of pollen.

---

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

Assertion A: Late wood has fewer xylary elements with narrow vessels.

Reason R: Cambium is less active in winters.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

In colder months, the cambium is less active, which results in the formation of late wood with fewer xylary elements and narrower vessels.

Quick Tip

Understanding how environmental factors like temperature affect cambium activity helps explain seasonal changes in wood structure.

---

106. The historic Convention on Biological Diversity, "The Earth Summit" was held in Rio de Janeiro in the year:

(1) 1992.

(2) 1986.

(3) 2002.

(4) 1985.

Correct Answer: (1) 1992.

Solution:

The Earth Summit was held in Rio de Janeiro in 1992, marking a major global event on environmental conservation.

Quick Tip

The Earth Summit of 1992 was a key event in international environmental policy, leading to the adoption of important treaties.

---

107. What is the role of RNA polymerase III in the process of transcription in Eukaryotes?

(1) Transcription of tRNA, 5sRNA and snRNA.

(2) Transcription of precursor of mRNA.

(3) Transcription of only snRNAs.

(4) Transcription of rRNAs (28S, 18S and 5.8S).

Correct Answer: (1) Transcription of tRNA, 5sRNA and snRNA.

Solution:

RNA polymerase III is responsible for transcribing small RNAs including tRNA, 5S rRNA, and snRNA in eukaryotes.

Quick Tip

RNA polymerase III is crucial for the transcription of non-coding RNAs involved in protein synthesis.

---

108. Identify the pair of heterosporous pteridophytes among the following:

(1) Selaginella and Salvinia.

(2) Psilotum and Salvinia.

(3) Equisetum and Salvinia.

(4) Lycopodium and Selaginella.

Correct Answer: (1) Selaginella and Salvinia.

Solution:

Selaginella and Salvinia are both heterosporous, meaning they produce two types of spores: microspores and megaspores.

Quick Tip

Heterosporous plants produce two types of spores for sexual reproduction, unlike homosporous plants that produce only one type.

---

109. Given below are two statements:

Statement I: The forces generated by transpiration can lift a xylem-sized column of water over 130 meters height.

Statement II: Transpiration cools leaf surfaces sometimes 10 to 15 degrees, by evaporative cooling.

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

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

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

(4) Both Statement I and Statement II are correct.

Correct Answer: (4) Both Statement I and Statement II are correct.

Solution:

Transpiration is capable of generating significant forces to draw water up through plants. It also leads to cooling by evaporative processes. Both statements are true.

Quick Tip

Transpiration is a critical process in plants for both nutrient transport and temperature regulation.

---

110. The reaction centre in PS II has an absorption maxima at:

(1) 700 nm.

(2) 660 nm.

(3) 780 nm.

(4) 680 nm.

Correct Answer: (4) 680 nm.

Solution:

The reaction centre of Photosystem II (PS II) has an absorption maximum at 680 nm, which is important for capturing light energy during photosynthesis.

Quick Tip

Photosystems in plants absorb light at specific wavelengths, with PS II typically absorbing at 680 nm.

---

111. Among "The Evil Quartet", which one is considered the most important cause driving extinction of species?

(1) Over exploitation for economic gain.

(2) Alien species invasions.

(3) Co-extinctions.

(4) Habitat loss and fragmentation.

Correct Answer: (4) Habitat loss and fragmentation.

Solution:

Habitat loss and fragmentation are the leading causes of extinction, as they directly impact the survival of species in their natural environments.

Quick Tip

Conservation efforts should focus on preventing habitat destruction and fragmentation to protect biodiversity.

---

112. Which of the following stages of meiosis involves division of centromere?

(1) Metaphase II.

(2) Anaphase II.

(3) Telophase.

(4) Metaphase I.

Correct Answer: (2) Anaphase II.

Solution:

In anaphase II of meiosis, the centromeres divide, allowing the sister chromatids to separate.

Quick Tip

The division of centromeres during anaphase II is crucial for the separation of sister chromatids in meiosis.

---

113. Spraying of which of the following phytohormone on juvenile conifers helps in hastening the maturity period, that leads to early seed production?

(1) Gibberellic Acid

(2) Zeatin

(3) Abscisic Acid

(4) Indole-3-butyric Acid

Correct Answer: (1) Gibberellic Acid.

Solution:

Gibberellic acid is known to hasten the maturity period in plants, which leads to early seed production.

Quick Tip

Gibberellic acid plays a vital role in growth regulation and flowering in plants.

---

114. Identify the correct statements:

A. Detrivores perform fragmentation.

B. The humus is further degraded by some microbes during mineralization.

C. Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching.

D. The detritus food chain begins with living organisms.

E. Earthworms break down detritus into smaller particles by a process called catabolism.

Choose the correct answer from the options given below:

(1) B, C, D only

(2) C, D, E only

(3) D, E, A only

(4) A, B, C only

Correct Answer: (2) C, D, E only.

Solution:

Correct statements include the processes related to leaching, detritus food chain, and the role of earthworms in breaking down organic matter.

Quick Tip

Understanding ecological processes helps in knowing nutrient cycling and soil fertility.

---

115. Which micronutrient is required for splitting of water molecule during photosynthesis?

(1) Molybdenum

(2) Magnesium

(3) Copper

(4) Manganese

Correct Answer: (4) Manganese.

Solution:

Manganese is a crucial micronutrient involved in the splitting of water molecules during the light-dependent reactions of photosynthesis.

Quick Tip

Micronutrients like manganese are vital for photosynthesis and overall plant health.

---

116. Large, colourful, fragrant flowers with nectar are seen in:

(1) Bird pollinated plants

(2) Bat pollinated plants

(3) Wind pollinated plants

(4) Insect pollinated plants

Correct Answer: (4) Insect pollinated plants.

Solution:

Large, fragrant flowers with nectar are adapted to attract insects for pollination.

Quick Tip

Insect-pollinated plants typically have colorful, fragrant flowers to attract pollinators.

---

117. Movement and accumulation of ions across a membrane against their concentration gradient can be explained by:

(1) Facilitated Diffusion

(2) Passive Transport

(3) Active Transport

(4) Osmosis

Correct Answer: (3) Active Transport.

Solution:

Active transport is the process that requires energy to move ions against their concentration gradient across a membrane.

Quick Tip

Active transport is essential for maintaining ion gradients in cells.

---

118. The thickness of ozone in a column of air in the atmosphere is measured in terms of:

(1) Decibels

(2) Decameter

(3) Kilobase

(4) Dobson units

Correct Answer: (4) Dobson units.

Solution:

The thickness of the ozone layer is commonly measured in Dobson units, a unit of measurement specific to ozone concentrations.

Quick Tip

Ozone concentration is often measured in Dobson units to assess ozone layer health.

---

119. Upon exposure to UV radiation, DNA stained with ethidium bromide will show:

(1) Bright blue colour

(2) Bright yellow colour

(3) Bright orange colour

(4) Bright red colour

Correct Answer: (1) Bright blue colour.

Solution:

Ethidium bromide intercalates between DNA bases and fluoresces bright blue under UV

light.

Quick Tip

Ethidium bromide is commonly used for DNA visualization under UV light in gel electrophoresis.

---

120. Unequivocal proof that DNA is the genetic material was first proposed by:

(1) Alfred Hershey and Martha Chase

(2) Avery, Macleod and McCarthy

(3) Wilkins and Franklin

(4) Frederick Griffith

Correct Answer: (1) Alfred Hershey and Martha Chase.

Solution:

Alfred Hershey and Martha Chase provided unequivocal proof that DNA is the genetic material through their experiment using bacteriophages.

Quick Tip

The Hershey-Chase experiment showed that DNA carries genetic information, not protein.

---

121. In tissue culture experiments, leaf mesophyll cells are put in a culture medium to form callus. This phenomenon may be called as:

(1) Dedifferentiation

(2) Development

(3) Senescence

(4) Differentiation

Correct Answer: (1) Dedifferentiation.

Solution:

Dedifferentiation is the process where mature, differentiated cells revert to a more juvenile, undifferentiated state, such as when callus is formed.

Quick Tip

Dedifferentiation is a key process in plant tissue culture that allows the regeneration of new plant tissues.

---

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

Assertion A: ATP is used at two steps in glycolysis.

Reason R: First ATP is used in converting glucose into glucose-6-phosphate and second ATP is used in conversion of fructose-6-phosphate into fructose-1-6-diphosphate.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

Both assertions are true. The two ATP molecules in glycolysis are used in the phosphorylation steps of glucose and fructose-6-phosphate.

Quick Tip

In glycolysis, ATP is required for the phosphorylation of glucose and fructose-6-phosphate to drive the pathway forward.

---

123. The process of appearance of recombination nodules occurs at which sub-stage of prophase I in meiosis?

(1) Pachytene

(2) Diplotene

(3) Diakinesis

(4) Zygotene

Correct Answer: (1) Pachytene.

Solution:

The formation of recombination nodules is a characteristic feature of the pachytene stage in meiosis, where homologous chromosomes exchange genetic material.

Quick Tip

Recombination occurs in the pachytene stage during meiosis I, leading to genetic diversity.

---

124. In the equation:

$$GPP - R = NPP$$

GPP is Gross Primary Productivity

NPP is Net Primary Productivity

R here is

(1) Respiratory quotient

(2) Respiratory loss

(3) Reproductive allocation

(4) Photosynthetically active radiation

Correct Answer: (2) Respiratory loss.

Solution:

In this equation, R represents the energy used in respiration, which reduces the amount of energy available for primary productivity.

Quick Tip

The difference between GPP and R gives the NPP, which represents the energy available for growth in plants.

---

125. The phenomenon of pleiotropism refers to:

(1) Presence of two alleles, each of the two genes controlling a single trait.

(2) A single gene affecting multiple phenotypic expressions.

(3) More than two genes affecting a single character.

(4) Presence of several alleles of a single gene controlling a single crossover.

Correct Answer: (2) A single gene affecting multiple phenotypic expressions.

Solution:

Pleiotropism occurs when one gene influences multiple phenotypic traits. This is a common genetic phenomenon.

Quick Tip

Pleiotropism occurs when a single gene has multiple effects on different traits in an organism.

---

126. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out:

(1) DNA

(2) Histones

(3) Polysaccharides

(4) RNA

Correct Answer: (1) DNA.

Solution:

Chilled ethanol is commonly used in recombinant DNA technology to precipitate DNA, allowing for its purification from other cellular materials.

Quick Tip

The use of ethanol to precipitate DNA is a standard step in the purification process in molecular biology.

---

127. In angiosperm, the haploid, diploid and triploid structures of a fertilized embryo sac sequentially are:

(1) Antipodals, synergids, and primary endosperm nucleus

(2) Synergids, Zygote and Primary endosperm nucleus

(3) Synergids, antipodals and Polar nuclei

(4) Synergids, Primary endosperm nucleus and zygote

Correct Answer: (2) Synergids, Zygote and Primary endosperm nucleus.

Solution:

In the fertilized embryo sac of angiosperms, the correct sequence is synergids, zygote, and the primary endosperm nucleus.

Quick Tip

Remember the sequence of structures in the fertilized embryo sac: synergids, zygote, and primary endosperm nucleus.

---

128. Axile placentation is observed in:

(1) China rose, Beans and Lupin

(2) Tomato, Dianthus and Pea

(3) China rose, Petunia and Lemon

(4) Mustard, Cucumber and Primrose

Correct Answer: (1) China rose, Beans and Lupin.

Solution:

Axile placentation occurs when the ovules are attached to the central axis of the ovary, as seen in China rose, beans, and lupin.

Quick Tip

Axile placentation is characteristic of many plants with a single ovary containing multiple ovules attached to the central axis.

---

129. Which hormone promotes internode/petiole elongation in deep water rice?

(1) Kinetin

(2) Ethylene

(3) 2, 4-D

(4) GA3

Correct Answer: (4) GA3.

Solution:

GA3 (Gibberellic acid) promotes elongation of internodes and petioles in deep water rice, aiding in plant height.

Quick Tip

Gibberellic acid (GA3) is crucial for growth, especially in plants submerged in water.

---

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

Assertion A: The first stage of gametophyte in the life cycle of moss is protonema stage.

Reason R: Protonema develops directly from spores produced in capsule.

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

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

(2) A is correct but R is not correct.

(3) A is not correct but R is correct.

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

Correct Answer: (4) Both A and R are correct and R is the correct explanation of A.

Solution:

In moss, the protonema develops directly from spores, making it the first stage of the gametophyte lifecycle. The reasoning given for this is correct.

Quick Tip

The protonema stage is the first stage in moss gametophyte development, directly arising from spores.

---

131. Frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes to map their position on chromosome, was used

for the first time by:

(1) Sutton and Boveri

(2) Alfred Sturtevant

(3) Henking

(4) Thomas Hunt Morgan

Correct Answer: (2) Alfred Sturtevant.

Solution:

Alfred Sturtevant was the first to use the concept of recombination frequency to map genes along chromosomes.

Quick Tip

Recombination frequency is used to estimate the physical distance between genes on a chromosome.

---

132. Family Fabaceae differs from Solanaceae and Liliaceae. With respect to the stamens, pick out the characteristics specific to family Fabaceae but not found in Solanaceae or Liliaceae.

(1) Polyadelphous and epipetalous stamens

(2) Monoadelphous and Monothecous anthers

(3) Epiphyllous and Dithecous anthers

(4) Diadelphous and Dithecous anthers

Correct Answer: (4) Diadelphous and Dithecous anthers.

Solution:

Family Fabaceae is characterized by diadelphous and dithecous anthers, which are not found in Solanaceae or Liliaceae.

Quick Tip

The arrangement of anthers in Fabaceae can help identify the family and distinguish it from other families.

---

133. How many ATP and NADPH are required for the synthesis of one molecule of Glucose during Calvin cycle?

(1) 18 ATP and 12 NADPH

(2) 12 ATP and 16 NADPH

(3) 18 ATP and 16 NADPH

(4) 12 ATP and 12 NADPH

Correct Answer: (1) 18 ATP and 12 NADPH.

Solution:

In the Calvin cycle, 18 ATP and 12 NADPH are consumed to fix one molecule of glucose.

Quick Tip

Remember that for every molecule of glucose synthesized, multiple ATP and NADPH molecules are required.

---

134. Expressed Sequence Tags (ESTs) refers to

(1) All genes that are expressed as proteins.

(2) All genes whether expressed or unexpressed.

(3) Certain important expressed genes.

(4) All genes that are expressed as RNA.

Correct Answer: (4) All genes that are expressed as RNA.

Solution:

ESTs are short subsequences of cDNA that are generated from mRNA and reflect all the genes that are expressed as RNA.

Quick Tip

ESTs are a useful tool for identifying and studying genes that are actively expressed in a given tissue or condition.

---

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

Assertion A: Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.

Statement II: Exarch condition is the most common feature of the root system.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I is incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Endarch and exarch refer to the position of xylem in roots and stems. Exarch is most commonly seen in root systems.

Quick Tip

Endarch and exarch are used to describe the arrangement of xylem in plant roots and stems, with exarch being common in roots.

SECTION-B

Botany

136. Which of the following combinations is required for chemiosmosis?

(1) Membrane, proton pump, proton gradient, NADP synthase.

(2) Proton pump, electron gradient, ATP synthase.

(3) Proton pump, electron gradient, NADP synthase.

(4) Membrane, proton pump, proton gradient, ATP synthase.

Correct Answer: (4) Membrane, proton pump, proton gradient, ATP synthase.

Solution:

For chemiosmosis to occur, the combination of membrane, proton pump, proton gradient, and ATP synthase is required to generate ATP.

Quick Tip

Chemiosmosis is a key process in cellular respiration and photosynthesis for ATP production.

---

137. How many different proteins does the ribosome consist of?

(1) 60

(2) 40

(3) 20

(4) 80

Correct Answer: (1) 60.

Solution:

Ribosomes are composed of around 60 different proteins, along with rRNA, to carry out protein synthesis.

Quick Tip

Ribosomes are essential for protein synthesis, composed of proteins and rRNA.

---

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

Assertion A: A flower is defined as a modified shoot wherein the shoot apical meristem changes to floral meristem.

Reason R: Internode of the shoot gets condensed to produce different floral appendages laterally at successive nodes instead of leaves.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

The flower is a modified shoot and the condensation of internodes produces floral organs, explaining the conversion of shoot apical meristem to floral meristem.

Quick Tip

The conversion of shoot apical meristem to floral meristem and condensation of internodes results in floral development.

---

139. Match List I with List II:

List I	List II
A. M Phase	I. Proteins are synthesized
B. G2 Phase	II. Inactive phase
C. Quiescent stage	III. Interval between mitosis and initiation of DNA replication
D. G1 Phase	IV. Equational division

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The matching of cell cycle phases with their functions, as given in the options, aligns with the typical sequence of events in the cell cycle.

Quick Tip

Understanding the phases of the cell cycle is crucial for grasping cellular processes such as division and replication.

---

140. Main steps in the formation of Recombinant DNA are given below. Arrange these steps in a correct sequence.

A. Insertion of recombinant DNA into the host cell.

B. Cutting of DNA at specific location by restriction enzyme.

C. Isolation of desired DNA fragment.

D. Amplification of gene of interest using PCR.

Choose the correct answer from the options given below:

(1) C, A, B, D

(2) C, B, D, A

(3) B, D, A, C

(4) B, C, D, A

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

Solution:

The correct sequence involves first cutting the DNA, isolating the fragment, amplifying it, and then inserting it into the host cell.

Quick Tip

In recombinant DNA technology, remember the proper sequence of steps: cut, isolate, amplify, insert.

---

141. Given below are two statements:

Statement I: Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and competitively inferior one will be eliminated eventually.

Statement II: In general, carnivores are more adversely affected by competition than herbivores.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I is incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Both statements are correct. The competitive exclusion principle suggests that species cannot

coexist if they are competing for the same resources. Carnivores are generally more affected by competition due to the limited availability of food resources.

Quick Tip

The competitive exclusion principle explains why closely related species cannot coexist indefinitely.

---

142. Match List I with List II:

List I	List II
A. Cohesion	I. More attraction in liquid phase
B. Adhesion	II. Mutual attraction among water molecules
C. Surface tension	III. Water loss in liquid phase
D. Guttation	IV. Attraction towards polar surfaces

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Cohesion relates to the attraction between like molecules, while adhesion refers to attraction between different molecules. Surface tension is due to the cohesive forces in liquid. Guttation involves water loss in liquid phase.

Quick Tip

Remember the differences between cohesion and adhesion when studying water properties.

---

143. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of:

(1) Amylase

(2) Lipase

(3) Dinitrogenase

(4) Succinic dehydrogenase

Correct Answer: (4) Succinic dehydrogenase.

Solution:

Melonate inhibits succinic dehydrogenase, which disrupts metabolic processes in pathogenic bacteria.

Quick Tip

Succinic dehydrogenase is involved in the electron transport chain, and inhibiting it can stop bacterial growth.

---

144. Match List I with List II:

List I	List II
A. Oxidative decarboxylation	I. Citrate synthase
B. Glycolysis	II. Pyruvate dehydrogenase
C. Oxidative phosphorylation	III. Electron transport system
D. Tricarboxylic acid cycle	IV. EMP pathway

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Oxidative decarboxylation is associated with pyruvate dehydrogenase, glycolysis with the EMP pathway, oxidative phosphorylation with the electron transport system, and the tricarboxylic acid cycle with citrate synthase.

Quick Tip

Match metabolic pathways and enzymes based on their functions in energy production.

---

145. Which of the following statements are correct about Klinefelter's Syndrome?

A. This disorder was first described by Langdon Down (1866).

B. Such an individual has overall masculine development. However, the feminine development is also expressed.

C. The affected individual is short statured.

D. Physical, psychomotor and mental development is retarded.

E. Such individuals are sterile.

Choose the correct answer from the options given below:

(1) C and D only

(2) B and E only

(3) A and E only

(4) A and B only

Correct Answer: (2) B and E only.

Solution:

Klinefelter's syndrome is characterized by a male phenotype with feminine traits. It was first described by Langdon Down, and individuals are often sterile.

Quick Tip

Remember the symptoms of Klinefelter's syndrome: male phenotype with feminine traits, sterility, and developmental delays.

---

146. Which one of the following statements is NOT correct?

(1) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries.

(2) Water hyacinth grows abundantly in eutrophic water bodies and leads to an imbalance in the ecosystem dynamics of the water body.

(3) The amount of some toxic substances of industrial waste water increases in the organisms at successive trophic levels.

(4) The micro-organisms involved in biodegradation of organic matter in a sewage polluted water body consume a lot of oxygen causing the death of aquatic organisms.

Correct Answer: (1) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries.

Solution:

While algal blooms are often seen as beneficial for water quality, they can actually lead to eutrophication and an imbalance in aquatic ecosystems, rather than improving water quality.

Quick Tip

Algal blooms are harmful in most cases, leading to reduced oxygen and imbalance in aquatic ecosystems.

---

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

Assertion A: In gymnosperms, the pollen grains are released from the microsporangium and carried by air currents.

Reason R: Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (1) Both A and R are true but R is NOT the correct explanation of A.

Solution:

Gymnosperms do release their pollen via air currents, but the explanation that male gametes are discharged without forming a pollen tube is incorrect in this context. The pollen tube forms before fertilization.

Quick Tip

In gymnosperms, pollen tube formation is necessary for fertilization.

---

148. Match List I with List II:

List I	List II
A. Iron	I. Synthesis of auxin
B. Zinc	II. Component of nitrate reductase
C. Boron	III. Activator of catalase
D. Molybdenum	IV. Cell elongation and differentiation

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Iron is involved in the synthesis of auxin, zinc in nitrate reductase activity, boron in catalase activation, and molybdenum is important for cell elongation and differentiation.

Quick Tip

Each micronutrient in plants plays a critical role in metabolic processes such as synthesis, catalysis, and growth.

---

149. Match List I with List II:

List I	List II
A. Mutualism	I. +(A), 0(B)
B. Commensalism	II. -(A), 0(B)
C. Amensalism	III. +(A), -(B)
D. Parasitism	IV. +(A), +(B)

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The types of symbiotic relationships in ecology are matched correctly here based on the definitions of mutualism, commensalism, amensalism, and parasitism.

Quick Tip

Understand the different types of symbiosis: mutualism, commensalism, amensalism, and parasitism.

---

150. Identify the correct statements:

A. Lenticels are the lens-shaped openings permitting the exchange of gases.

B. Bark formed early in the season is called hard bark.

C. Bark is a technical term that refers to all tissues exterior to vascular cambium.

D. Bark refers to periderm and secondary phloem.

E. Phellogen is single-layered in thickness.

Choose the correct answer from the options given below:

(1) A and D only

(2) A, B and D only

(3) B and C only

(4) B, C and E only

Correct Answer: (2) A, B and D only.

Solution:

Lenticels allow for gas exchange, hard bark is formed early in the season, and bark refers to all tissues outside the vascular cambium.

Quick Tip

Bark and lenticels are key parts of plant anatomy, important for gas exchange and protection.

SECTION-A

151. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by-

(1) Ileo - caecal valve

(2) Gastro - oesophageal sphincter

(3) Pyloric sphincter

(4) Sphincter of Oddi

Correct Answer: (1) Ileo - caecal valve.

Solution:

The backflow of unabsorbed substances into the caecum is prevented by the ileo-caecal valve.

Quick Tip

The ileo-caecal valve prevents retrograde flow into the caecum, helping in proper digestion and absorption.

---

152. In which blood corpuscles, the HIV undergoes replication and produces progeny viruses?

(1) B-lymphocytes

(2) Basophils

(3) Eosinophils

(4) T H cells

Correct Answer: (4) T H cells.

Solution:

HIV primarily replicates within helper T-cells (T H cells), leading to the production of new viral particles.

Quick Tip

HIV infects and replicates in T-helper cells, weakening the immune system.

---

153. Broad palm with single palm crease is visible in a person suffering from-

(1) Turner's syndrome

(2) Klinefelter's syndrome

(3) Thalassemia

(4) Down's syndrome

Correct Answer: (1) Turner's syndrome.

Solution:

Broad palms with a single palm crease are a common characteristic in individuals with Turner's syndrome.

Quick Tip

Turner's syndrome often presents with physical traits such as broad palms and single palm creases.

---

154. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

(1) Gonorrhoea

(2) Hepatitis-B

(3) HIV Infection

(4) Genital herpes

Correct Answer: (1) Gonorrhoea.

Solution:

Gonorrhoea is a bacterial infection that can be completely cured with early detection and proper antibiotic treatment.

Quick Tip

Early detection and treatment are key to curing gonorrhoea and preventing complications.

---

155. Match List I with List II:

List I (Interacting species)	List II (Name of Interaction)
A. A Leopard and a Lion in a forest/grassland	I. Competition
B. A Cuckoo laying egg in a Crow's nest	II. Brood parasitism
C. Fungi and root of a higher plant in Mycorrhizae	III. Mutualism
D. A cattle egret and a Cattle in a field	IV. Commensalism

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The interactions between species such as mutualism, competition, and parasitism are correctly matched based on the nature of the relationships described.

Quick Tip

Understand the types of species interactions: mutualism, competition, parasitism, and commensalism.

---

156. Match List I with List II:

List I (Cells)	List II (Secretion)
A. Peptic cells	I. Mucus
B. Goblet cells	II. Bile juice
C. Oxyntic cells	III. Proenzyme pepsinogen
D. Hepatic cells	IV. HCl and intrinsic factor for absorption of vitamin B12

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Peptic cells secrete pepsinogen, goblet cells secrete mucus, oxyntic cells secrete HCl and intrinsic factor, and hepatic cells secrete bile juice.

Quick Tip

Match each cell type with its specific secretion to understand the digestive process.

---

157. Given below are two statements:

Statement I: A protein is imagined as a line, the left end represented by first amino acid (C-terminal) and the right end represented by last amino acid (N-terminal).

Statement II: Adult human haemoglobin consists of 4 subunits (two subunits of type and two subunits of type).

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

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Both statements are correct. A protein structure is typically referred to as a linear sequence of amino acids, with distinct N-terminal and C-terminal ends. Human hemoglobin indeed consists of four subunits, two of -type and two of -type.

Quick Tip

Understanding protein structure involves knowing the N- and C-terminal ends, as well as the quaternary structure of proteins like hemoglobin.

---

158. Given below are two statements:

Statement I: RNA mutates at a faster rate.

Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Both statements are true. RNA is more prone to mutations due to its lack of proofreading mechanisms compared to DNA, and viruses with RNA genomes and shorter lifespans tend to evolve rapidly.

Quick Tip

Viruses with RNA genomes mutate faster due to error-prone replication and short lifespans.

---

159. Match List I with List II:

List I	List II
A. Vasectomy	I. Oral method
B. Coitus interruptus	II. Barrier method
C. Cervical caps	III. Surgical method
D. Saheli	IV. Natural method

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Vasectomy is an oral method, coitus interruptus is a barrier method, cervical caps are surgical methods, and Saheli is a natural method.

Quick Tip

Understanding different birth control methods and their classification can help in family planning decisions.

---

160. Match List I with List II:

List I	List II
A. Ringworm	I. Haemophilus influenzae
B. Filariasis	II. Trichophyton
C. Malaria	III. Wuchereria bancrofti
D. Pneumonia	IV. Plasmodium vivax

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Ringworm is caused by Trichophyton, filariasis by Wuchereria bancrofti, malaria by Plasmodium vivax, and pneumonia by Haemophilus influenzae.

Quick Tip

Match diseases to their causative agents to understand better the type of treatment required.

---

161. Match List I with List II:

List I	List II
A. CCK	I. Kidney
B. GIP	II. Heart
C. ANF	III. Gastric gland
D. ADH	IV. Pancreas

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

CCK (cholecystokinin) affects the kidney, GIP (gastric inhibitory peptide) affects the pancreas, ANF (atrial natriuretic factor) affects the heart, and ADH (antidiuretic hormone) affects the gastric gland.

Quick Tip

Understand how hormones regulate different organs for better comprehension of their physiological roles.

---

162. Given below are two statements:

Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Both statements are correct. The ejaculatory duct forms when the vas deferens meets the seminal vesicle, and the cervical canal, along with the vagina, forms the birth canal.

Quick Tip

Understand the anatomy of the male and female reproductive systems for better comprehension of their functions.

---

163. Which of the following techniques does not serve the purpose of early diagnosis of a disease for its early treatment?

(1) Serum and Urine analysis

(2) Polymerase Chain Reaction (PCR) technique

(3) Enzyme Linked Immuno-Sorbent Assay (ELISA) technique

(4) Recombinant DNA Technology

Correct Answer: (4) Recombinant DNA Technology.

Solution:

Recombinant DNA technology is mainly used for genetic manipulation and research, not for early diagnosis of diseases.

Quick Tip

PCR and ELISA are useful for early diagnosis, while recombinant DNA technology is more research-focused.

---

164. Which of the following are NOT considered as part of endomembrane system?

A. Mitochondria B. Endoplasmic Reticulum

C. Chloroplasts D. Golgi complex

E. Peroxisomes

Choose the most appropriate answer from the options given below:

(1) A, C and E only

(2) A and D only

(3) A, D and E only

(4) B and D only

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

Solution:

Mitochondria, chloroplasts, and peroxisomes are not considered part of the endomembrane system, which mainly includes the endoplasmic reticulum, Golgi complex, and vesicles.

Quick Tip

The endomembrane system involves structures responsible for protein and lipid synthesis, excluding mitochondria and chloroplasts.

---

165. Match List I with List II:

List I	List II
A. Heroin	I. Effect on cardiovascular system
B. Marijuana	II. Slow down body function
C. Cocaine	III. Painkiller
D. Morphine	IV. Interfere with transport of dopamine

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Heroin affects the cardiovascular system, marijuana slows down body functions, cocaine interferes with the transport of dopamine, and morphine is a painkiller.

Quick Tip

Understanding the effects of various drugs on the body helps in recognizing their therapeutic and harmful properties.

---

166. Given below are two statements:

Statement I: Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

Statement II: When the inhibitor closely resembles the substrate in its molecular structure

and inhibits the activity of the enzyme, it is known as competitive inhibitor.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Low temperature does preserve enzymes in an inactive state, and high temperature causes denaturation. Competitive inhibition occurs when an inhibitor resembles the substrate.

Quick Tip

Both low and high temperatures play crucial roles in enzyme activity. Competitive inhibition is a key concept in biochemistry.

---

167. Which of the following functions is carried out by cytoskeleton in a cell?

(1) Protein synthesis

(2) Motility

(3) Transportation

(4) Nuclear division

Correct Answer: (2) Motility.

Solution:

The cytoskeleton is responsible for cell motility, shape, and intracellular transport. It does not directly play a role in protein synthesis or nuclear division.

Quick Tip

Cytoskeleton functions extend beyond motility to include maintaining cell shape and facilitating transport.

---

168. Given below are two statements:

Statement I: Ligaments are dense irregular tissue.

Statement II: Cartilage is dense regular tissue.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is true but Statement II is false.

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

(4) Both Statement I and Statement II are true.

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

Solution:

Ligaments are dense irregular connective tissues, whereas cartilage is dense irregular tissue, not regular tissue.

Quick Tip

Understanding tissue types helps in distinguishing between the structures and functions of ligaments and cartilage.

---

169. Match List I with List II:

List I (Type of Joint)	List II (Found between)
A. Cartilaginous Joint	I. Between flat skull bones
B. Ball and Socket Joint	II. Between adjacent vertebrae in vertebral column
C. Fibrous Joint	III. Between carpal and metacarpal of thumb
D. Saddle Joint	IV. Between Humerus and Pectoral girdle

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Cartilaginous joints are found between vertebrae, ball and socket joints between humerus and pectoral girdle, fibrous joints between flat skull bones, and saddle joints between carpal

and metacarpal of thumb.

Quick Tip

Different joint types allow specific movements and are found between various bones in the body.

---

170. Match List I with List II:

List I	List II
A. Gene ‘a’	I. -galactosidase
B. Gene ‘y’	II. Transacetylase
C. Gene ‘i’	III. Permease
D. Gene ‘z’	IV. Repressor protein

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

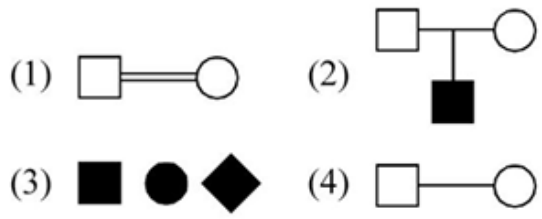
Gene ‘a’ encodes -galactosidase, Gene ‘y’ encodes a repressor protein, Gene ‘i’ encodes permease, and Gene ‘z’ encodes transacetylase.

Quick Tip

Understanding the function of each gene helps in mapping out metabolic pathways, such as the lac operon.

---

171. Which one of the following symbols represents mating between relatives in human pedigree analysis?



Correct Answer: (4)

Solution:

The correct symbol for mating between relatives is used in pedigree analysis to represent consanguinity.

Quick Tip

Pedigree charts are essential tools for understanding inheritance patterns of genetic traits.

---

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

Assertion A: Endometrium is necessary for implantation of blastocyst.

Reason R: In the absence of fertilization, the corpus luteum degenerates that causes disintegration of endometrium.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

Both the statements are true. The endometrium is essential for the implantation of the blastocyst, and without fertilization, the corpus luteum degenerates, leading to the disintegration of the endometrium.

Quick Tip

Understanding the menstrual cycle and implantation process is important for studying reproductive biology.

---

173. Given below are statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Nephrons are of two types: Cortical Juxta medullary, based on their relative position in cortex and medulla.

Reason R: Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.

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

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

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

Both statements are true. Juxta medullary nephrons indeed have short loops of Henle, while cortical nephrons have longer loops, and the two types are based on their relative position.

Quick Tip

Understanding the structure of nephrons helps in comprehending kidney function and urine formation.

---

174. Radial symmetry is NOT found in adults of phylum:

(1) Hemichordata

(2) Coelenterata

(3) Echinodermata

(4) Ctenophora

Correct Answer: (1) Hemichordata.

Solution:

Radial symmetry is characteristic of many organisms, but it is absent in Hemichordata, where the symmetry is bilateral.

Quick Tip

Recognizing symmetry types in organisms helps in understanding their developmental biology.

---

175. Match List I with List II with respect to human eye:

List I	List II
A. Fovea	I. Visible coloured portion of eye that regulates diameter of pupil.
B. Iris	II. External layer of eye formed of dense connective tissue.
C. Blind spot	III. Point of greatest visual acuity or resolution.
D. Sclera	IV. Point where optic nerve leaves the eyeball and photoreceptor cells are absent.

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The fovea is the point of greatest visual acuity, the iris regulates the diameter of the pupil, the blind spot is where the optic nerve leaves the eyeball, and the sclera is the external layer of the eye.

Quick Tip

Understanding the structure of the human eye is crucial for recognizing its functions in vision.

---

176. Which of the following statements is correct?

(1) Biomagnification refers to increase in concentration of the toxicant at successive trophic

levels.

(2) Presence of large amount of nutrients in water restricts ‘Algal Bloom’.

(3) Algal Bloom decreases fish mortality.

(4) Eutrophication refers to increase in domestic sewage and waste water in lakes.

Correct Answer: (1) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.

Solution:

Biomagnification refers to the process where the concentration of harmful substances increases as they move up the food chain.

Quick Tip

Understanding ecological processes like biomagnification helps to grasp the impact of pollutants on ecosystems.

---

177. Which of the following statements are correct regarding female reproductive cycle?

A. In non-primate mammals cyclical changes during reproduction are called oestrus cycle.

B. First menstrual cycle begins at puberty and is called menopause.

C. Lack of menstruation may be indicative of pregnancy.

D. Cyclic menstruation extends between menarche and menopause.

Choose the most appropriate answer from the options given below:

(1) A and B only

(2) A, B and C only

(3) A, C and D only

(4) A and D only

Correct Answer: (4) A and D only.

Solution:

The oestrus cycle is typical in non-primate mammals, and menstrual cycles extend from menarche to menopause in humans. Lack of menstruation can indeed indicate pregnancy.

Quick Tip

Understanding the reproductive cycles in different species helps in grasping their hormonal regulation.

---

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

Assertion A: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.

Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.

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

(1) Both Statement I and Statement II are false.

(2) Statement I is correct but Statement II is false.

(3) Statement I is incorrect but Statement II is true.

(4) Both Statement I and Statement II are true.

Correct Answer: (4) Both Statement I and Statement II are true.

Solution:

Prokaryotic DNA is held in the nucleoid region with proteins, while eukaryotic DNA wraps around histones forming nucleosomes.

Quick Tip

Understanding the differences in prokaryotic and eukaryotic DNA organization helps in exploring their genetic processes.

---

179. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

(1) Numbat, Spotted cuscus, Flying phalanger

(2) Mole, Flying squirrel, Tasmanian tiger cat

(3) Lemur, Anteater, Wolf

(4) Tasmanian wolf, Bobcat, Marsupial mole

Correct Answer: (1) Numbat, Spotted cuscus, Flying phalanger.

Solution:

Adaptive radiation is the evolutionary diversification of a group into different ecological niches, which is evident in Australian marsupials.

Quick Tip

Studying adaptive radiation helps in understanding the evolution of species into different niches.

---

180. Match List I with List II:

List I	List II
A. Taenia	I. Nephridia
B. Paramoecium	II. Contractile vacuole
C. Periplaneta	III. Flame cells
D. Pheretima	IV. Urecose gland

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Taenia has nephridia for excretion, Paramoecium has a contractile vacuole, Periplaneta has flame cells, and Pheretima has the urecose gland.

Quick Tip

Understanding excretory organs helps in recognizing how different species eliminate waste.

---

181. Given below are two statements: One is labelled as Assertion A and the other is

labelled as Reason R:

Assertion A: Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.

Reason R: Ban on amniocentesis checks increasing menace of female foeticide.

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 NOT the correct explanation of A.

(2) A is true but R is false.

(3) A is false but R is true.

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

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution:

Amniocentesis is a technique for sex determination, and its ban has helped curb female foeticide in many regions.

Quick Tip

Ethical issues in reproductive health are crucial for reducing harmful practices like female foeticide.

---

182. Which of the following is not a cloning vector?

(1) YAC

(2) pBR322

(3) Probe

(4) BAC

Correct Answer: (3) Probe.

Solution:

A probe is not a cloning vector, it is a tool used for detecting specific DNA sequences.

Quick Tip

Cloning vectors include YAC, BAC, and plasmids, while probes are used for sequence detection.

183. Given below are two statements:

Statement I: Electrostatic precipitator is most widely used in thermal power plants.

Statement II: Electrostatic precipitator in thermal power plant removes ionizing radiations.

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

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

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

(4) Both Statement I and Statement II are correct.

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

Solution:

Electrostatic precipitators are used to remove particulate matter from the air, not ionizing radiation.

Quick Tip

Understanding the function of electrostatic precipitators helps in comprehending air pollution control techniques.

---

184. Match List I with List II:

List I	List II
A. P-wave	I. Beginning of systole
B. Q-wave	II. Repolarisation of ventricles
C. QRS complex	III. Depolarisation of atria
D. T-wave	IV. Depolarisation of ventricles

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

P-wave represents depolarisation of atria, QRS complex represents depolarisation of ventricles, T-wave represents repolarisation of ventricles, and Q-wave marks the beginning of systole.

Quick Tip

Knowing the phases of the ECG helps in understanding heart function and electrical activity.

---

185. Vital capacity of lung is:

(1) IRV + ERV + TV + RV

(2) IRV + ERV + TV - RV

(3) IRV + ERV + TV

(4) IRV + ERV

Correct Answer: (3) IRV + ERV + TV.

Solution:

Vital capacity is the sum of inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and tidal volume (TV).

Quick Tip

Vital capacity is an important measure of lung function.

SECTION-B

Zoology

186. Given below are two statements:

Statement I: During G0 phase of cell cycle, the cell is metabolically inactive.

Statement II: The centrosome undergoes duplication during S phase of interphase.

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

(1) Both Statement I and Statement II are incorrect.

(2) Statement I is correct but Statement II is incorrect.

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

(4) Both Statement I and Statement II are correct.

Correct Answer: (3) Statement I is incorrect but Statement II is correct.

Solution:

During the G0 phase, cells may be inactive or quiescent, but not all cells are metabolically inactive. Centrosome duplication occurs in the S-phase of the cell cycle.

Quick Tip

Understanding the phases of the cell cycle is key to knowing cell division and growth processes.

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187. The parts of human brain that help in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are:

(1) Corpora quadrigemina hippocampus

(2) Brain stem epithalamus

(3) Corpus callosum and thalamus

(4) Limbic system hypothalamus

Correct Answer: (4) Limbic system hypothalamus.

Solution:

The limbic system and hypothalamus are responsible for regulating emotions and sexual behaviours.

Quick Tip

The limbic system is essential for emotions, memory, and behavior.

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188. In cockroach, excretion is brought about by:

(1) A, B and E only

(2) B, C and D only

(3) B and D only

(4) A and E only

Correct Answer: (1) A, B and E only.

Solution:

Excretion in cockroaches is carried out by phallic glands, urecose glands, and collaterial glands.

Quick Tip

Understanding excretion systems in invertebrates helps in comparing with other animal systems.

---

189. Which of the following statements are correct?

A. An excessive loss of body fluid from the body switches off osmoreceptors.

B. ADH facilitates water reabsorption to prevent diuresis.

C. ANF causes vasodilation.

D. ADH causes increase in blood pressure.

E. ADH is responsible for decrease in GFR.

Choose the correct answer from the options given below:

(1) B, C and D only

(2) A, B and E only

(3) C, D and E only

(4) A and B only

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

Solution:

ADH plays a role in water reabsorption and blood pressure regulation, while ANF is involved in vasodilation. GFR is affected by ADH.

Quick Tip

Focus on understanding how hormones like ADH and ANF affect blood pressure and kidney function.

---

190. Which one of the following is NOT an advantage of inbreeding?

(1) It exposes harmful recessive genes that are eliminated by selection.

(2) Elimination of less desirable genes and accumulation of superior genes takes place due to it.

(3) It decreases the productivity of inbred population, after continuous inbreeding.

(4) It decreases homozygosity.

Correct Answer: (4) It decreases homozygosity.

Solution:

Inbreeding increases homozygosity, leading to the expression of harmful recessive genes.

Quick Tip

Inbreeding depression can reduce genetic diversity, while outbreeding introduces more genetic variation.

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191. Which of the following statements are correct regarding skeletal muscle?

A. Muscle bundles are held together by collagenous connective tissue layer called fascicle.

B. Sarcoplasmic reticulum of muscle fibre is a store house of calcium ions.

C. Striated appearance of skeletal muscle fibre is due to distribution pattern of actin and myosin proteins.

D. M line is considered as functional unit of contraction called sarcomere.

Choose the most appropriate answer from the options given below:

(1) B and C only

(2) A, C and D only

(3) C and D only

(4) A, B and C only

Correct Answer: (4) A, B and C only.

Solution:

Skeletal muscle fibres are striated due to actin and myosin, and the sarcoplasmic reticulum stores calcium ions for muscle contraction.

Quick Tip

Understanding muscle structure is key to comprehending muscle contraction mechanisms.

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192. Match List I with List II.

List I	List II
A. Logistic growth	I. Unlimited resource availability
B. Exponential growth	II. Limited resource availability
C. Expanding age pyramid	III. Pre-reproductive age group is largest
D. Stable age pyramid	IV. Equal proportion of pre-reproductive and reproductive age groups

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Logistic growth occurs in limited resource conditions, exponential growth in unlimited conditions. Expanding age pyramid shows more pre-reproductive individuals, while the stable age pyramid shows equal proportions of age groups.

Quick Tip

Understanding population growth models is crucial in ecology.

---

193. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows 5' AUCGAUCGAUCGAUCGAUCG AUCG AUCG 3'?

(1) 3' UAGCUAGCUAGCUAGCUA GCUAGCUAGC 5'

(2) 5' ATCGATCGATCGATCGATCG ATCGATCG 3'

(3) 3' ATCGATCGATCGATCGATCG ATCGATCG 5'

(4) 5’ UAGCUAGCUAGCUAGCUA, GCUAGC UAGC 3’

Correct Answer: (2) 5’ ATCGATCGATCGATCGATCG ATCGATCG 3’.

Solution:

mRNA is synthesized from the DNA template strand in the 5’ to 3’ direction, thus the coding strand will be complementary to the mRNA.

Quick Tip

Always check the directionality of mRNA synthesis and its complementarity with the coding strand.

---

194. Which of the following statements are correct?

A. Basophils are most abundant cells of the total WBCs.

B. Basophils secrete histamine, serotonin and heparin.

C. Basophils are involved in inflammatory response.

D. Basophils have kidney shaped nucleus.

E. Basophils are agranulocytes.

Choose the correct answer from the options given below:

(1) C and E only

(2) B and C only

(3) A and B only

(4) D and E only

Correct Answer: (2) B and C only.

Solution:

Basophils secrete histamine, serotonin, and heparin, and are involved in inflammatory response. They are granulocytes, not agranulocytes.

Quick Tip

Basophils play a key role in allergic reactions and inflammation.

---

195. Match List I with List II:

List I	List II
A. Mast cells	I. Ciliated epithelium
B. Inner surface	II. Areolar connective tissue
C. Blood	III. Cuboidal epithelium
D. Tubular parts	IV. Specialised connective tissue

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Mast cells are associated with specialised connective tissue, while blood is connected to ciliated epithelium. The inner surface of bronchioles is made of cuboidal epithelium, and tubular parts of the nephron are made of areolar connective tissue.

Quick Tip

Focus on the structures of different tissues and their functions in the body.

---

196. Which of the following is a characteristic feature of cockroach regarding sexual dimorphism?

(1) Presence of anal styles

(2) Presence of sclerites

(3) Presence of anal cerci

(4) Dark brown body colour and anal cerci

Correct Answer: (3) Presence of anal cerci.

Solution:

In cockroaches, anal cerci are a distinguishing feature related to sexual dimorphism.

Quick Tip

Pay attention to the physical traits that differentiate sexes in animals.

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197. Which of the following are NOT under the control of thyroid hormone?

A. Maintenance of water and electrolyte balance

B. Regulation of basal metabolic rate

C. Normal rhythm of sleep-wake cycle

D. Development of immune system

E. Support the process of R.B.Cs formation

Choose the correct answer from the options given below:

(1) B and C only

(2) C and D only

(3) D and E only

(4) A and D only

Correct Answer: (4) A and D only.

Solution:

Thyroid hormones play a role in regulating metabolic rate and other body functions, but not water balance or the immune system directly.

Quick Tip

Understanding the role of thyroid hormones can help explain various physiological processes.

---

198. Select the correct statements.

A. Tetrad formation is seen during Leptotene.

B. During Anaphase, the centromeres split and chromatids separate.

C. Terminalization takes place during Pachytene.

D. Nucleolus, Golgi complex and ER are reformed during Telophase.

E. Crossing over takes place between sister chromatids of homologous chromosomes.

Choose the correct answer from the options given below:

(1) B and D only

(2) A, C and E only

(3) B and E only

(4) A and C only

Correct Answer: (1) B and D only.

Solution:

Anaphase is where the centromere splits and chromatids separate. The reformation of the nucleolus and other organelles happens in telophase.

Quick Tip

Knowing the stages of cell division will help with understanding chromosomal behavior during mitosis and meiosis.

---

199. The unique mammalian characteristics are:

(1) hairs, pinna and mammary glands

(2) hairs, pinna and indirect development

(3) pinna, monocondylic skull and mammary glands

(4) hairs, tympanic membrane and mammary glands

Correct Answer: (1) hairs, pinna and mammary glands.

Solution:

These are the distinctive characteristics of mammals that separate them from other vertebrates.

Quick Tip

Familiarize yourself with distinguishing characteristics of major animal groups, especially mammals.

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200. Select the correct statements with reference to chordates.

A. Presence of a mid-dorsal, solid and double nerve cord.

B. Presence of closed circulatory system.

C. Presence of paired pharyngeal gillslits.

D. Presence of dorsal heart.

E. Triploblastic pseudocoelomate animals.

Choose the correct answer from the options given below:

(1) B and C only

(2) B, D and E only

(3) C, D and E only

(4) A, C and D only

Correct Answer: (4) A, C and D only.

Solution:

Chordates typically have a dorsal nerve cord, a closed circulatory system, and pharyngeal gill slits. They are triploblastic but not pseudocoelomate.

Quick Tip

Review the common features of chordates, including their body structures and organ systems.
