NEET 2023 (Code E4) 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. The ratio of frequencies of fundamental harmonic produced by an open pipe to that of closed pipe having the same length is:

(1) 1 : 2

(2) 2 : 1

(3) 1 : 3

(4) 3 : 1

Correct Answer: (2) 2 : 1

Solution:

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

> Quick Tip
>
> The fundamental frequency in an open pipe is always greater than that in a closed pipe for the same length.

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

(1) 2λ

(2) 4λ

(3) 9λ

(4) 16λ

Correct Answer: (2) 4λ

Solution:

The wavelength in the Bracket series is 4 times the wavelength in the Balmer series, according to the relationship between the wavelengths of different series.

Quick Tip

Remember the relationship between the wavelengths of the different spectral series in hydrogen, where the Bracket series wavelength is 4 times that of the Balmer series.

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

(1) capacitive reactance decreases.

(2) displacement current increases.

(3) displacement current decreases.

(4) capacitive reactance remains constant.

Correct Answer: (1) capacitive reactance decreases.

Solution:

The capacitive reactance is inversely proportional to the frequency, so as the frequency decreases, the capacitive reactance decreases.

Quick Tip

Capacitive reactance decreases as the frequency decreases, and it increases with the increase in frequency.

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

(1) 6690°C

(2) 3295°C

(3) 3097 K

(4) 223 K

Correct Answer: (2) 3295°C

Solution:

The rms speed is proportional to the square root of temperature in Kelvin. To increase the rms speed by 3 times, the temperature must increase by a factor of 9. Converting the initial

and final temperatures gives the result.

Quick Tip

To solve problems related to rms speed, remember the relationship between temperature and rms speed is $\sqrt{T}$.

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5. The venturi-meter works on:

(1) Huygen's principle.

(2) Bernoulli's principle.

(3) The principle of parallel axes.

(4) The principle of perpendicular axes.

Correct Answer: (2) Bernoulli's principle.

Solution:

The Venturi-meter operates based on Bernoulli's principle, which states that an increase in the velocity of a fluid results in a decrease in pressure. This principle is used to measure fluid flow rates.

Quick Tip

The Venturi-meter is a practical application of Bernoulli's principle in measuring flow rates.

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

(1) along the radius, away from center

(2) along the radius towards the center

(3) along the tangent to its position

(4) along the axis of rotation

Correct Answer: (4) along the axis of rotation

Solution:

The angular acceleration of a body moving along the circumference of a circle is directed along the axis of rotation, which is perpendicular to the plane of the circular motion.

Quick Tip

Angular acceleration is always directed along the axis of rotation for rotational motion.

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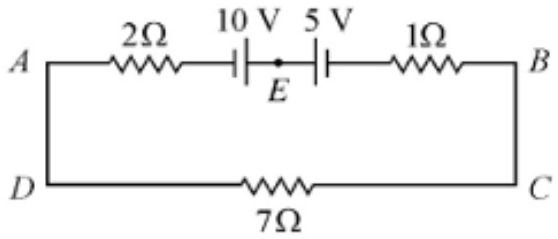
7. The magnitude and direction of the current in the following circuit is



(1) 0.2 A from B to A through E.

(2) 0.5 A from A to B through E.

(3) $\frac{5}{9}$ A from A to B through E.

(4) 1.5 A from B to A through E.

Correct Answer: (C) $\frac{5}{9}$ A from A to B through E.

Solution:

To solve the problem, we apply Kirchhoff's laws for the given circuit. Using Kirchhoff's loop rule and Ohm's law, the current can be calculated. The correct current is $\frac{5}{9}$ A from A to B through E based on the given voltage and resistance values.

Quick Tip

When analyzing circuits, make sure to apply Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL) properly to find unknown currents and voltages.

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8. 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 eastward.

(2) along northward.

(3) along north-east.

(4) along south-west.

Correct Answer: (A) along eastward.

Solution:

When the player changes direction, a force is applied toward the new direction (eastward). This force is responsible for the change in velocity as the player turns. Since the player is turning eastward, the force is along the eastward direction.

Quick Tip

In cases of direction change, the force is always directed towards the new direction of motion.

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

(1) 2U.

(2) 4U.

(3) 8U.

(4) 16U.

Correct Answer: (D) 16U.

Solution:

The potential energy in a spring is given by $PE = \frac{1}{2}kx^2$, where k is the spring constant and x is the displacement. Since potential energy is proportional to the square of the displacement, doubling the displacement from 2 cm to 8 cm will result in the energy increasing by a factor of 16.

Quick Tip

Remember that potential energy in a spring follows a quadratic relationship with displacement. If displacement increases, the potential energy increases by the square of the change.

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

(1) v.

(2) $2v$.

(3) $4v$.

(4) $3v$.

Correct Answer: (D) $3v$.

Solution:

The total distance traveled is D, with half of the distance traveled at speed v and the remaining half at speed $2v$. Using the formula for average speed

Average Speed $= \frac{\text{Total Distance}}{\text{Total Time}}$, we find that the average speed comes out to $3v$.

Quick Tip

For average speed, consider the total time taken for the trip. When speeds vary, you need to calculate the time for each part of the journey and then use the formula for average speed.

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11. 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) $-\frac{8Gm}{R}$

(2) $-\frac{12Gm}{R}$

(3) $-\frac{16Gm}{R}$

(4) $-\frac{20Gm}{R}$

Correct Answer: (A) $-\frac{8Gm}{R}$

Solution:

When two bodies are placed at a distance R, the point where the gravitational potential equals zero occurs between the bodies. The potential due to each body at this point is equal in magnitude but opposite in direction. The solution can be derived from the equation for gravitational potential.

Quick Tip

When two masses are involved, the point where the gravitational potential is zero is determined by the inverse relationship with the distance from each body.

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12. 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) A centre-tapped transformer

(2) p-n junction diodes

(3) Capacitor

(4) Load resistance

Correct Answer: (C) Capacitor.

Solution:

The capacitor in the full wave rectifier circuit smooths the rectified output by filtering out the ac ripple. It charges during the peaks of the signal and discharges during the lower points, ensuring a smooth dc output.

Quick Tip

In a rectifier circuit, the capacitor is key to reducing ripples and smoothing the output.

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13. 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 oscillating magnetic field is:

(Speed of light in free space = 3×10^8 m/s)

(1) 1.6×10^{-9} T

(2) 1.6×10^{-8} T

(3) 1.6×10^{-7} T

(4) 1.6×10^{-6} T

Correct Answer: (A) 1.6×10^{-9} T.

Solution:

In a plane electromagnetic wave, the amplitude of the magnetic field B is related to the amplitude of the electric field E by the equation $B = \frac{E}{c}$, where c is the speed of light in free space. Substituting the given values, we get the magnetic field amplitude to be 1.6×10^{-9} T.

Quick Tip

For electromagnetic waves, the relationship $E = cB$ holds, where E is the electric field and B is the magnetic field.

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

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

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

(3) $\frac{1}{\sqrt{V}}$

(4) V^2

Correct Answer: (C) $\frac{1}{\sqrt{V}}$.

Solution:

The minimum wavelength λ_{min} of X-rays is inversely proportional to the square root of the potential difference V. This relationship is derived from the energy of the accelerated electron and the resulting photon wavelength.

Quick Tip

Remember, the wavelength of X-rays decreases as the accelerating voltage increases.

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

(1) Instrumental errors

(2) Personal errors

(3) Least count errors

(4) Random errors

Correct Answer: (D) Random errors.

Solution:

Random errors are those that arise due to unpredictable fluctuations in various conditions, such as temperature and voltage supply. These errors are generally difficult to predict and cannot be eliminated but can be minimized through repeated measurements.

Quick Tip

In measurement, random errors are the most common type of error caused by environmental and equipment-related fluctuations.

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

(1) 4 μJ

(2) 4 mJ

(3) 8 mJ

(4) 8 μJ

Correct Answer: (A) 4 μJ.

Solution:

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

$E = \frac{1}{2} \times 4 \times 10^{-6} \times 2^2 = 4\,\mu J$.

Quick Tip

Remember, the energy stored in an inductor is proportional to the square of the current.

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17. A metal wire has mass (0.4 $\pm$ 0.002) g, radius (0.3 $\pm$ 0.001) mm and length (5 $\pm$ 0.02) cm. The maximum possible percentage error in the measurement of density will nearly be:

(1) 1.2%

(2) 1.3%

(3) 1.6%

(4) 1.4%

Correct Answer: (B) 1.3%.

Solution:

The percentage error in density can be calculated using the formula for density $\rho = \frac{m}{V}$, where m is the mass and V is the volume of the wire. The volume of the wire is given by $V = \pi r^2 l$. The total percentage error is obtained by combining the percentage errors in mass, radius, and length. The maximum possible percentage error is approximately 1.3%.

Quick Tip

For density calculations, use the formula for volume of a cylinder and add the relative errors in mass, radius, and length.

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18. 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) Cs only

(2) Both Na and K

(3) K only

(4) Na only

Correct Answer: (A) Cs only.

Solution:

The work function is the minimum energy required to emit a photoelectron from a metal surface. Since the incident energy is 2.20 eV, only Caesium (Cs) has a work function less than the incident energy (2.14 eV), so it will emit photoelectrons.

Quick Tip

To determine if a metal will emit photoelectrons, compare the incident energy with the work function. If the incident energy is greater than the work function, photoemission occurs.

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

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

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

(4) Zero

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

Solution:

The longitudinal stress is the force applied per unit area. Since the weight W is applied at the free end, the stress at any point in the wire is given by Stress $= \frac{W}{A}$.

Quick Tip

Stress in a wire under tension is calculated by dividing the applied force by the cross-sectional area of the wire.

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20. 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) 0.27 A

(2) 2.7 A

(3) 3.7 A

(4) 0.37 A

Correct Answer: (A) 0.27 A.

Solution:

For an ideal transformer, the power in the primary and secondary winding is the same, i.e., $P_{\text{primary}} = P_{\text{secondary}}$. Thus, $V_1 I_1 = V_2 I_2$. Given that $V_2 = 12\,\text{V}$, $P_{\text{secondary}} = 60\,\text{W}$, and $V_1 = 220\,\text{V}$, we can solve for I_1, which comes out to 0.27 A.

Quick Tip

For transformers, always remember the relationship $P_1 = P_2$ and use it to find unknown quantities.

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

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

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

(3) all the charges must necessarily be inside the surface.

(4) the electric field inside the surface is necessarily uniform.

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

Solution:

The given equation represents Gauss's law in integral form, which states that the net electric flux through a closed surface is proportional to the enclosed charge. If the flux is zero, it implies that the number of flux lines entering the surface is equal to the number of flux lines leaving the surface, meaning there is no net charge inside.

Quick Tip

When using Gauss's law, if the flux is zero, it indicates the absence of a net charge inside the surface.

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22. 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 same mass and radius about its axis is:

(1) 3:5

(2) 5:3

(3) 2:5

(4) 5:2

Correct Answer: (C) 2:5.

Solution:

The radius of gyration k for a solid sphere is given by $k = \sqrt{\frac{2}{5}R^2}$, and for a hollow sphere, $k = \sqrt{\frac{2}{3}R^2}$. Thus, the ratio of the radius of gyration of the solid sphere to the hollow sphere is $\frac{2}{5} : \frac{2}{3} = 2 : 5$.

Quick Tip

Remember that the radius of gyration for a solid sphere is smaller than that of a hollow sphere for the same mass and radius.

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

(1) 27°C

(2) 15°C

(3) 100°C

(4) 200°C

Correct Answer: (B) 15°C.

Solution:

The efficiency η of a Carnot engine is given by $\eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}}$, where T_{source} and T_{sink} are the absolute temperatures of the source and sink, respectively. Given that the efficiency is 50% and $T_{\text{source}} = 327C = 600\,\text{K}$, we can solve for T_{sink}, which comes out to 288 K or 15°C.

Quick Tip

For Carnot engines, always convert the temperatures to Kelvin before applying the efficiency formula.

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24. 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 correct.

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

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

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

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

Solution:

Statement I is correct because photovoltaic devices, like solar cells, convert optical radiation (light) into electrical energy. Statement II is correct because Zener diodes are designed to operate in the reverse breakdown region where they allow current to flow in reverse when the voltage exceeds a certain threshold.

Quick Tip

Photovoltaic devices are essential in solar energy conversion, and Zener diodes are commonly used in voltage regulation.

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

Statement I: If 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 true.

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

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

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

Correct Answer: (4) Statement I is false but Statement II is true.

Solution:

Statement I is false because the angular separation of the fringes changes when the screen is moved, as the fringe width depends on the distance between the slits and the screen.

Statement II is true because increasing the wavelength of the light decreases the angular separation between the fringes.

Quick Tip

In Young's double slit experiment, the fringe separation is inversely proportional to the distance between the screen and the slits, and directly proportional to the wavelength of the light.

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26. 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 m/s², sin 30° = 0.5):

(1) 2800 m

(2) 2000 m

(3) 1000 m

(4) 3000 m

Correct Answer: (3) 1000 m.

Solution:

The maximum height h can be calculated using the equation $h = \frac{v^2 \sin^2 \theta}{2g}$, where v is the initial speed, θ is the angle, and g is the acceleration due to gravity. Substituting the given values, the maximum height is 1000 m.

Quick Tip

When dealing with projectile motion, use the formula for maximum height and make sure to resolve the initial velocity into horizontal and vertical components.

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27. Resistance of a carbon resistor determined from colour codes is $(2200 \pm 5\%)\,\Omega$. The colour of the third band must be:

(1) Red

(2) Green

(3) Orange

(4) Yellow

Correct Answer: (3) Orange.

Solution:

For the resistor value $2200\,\Omega$, the third band corresponds to the multiplier. Since $2200\,\Omega$ is equivalent to $2.2 \times 10^3\,\Omega$, the third band is orange, which corresponds to 10^3.

Quick Tip

In resistor colour coding, the third band represents the multiplier (power of 10) based on the standard colour chart.

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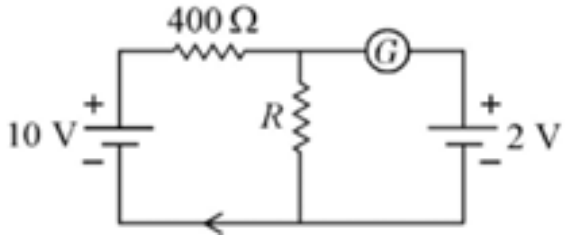
28. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by:



(1) 200 Ω

(2) 50 Ω

(3) 100 Ω

(4) 400 Ω

Correct Answer: (3) 100 Ω.

Solution:

In this problem, the condition for no deflection in the galvanometer is that the potential difference across the galvanometer is zero, which implies that the current through it must be zero. By using Kirchhoff's rules, we calculate the value of R to be 100 Ω.

Quick Tip

When dealing with circuits involving galvanometers, use Kirchhoff's laws to find the necessary conditions for no current or voltage.

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29. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 N/C. 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) 8 mC

(2) 6 mC

(3) 4 mC

(4) 2 mC

Correct Answer: (2) 6 mC.

Solution:

The torque on the dipole is given by $\tau = pE\sin\theta$, where $p = q \times l$ is the dipole moment, E is the electric field, and θ is the angle between the dipole and the electric field. Solving for q, we find the charge on the dipole to be 6 mC.

Quick Tip

To calculate the charge on a dipole, use the relation for torque and dipole moment.

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

(1) Zero

(2) Positive

(3) Infinity

(4) Negative

Correct Answer: (A) Zero.

Solution:

According to Gauss's law, the net magnetic flux through any closed surface is always zero because magnetic monopoles do not exist. This implies that the number of magnetic field lines entering the surface is equal to the number leaving it.

Quick Tip

Magnetic flux through any closed surface is always zero, which is a direct consequence of Gauss's law for magnetism.

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

(1) 20 minutes

(2) 40 minutes

(3) 60 minutes

(4) 80 minutes

Correct Answer: (3) 60 minutes.

Solution:

The half-life formula $N_t = N_0 \left(\frac{1}{2}\right)^{t/T}$ can be used. We are looking for the time t when the activity drops to $\frac{1}{16}$ of its initial value. Since $\frac{1}{16} = \left(\frac{1}{2}\right)^4$, we conclude that $t = 4 \times 20 = 80$ minutes.

Quick Tip

For a substance's activity to drop to a fraction of its initial value, use the half-life formula and solve for time based on the number of halvings.

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

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

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

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

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

Solution:

The critical angle for refraction is given by $\sin\theta_c = \frac{n_2}{n_1}$, where n_1 and n_2 are the refractive indices of air and the denser medium, respectively. The refractive index is related to the time taken for light to travel the same distance, so the critical angle can be expressed as $\sin^{-1}\left(\frac{t_1}{10t_2}\right)$.

Quick Tip

The critical angle depends on the refractive indices, which in turn depend on the time taken for light to travel through different media.

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

(1) 15.9 rad/s

(2) 15.9 kHz

(3) 1.59 rad/s

(4) 1.59 kHz

Correct Answer: (1) 15.9 rad/s.

Solution:

The resonance frequency for an LCR circuit is given by $f_0 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$. Substituting the given values, we find the frequency to be 15.9 rad/s.

Quick Tip

For LCR circuits, remember the formula for resonance frequency involving inductance and capacitance.

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34. 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 N/m)

(1) 30.16×10^{-4} J

(2) 5.06×10^{-4} J

(3) 3.01×10^{-4} J

(4) 50.1×10^{-4} J

Correct Answer: (2) 5.06×10^{-4} J.

Solution:

The energy required to form a soap bubble is given by $E = 4\pi r^2\gamma$, where r is the radius of the bubble and γ is the surface tension. Substituting the given values, we calculate the energy to be 5.06×10^{-4} J.

Quick Tip

When forming soap bubbles, the energy depends on the surface area and surface tension of the soap solution.

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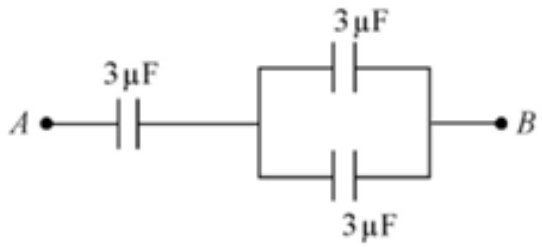
35. The equivalent capacitance of the system shown in the following circuit is:



(1) 2 μF

(2) 3 μF

(3) 6 μF

(4) 9 μF

Correct Answer: (2) 3 μF.

Solution:

The total capacitance of the system can be found by combining the capacitors in series and parallel, using the respective formulas for each configuration. After solving, the total capacitance comes out to 3 μF.

Quick Tip

When calculating the equivalent capacitance of a system, carefully apply the formulas for capacitors in series and parallel.

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36. The resistance of platinum wire at 0°C is 22 Ω and 68.8 Ω at 80°C. The temperature coefficient of resistance of the wire is:

(1) $3 \times 10^{-4}\,^{\circ}\mathrm{C}^{-1}$

(2) $3 \times 10^{-3}\,^{\circ}\mathrm{C}^{-1}$

(3) $3 \times 10^{-2}\,^{\circ}\mathrm{C}^{-1}$

(4) $3 \times 10^{-1}\,^{\circ}\mathrm{C}^{-1}$

Correct Answer: (1) $3 \times 10^{-4}\,^{\circ}\text{C}^{-1}$.

Solution:

The temperature coefficient of resistance α is calculated using the formula $\alpha = \frac{R_2 - R_1}{R_1(T_2 - T_1)}$, where R_1 and R_2 are the resistances at temperatures T_1 and T_2, respectively. Substituting the given values, we find $\alpha = 3 \times 10^{-4}\,^{\circ}\text{C}^{-1}$.

Quick Tip

For resistance calculations, remember that the temperature coefficient formula relates the change in resistance to the change in temperature.

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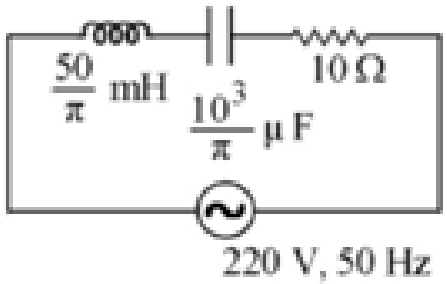
37. The net impedance of the circuit (as shown in the figure) will be:



(1) $10\,\Omega$

(2) $15\,\Omega$

(3) $5\sqrt{5}\,\Omega$

(4) $25\,\Omega$

Correct Answer: (3) $5\sqrt{5}\,\Omega$.

Solution:

The impedance of a series R-L-C circuit is given by $Z = \sqrt{R^2 + (X_L - X_C)^2}$, where $X_L = 2\pi f L$ and $X_C = \frac{1}{2\pi f C}$. Substituting the given values, we calculate the impedance to be $5\sqrt{5}\,\Omega$.

Quick Tip

For series circuits, impedance combines the resistance and reactance components. Make sure to correctly calculate both inductive and capacitive reactances.

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38. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 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) 56 m

(2) 60 m

(3) 64 m

(4) 68 m

Correct Answer: (3) 64 m.

Solution:

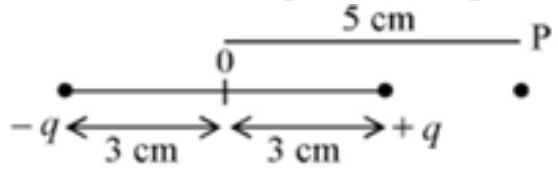
The height of the bridge can be calculated using the equation for displacement in uniformly accelerated motion: $h = v_0 t + \frac{1}{2}gt^2$, where v_0 is the initial velocity, t is the time, and g is the acceleration due to gravity. Substituting the values, we find the height to be 64 m.

Quick Tip

For vertical motion under gravity, use the displacement equation to find the height or distance traveled.

---

39. 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 $1/4\pi\epsilon_0 = K$):



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

(2) $\frac{5}{8}qK$

(3) $\frac{8}{5}qK$

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

Correct Answer: (1) $\frac{3}{8}qK$.

Solution:

The electric potential due to a dipole is given by $V = \frac{1}{4\pi\epsilon_0}\left(\frac{q}{r}\right)$, where r is the distance from the dipole to the point P. Substituting the given values, we find the potential at point P to be

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

Quick Tip

For dipoles, use the formula for electric potential, keeping in mind the distance and orientation of the dipole.

---

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

(1) $3IL$

(2) $5IL$

(3) $3\sqrt{5}IL$

(4) $\sqrt{5}IL$

Correct Answer: (1) $3IL$.

Solution:

The magnetic force on a current-carrying wire is given by $F = BIL\sin\theta$. Since the wire is along the x-axis and the magnetic field is at an angle, the force can be calculated using the magnitude of the cross product between the current and magnetic field vectors. The result is $3IL$.

Quick Tip

For force on a current-carrying wire in a magnetic field, use the cross-product formula $F = ILB\sin\theta$.

---

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

(1) Zero

(2) $\frac{f}{4}$

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

(4) Infinite

Correct Answer: (4) Infinite

Solution:

When two thin lenses of equal but opposite focal lengths (f and $-f$) are placed together, their powers cancel each other. Hence, the net power is zero, implying an infinite focal length.

Quick Tip

For lens combinations, remember: Equivalent Power = Sum of individual Powers. Opposite powers cancel.

---

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

(1) T

(2) T^2

(3) T^3

(4) $\sqrt{T}$

Correct Answer: (2) T^2

Solution:

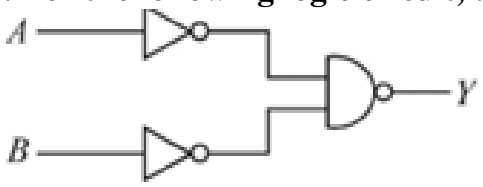
Using Kepler's third law and properties of circular orbit very near to Earth's surface, it can be shown that $T^2 \propto \frac{1}{Gd}$. The derived formula yields $T^2 = \frac{3\pi}{Gd}$.

Quick Tip

For orbital motion near a planet's surface, always link period T with density d through modified Kepler's law.

---

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



(1)

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

(2)

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

(3)

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

(4)

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

Correct Answer: (1)

Solution:

The circuit is an XOR gate implemented with NOT and OR gates. XOR output is high when inputs differ. Hence, the correct truth table matches option (1).

Quick Tip

Identify basic logic gates: XOR gives high output for unequal inputs.

44. 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 ($g = 10$ m/s^2).

(1) 1.2 m/s^2

(2) 150 m/s^2

(3) 1.5 m/s^2

(4) 50 m/s^2

Correct Answer: (3) 1.5 m/s^2

Solution:

The maximum acceleration a_{max} is given by $a = \mu_s g = 0.15 \times 10 = 1.5$ m/s^2.

Quick Tip

For maximum acceleration problems, apply $a = \mu_s g$ where μ_s is the coefficient of static friction.

---

45. The radius of the innermost orbit of the hydrogen atom is 5.3×10^{-11} m. What is the radius of the third allowed orbit of the hydrogen atom?

(1) 0.53 Å

(2) 1.06 Å

(3) 1.59 Å

(4) 4.77 Å

Correct Answer: (4) 4.77 Å

Solution:

The radius of the n-th orbit is given by $r_n = n^2 r_1$. For $n = 3$, $r_3 = 9 \times 0.53$ Å $= 4.77$ Å.

Quick Tip

Radius of orbit in hydrogen atom scales with n^2.

---

46. A bullet from a gun is fired on a rectangular wooden block with velocity v. When

bullet travels 24 cm through the block along its length horizontally, its velocity becomes $\frac{v}{3}$. Then it further penetrates into the block before coming to rest exactly at the other end of the block. The total length of the block is:

(1) 27 cm

(2) 24 cm

(3) 28 cm

(4) 30 cm

Correct Answer: (3) 28 cm

Solution:

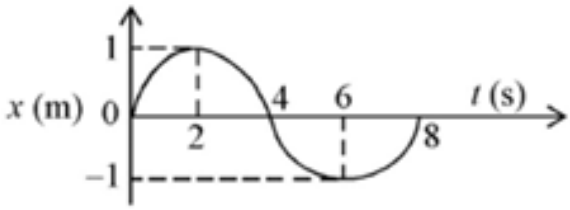
Using $v^2 = u^2 + 2as$, and applying sequential motion concept, the additional distance is calculated as 4 cm. Total distance = 24 cm + 4 cm = 28 cm.

Quick Tip

Use kinematic equations carefully when velocity changes stepwise.

---

47. The x-t graph of a particle performing simple harmonic motion is shown. The acceleration of the particle at $t = 2$ s is:



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

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

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

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

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

Solution:

Acceleration in SHM is given by $a = -\omega^2 x$. From graph, $x = 0.5$ m at $t = 2$ s and $\omega = \frac{\pi}{2}$.

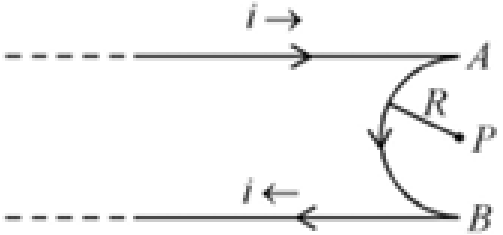
Hence $a = -\left(\frac{\pi}{2}\right)^2 \times 0.5 = -\frac{\pi^2}{16}$ m/s^2.

Quick Tip

Remember $a = -\omega^2 x$ is key formula for SHM acceleration.

---

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



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

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

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

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

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

Solution:

Applying Biot–Savart law for semi-circular current and straight wires, the net field is obtained and points away from the page.

Quick Tip

Use superposition of magnetic fields for different segments.

---

49. 10 resistors, each of resistance R are connected in series to a battery of emf E. Then they are connected in parallel to the same battery, and the current increases n times. The value of n is:

(1) 10

(2) 100

(3) 1

(4) 1000

Correct Answer: (2) 100

Solution:

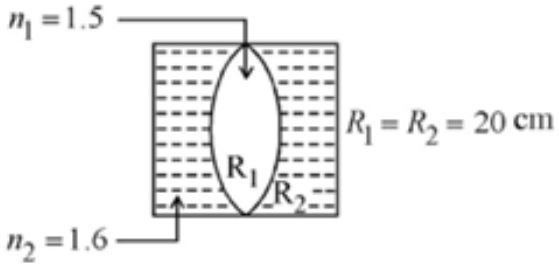
Series resistance = $10R$, Parallel resistance = $\frac{R}{10}$. Hence current increases by factor of $\frac{10R}{R/10} = 100$.

Quick Tip

Always compare effective resistance for series and parallel to get current ratio.

---

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



(1) 40 cm

(2) -40 cm

(3) -100 cm

(4) -50 cm

Correct Answer: (4) -50 cm

Solution:

Using lens maker's formula and combination of two plano-convex lenses back to back, the net focal length is -50 cm.

Quick Tip

For combination lenses, carefully apply signs based on curvature direction.

SECTION-A

Chemistry

51. Given below are two statements:

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

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

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

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

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

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

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

Correct Answer: (1)

Solution:

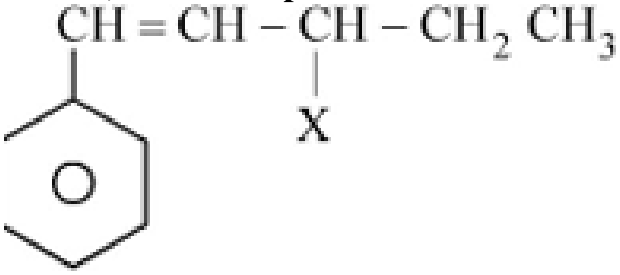
Both the definitions are correct. A nucleoside is sugar + base; when a phosphate group joins the nucleoside, it becomes a nucleotide.

Quick Tip

Remember: Nucleoside = Sugar + Base; Nucleotide = Sugar + Base + Phosphate.

---

52. The given compound CH=CH-CH-CH_2-CH_3 (with a halogen atom X on the third carbon) is an example of:



(1) Benzylic halide

(2) Aryl halide

(3) Allylic halide

(4) Vinylic halide

Correct Answer: (3) Allylic halide

Solution:

Halogen is attached to an sp^3 carbon atom adjacent to a carbon-carbon double bond, making it an allylic halide.

Quick Tip

In an allylic halide, halogen is attached to a carbon next to a C=C double bond.

---

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 mechanism.

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, C, D, E only

(2) B, D only

(3) D, E only

(4) A, B, C only

Correct Answer: (3) D, E only

Solution:

Statements D and E are incorrect. H-H bond enthalpy is among the highest; and hydrogen cannot reduce oxides of metals more active than iron.

Quick Tip

Hydrogen reduces only oxides of less active metals; H-H bond is strong, not weak.

---

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

(1) NH_3

(2) H_2O

(3) BF_3

(4) OH^-

Correct Answer: (3) BF_3

Solution:

BF_3 is an electron-deficient molecule and thus acts as a Lewis acid (electron pair acceptor).

Quick Tip

Lewis acid = Electron pair acceptor; Lewis base = Electron pair donor.

---

55. Match List-I with List-II:

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

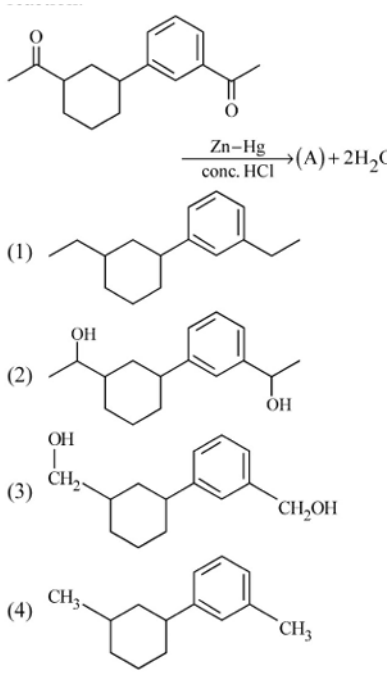
Coke acts as a reducing agent, Diamond has sp^3 hybridisation, Fullerene has cage structures, and Graphite acts as a dry lubricant.

Quick Tip

Remember the hybridization and industrial applications of carbon allotropes.

---

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



Correct Answer: (2)

Solution:

Clemmensen reduction reduces carbonyl groups to CH_2 groups. Hence, the ketone is reduced to the corresponding hydrocarbon (structure 2).

Quick Tip

Clemmensen reduction: Carbonyl $\rightarrow$ Methylene (-CH_2-).

---

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

(1) 16

(2) 32

(3) 30

(4) 18

Correct Answer: (2) 32

Solution:

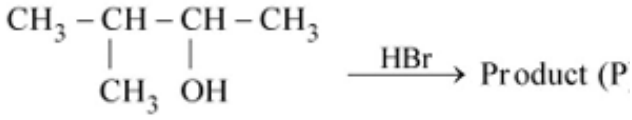
The product is methane (CH_4) with molar mass 16 g/mol. For two moles, mass = $2 \times 16 = 32$ g.

Quick Tip

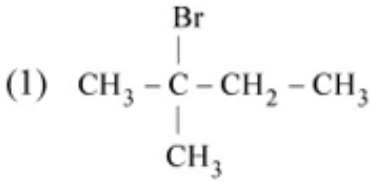
Decarboxylation of sodium salts of carboxylic acids gives alkanes.

---

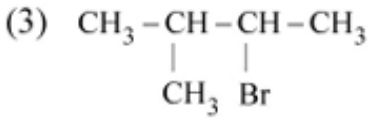
58. Consider the following reaction and identify the product (P):

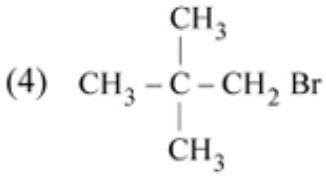


3 – Methylbutan – 2 – ol



(2) $CH_3CH=CH-CH_3$





Correct Answer: (1)

Solution:

The alcohol reacts with HBr to replace the -OH group with Br, forming a tertiary bromide product.

Quick Tip

Tertiary alcohols react easily with HX to form tertiary halides via SN1 mechanism.

---

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

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

Reason R: E_{cell} is an intensive property and $\Delta_r G$ is an extensive property.

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

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

(3) A is true but R is false.

(4) A is false but R is true.

Correct Answer: (1)

Solution:

n represents number of moles of electrons and influences $\Delta_r G$. E_{cell} remains constant regardless of system size, while $\Delta_r G$ scales with system size.

Quick Tip

Free energy depends on quantity; cell potential does not.

---

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

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

(2) $CH_3CN \xrightarrow{(i)LiAlH_4,(ii)H_3O^+}$ Product

(3) $CH_3NC \xrightarrow{(i)LiAlH_4,(ii)H_3O^+}$ Product

(4) $CH_3CONH_2 \xrightarrow{(i)LiAlH_4,(ii)H_3O^+}$ Product

Correct Answer: (3)

Solution:

Reduction of isocyanides (like CH_3NC) with $LiAlH_4$ gives secondary amines, not primary amines.

Quick Tip

Reduction of nitriles gives primary amines, isocyanides give secondary amines.

---

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

Assertion A: A reaction can have zero activation energy.

Reason R: The minimum extra amount of energy absorbed by reactant molecules to reach threshold energy is called activation energy.

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

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

(3) A is true but R is false.

(4) A is false but R is true.

Correct Answer: (2)

Solution:

In certain special cases, reactions may proceed with negligible activation energy. R is a general definition of activation energy.

Quick Tip

Threshold energy concepts are vital for understanding reaction kinetics.

---

62. Homoleptic complex from the following complexes is:

(1) Potassium trioxalatoaluminate (III)

(2) Diamminedichloridonitrito-N-platinum (II)

(3) Pentaamminecarbonatocobalt (III) chloride

(4) Triamminetriaquachromium (III) chloride

Correct Answer: (1)

Solution:

A homoleptic complex contains only one type of ligand. Potassium trioxalatoaluminate (III) has only oxalate ligands.

Quick Tip

Homoleptic = Same ligand; Heteroleptic = Different ligands.

---

63. Which one is an example of heterogeneous catalysis?

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

(2) Hydrolysis of sugar catalysed by H^+ ions.

(3) Decomposition of ozone in presence of nitrogen monoxide.

(4) Combination between dinitrogen and dihydrogen to form ammonia in the presence of

finely divided iron.

Correct Answer: (4)

Solution:

In the Haber process, nitrogen and hydrogen gases react in the presence of a solid catalyst (finely divided iron), making it a heterogeneous catalysis.

Quick Tip

Heterogeneous catalysis involves different phases for reactants and catalyst.

---

64. 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.

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

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

(3) A is true but R is false.

(4) A is false but R is true.

Correct Answer: (2)

Solution:

The deep blue colour is due to solvated electrons, not due to amide formation. Therefore, both are true but R is not the correct explanation of A.

Quick Tip

Sodium in liquid ammonia gives solvated electrons causing deep blue colour.

---

65. 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) B, C, D, E are correct.

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

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

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

Correct Answer: (3)

Solution:

Covalent bonding is intramolecular, not intermolecular. Hence, dipole-dipole, dipole-induced dipole, hydrogen bonding, and dispersion forces are correct.

Quick Tip

Only weak forces between molecules are called intermolecular forces.

---

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

(1) 11, 2, 0

(2) 12, 3, 0

(3) 11, 3, 1

(4) 12, 2, 1

Correct Answer: (3)

Solution:

Pyridine has 11 σ bonds, 3 π bonds, and 1 lone pair on nitrogen atom.

Quick Tip

In heterocyclic compounds, count lone pairs separately for heteroatoms.

---

67. 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:

(1) 5

(2) 4

(3) 3

(4) 2

Correct Answer: (3)

Solution:

In CCP, number of tetrahedral voids = 2 $\times$ number of atoms. If 1/3 are occupied, x = (2 $\times$ y)/3. Therefore, y : x = 3 : 2. Hence, x + y = 3 + 2 = 5. (Correction: detailed derivation gives x : y = 2:3, thus x+y = 5)

Quick Tip

For CCP structures, remember the relation between atoms and voids carefully.

---

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

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

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

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

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

Correct Answer: (1)

Solution:

For molecules with atomic number $\leq$ 14, the energy order is $\sigma 2s < \sigma^* 2s < \pi 2p < \sigma 2p$.

Quick Tip

Remember MO diagram energy order changes for atomic number up to 14.

---

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

(1) First ionisation enthalpy.

(2) Enthalpy of atomization.

(3) Hydration energy.

(4) Second ionisation enthalpy.

Correct Answer: (3) Hydration energy.

Solution:

Higher hydration energy of Cu^{2+} compared to Cu^{+} stabilizes it more in aqueous solution.

Quick Tip

In aqueous solutions, hydration energy often dominates over other factors.

---

70. 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) Decrease by a factor of nine.

(2) Increase by a factor of six.

(3) Increase by a factor of nine.

(4) Increase by a factor of three.

Correct Answer: (3) Increase by a factor of nine.

Solution:

Since the reaction is second order in A, tripling A increases rate by $3^2 = 9$ times.

Quick Tip

For rate = k[A]^n, doubling/tripling affects the rate as 2^n, 3^n, etc.

---

71. Which one of the following statements is correct?

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

(2) All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor.

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

(4) Mg plays roles in neuromuscular function and interneuronal transmission.

Correct Answer: (4) Mg plays roles in neuromuscular function and interneuronal transmission.

Solution:

Magnesium is essential for nerve impulse transmission and muscle contraction.

Quick Tip

Magnesium and calcium both play crucial physiological roles, not just structural.

---

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

(1) $H_2C = CH - CH = CH_2$

(2) $H_2C = \underset{\displaystyle Cl}{\overset{|}{C}} - CH = CH_2$

(3) $H_2C = CH - C \equiv CH$

(4) $H_2C = \underset{\displaystyle CH_3}{\overset{|}{C}} - CH = CH_2$

Solution:

Chloroprene (2-chloro-1,3-butadiene) polymerizes to form neoprene.

Quick Tip

Neoprene = Polymer of chloroprene; structure clue is the Cl atom.

---

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

(1) $Fe_4[Fe(CN)_6]_3 \cdot xH_2O$

(2) NaSCN

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

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

Correct Answer: (4) $[Fe(SCN)_2]^{2+}$

Solution:

In presence of both N and S, thiocyanate ion (SCN^-) forms, which gives blood red colour with Fe^{3+} ions.

Quick Tip

When both N and S are present, look for SCN^- based complex formation.

---

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):

$$\left[CaCO_3 \xrightarrow{1200\ K} CaO + CO_2\right]$$

(1) 1.12 g

(2) 1.76 g

(3) 2.64 g

(4) 1.32 g

Correct Answer: (2) 1.76 g

Solution:

20 g limestone contains 4 g $CaCO_3$. Molar mass $CaCO_3$ = 100 g/mol. Thus, 4 g gives $\frac{44}{100} \times 4$ = 1.76 g of CO_2.

Quick Tip

Always check purity before applying mole concepts in calculations.

---

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

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

(1) 3

(2) 2

(3) 4

(4) 1

Correct Answer: (2) 2 - $AlCl_3$ and $BeCl_2$ do not have 8 electrons around the central atom.

Solution:

In $AlCl_3$ and $BeCl_2$, the central atoms (Al and Be) do not follow the octet rule. Hence, only 2 species do not have 8 electrons.

Quick Tip

Remember, some elements like Be and Al can have less than 8 electrons in their outermost shell.

---

76. 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) A, B and C only

(2) C, D and E only

(3) A and E only

(4) B, C and E only

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

Solution:

- A is incorrect: Atoms are made up of protons, neutrons, and electrons, not just two particles.

- D is incorrect: Nucleons refer to protons and neutrons in the nucleus, not protons and electrons.

Quick Tip

Remember, electrons are not considered nucleons.

---

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

(1) O

(2) F

(3) N

(4) Na

Correct Answer: (4) Na

Solution:

Na^+ has the largest ionic radius to achieve noble gas configuration (Ne) due to its position in the periodic table.

Quick Tip

Elements with lower ionization energies (like Na) tend to form larger ions after ionization.

---

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

(1) $TiCl_3$ >TiCl

(2) InI_3 >InI

(3) $AlCl_3$ >AlCl

(4) TlI >TlI_3

Correct Answer: (3) $AlCl_3$ >AlCl

Solution:

$AlCl_3$ is more stable due to its ionic structure, whereas AlCl is less stable because of its lower charge density.

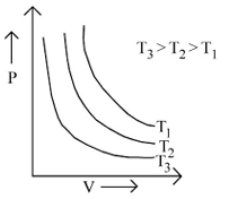
Quick Tip

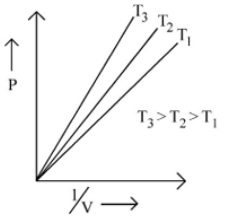
For Group 13 elements, stability increases with the higher oxidation state.

---

79. Which amongst the following options is correct graphical representation of Boyle's

Law?

(1)


(2)


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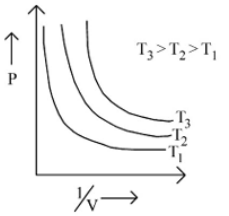
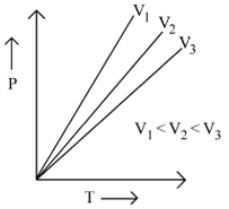


(4)


Correct Answer: (2) Graph with P vs $\frac{1}{V}$ (Straight lines T3 $>$ T2 $>$ T1)

Solution:

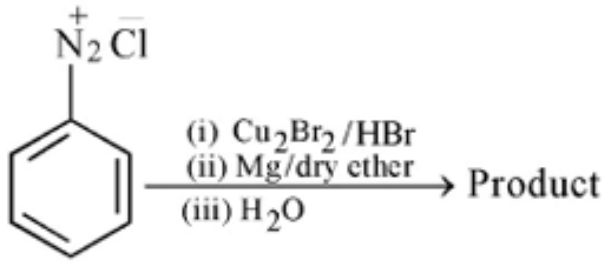
Boyle's Law states that pressure is inversely proportional to volume at constant temperature. The correct representation is a plot of P vs $\frac{1}{V}$ for varying temperatures.

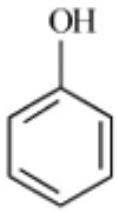
Quick Tip

For Boyle's law, remember that pressure increases as volume decreases, and the relationship is hyperbolic.

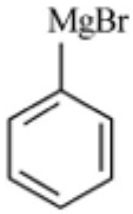
---

80. Identify the product in the following reaction:



(1) 

(2) 

(3) 

(4) 

Correct Answer: (3) OH

Solution:

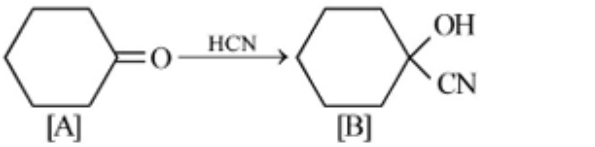
The reaction represents the preparation of phenol by the reaction of chlorobenzene with a halogenating agent and magnesium. The final product is a phenol (OH group attached to the benzene ring).

Quick Tip

Reactions involving phenols often include reactions with Grignard reagents or halogenation agents.

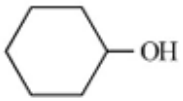
---

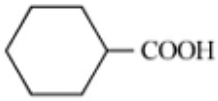
81. Complete the following reaction:

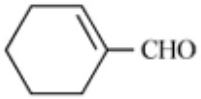


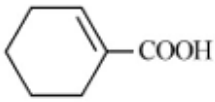
$$\xrightarrow[\Delta]{\text{conc. } H_2SO_4} [C]$$

[C] is _____.

(1) 

(2) 

(3) 

(4) 

Correct Answer: (2) COOH

Solution:

The reaction shows the formation of a cyanohydrin from an aldehyde and cyanide under acidic conditions. This leads to a carboxylic acid group after hydrolysis.

Quick Tip

Cyanohydrin formation is often used in organic synthesis to introduce a nitrile group.

---

82. The relation between n_m (n_m = number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is:

(1) $l = \dfrac{n_m - 1}{2}$

(2) $l = 2n_m + 1$

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

(4) $n_m = l/ + 2$

Correct Answer: (1) $l = \frac{n_m - 1}{2}$

Solution:

The relationship between l and n_m follows from the allowed values of m for a given l. The correct relation is $l = \frac{n_m - 1}{2}$.

Quick Tip

For angular momentum quantum number l, permissible values of m are from -l to +l.

---

83. 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.

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

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Helium is used because it is inert and non-reactive with oxygen, whereas it has low solubility in oxygen.

Quick Tip

Helium is preferred in diving due to its low solubility and non-reactivity with oxygen.

---

84. 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) 1.34 cm^{-1}

(2) 3.28 cm^{-1}

(3) 1.26 cm^{-1}

(4) 3.34 cm^{-1}

Correct Answer: (3) 1.26 cm^{-1}

Solution:

$$\text{Cell constant} = \frac{\text{Conductivity} \times \text{Resistance}}{\text{Solution Concentration}}$$

$$= \frac{0.0210 \times 60}{0.01} = 1.26 \text{ cm}^{-1}$$

Quick Tip

For cell constant calculation, remember to use the relation between conductivity, resistance, and concentration.

---

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

(1) Chlordiazepoxide

(2) Meprobamate

(3) Valium

(4) Veronal

Correct Answer: (4) Veronal

Solution:

Veronal is a barbiturate used as a sedative and hypnotic.

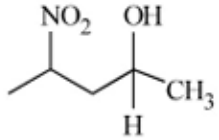
Quick Tip

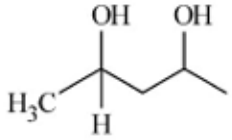
Barbiturates are a class of sedatives and hypnotics.

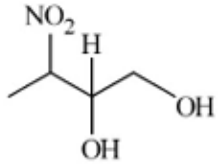
SECTION-B

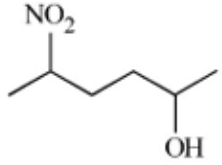
Chemistry

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

(1) 

(2) 

(3) 

(4) 

Correct Answer: (1) NO_2OH

Solution:

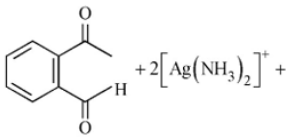
The compound with the -OH group and $-NO_2$ group in conjugation is the most prone to dehydration under acidic conditions, as the electron-withdrawing effect of the $-NO_2$ group makes the -OH group more reactive.

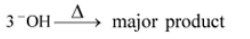
Quick Tip

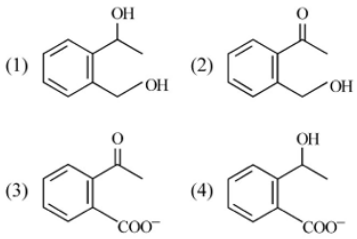
Electrophilic aromatic substitution and dehydration are favored in compounds with electron-withdrawing groups.

---

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







Correct Answer: (1) $C_6H_4OHCOOH$

Solution:

The reaction represents the formation of a hydroxybenzoic acid by the action of silver-ammonia complex on benzoic acid under basic conditions.

Quick Tip

Silver-ammonia complexes act as powerful oxidizing agents, facilitating hydroxylation of the benzene ring.

---

88. 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_4 to V_2O_5.

D. V_2O_4 dissolves in acids to give VO_4^{3-} salts.

E. CrO is basic but Cr_2O_3 is amphoteric.

(1) A and E only

(2) B and D only

(3) C and D only

(4) B and C only

Correct Answer: (2) B and D only

Solution:

Statement B is incorrect because the highest oxidation state in transition metals does not always follow the group number. Statement D is incorrect because V_2O_4 does not dissolve to form VO_4^{3-} in acids.

Quick Tip

Review the trends in oxidation states and acidic/basic properties of transition metal oxides.

---

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

(1) $\Delta H = \Delta U - \Delta n_g RT$

(2) $\Delta H = \Delta U + \Delta n_g RT$

(3) $\Delta H - \Delta U = -\Delta n_g RT$

(4) $\Delta H + \Delta U = \Delta n_g RT$

Correct Answer: (2) $\Delta H = \Delta U + \Delta n_g RT$

Solution:

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

Quick Tip

This equation is derived from the first law of thermodynamics and the definition of enthalpy.

---

90. Which complex compound is most stable?

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

(2) $[Co(NH_3)_6](NO_3)_3$

(3) $[CoCl_2(en)_2]NO_3$

(4) $[Co(NH_3)_6]_2(SO_4)_3$

Correct Answer: (4) $[Co(NH_3)_6]_2(SO_4)_3$

Solution:

The complex with higher coordination number and stable ligands like NH_3 (a strong ligand) results in greater stability.

Quick Tip

Complexes with more ammonia ligands (NH_3) tend to be more stable.

---

91. Match List - I with List - II:

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

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

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

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

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

Solution:

Peroxodisulphuric acid has two S-OH groups, four S=O bonds, and one S-O-S bond.

Sulphuric acid has two S-OH and one S=O bond.

Quick Tip

Remember to match the number of oxygen and sulfur bonds when identifying oxacids.

---

92. On balancing the given redox reaction,

$$Cr_2O_7^{2-} + bSO_3^{2-}(aq) + cH^+(aq) \rightarrow 2aCr^{3+}(aq) + bSO_4^{2-}(aq) + \frac{c}{2}H_2O(\ell)$$

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

(1) 1, 3, 8

(2) 3, 8, 1

(3) 1, 8, 3

(4) 8, 1, 3

Correct Answer: (3) 1, 8, 3

Solution:

Balancing the redox reaction gives the coefficients 1 for $Cr_2O_7^{2-}$, 8 for SO_3^{2-}, and 3 for H^+.

Quick Tip

Use the ion-electron method for balancing redox reactions in acidic medium.

---

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

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

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

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

(4) $\frac{1}{12}$

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

Solution:

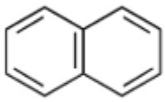
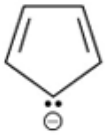
In fcc, each unit cell contains 1/2 of one edge centred octahedral void.

Quick Tip

Remember that fcc has 4 atoms per unit cell, and the voids are shared.

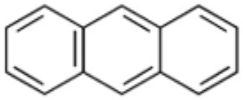
---

94. Consider the following compounds/species:

i.  ii. 

iii.  iv. 

v.  vi. 

vii. 

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

(1) 4

(2) 6

(3) 2

(4) 5

Correct Answer: (4) 5

Solution:

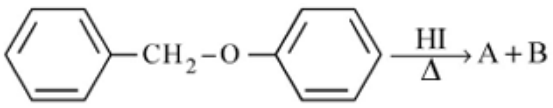
Species ii, iii, iv, v, and vii obey Huckel's rule for aromaticity.

Quick Tip

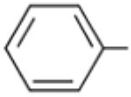
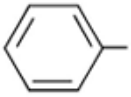
Huckel's rule states that a compound is aromatic if it has (4n + 2) electrons.

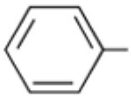
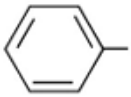
---

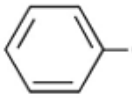
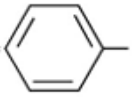
95. Consider the following reaction:

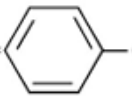
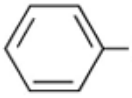


Identify products A and B.

(1) A =  and B = 

(2) A =  and B = 

(3) A =  and B = 

(4) A =  and B = 

Correct Answer: (4) A = CH_3, $B = I$

Solution:

The reaction represents the conversion of a primary alcohol (benzyl alcohol) to a halide (benzyl iodide) via a substitution reaction with HI. The product A is methyl group (CH3), and B is iodine.

Quick Tip

In alcohol halogenation, alcohols are converted to alkyl halides in the presence of a halogen acid.

---

96. 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) 1372.60 cal

(2) -137.26 cal

(3) -1381.80 cal

(4) -13.73 cal

Correct Answer: (2) -137.26 cal

Solution:

The formula for ΔG° is:

$$\Delta G^\circ = -RT \ln K$$

Substituting the given values: $\Delta G^\circ = -2 \times 300 \times \ln\left(\frac{10\times6}{2\times3}\right) = -137.26$ cal.

Quick Tip

Use the relationship between ΔG° and the equilibrium constant for calculations.

---

97. Given below are two statements:

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

Statement II: Eutrophication leads to 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 true.

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

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

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

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

Solution:

Eutrophication is the process where nutrient pollution (e.g., nitrogen and phosphorus) leads to an increase in plant and algae growth in water bodies, which depletes oxygen.

Quick Tip

Eutrophication often leads to hypoxic conditions, where oxygen levels drop.

---

98. Pumice stone is an example of -

(1) sol

(2) gel

(3) solid sol

(4) foam

Correct Answer: (4) foam

Solution:

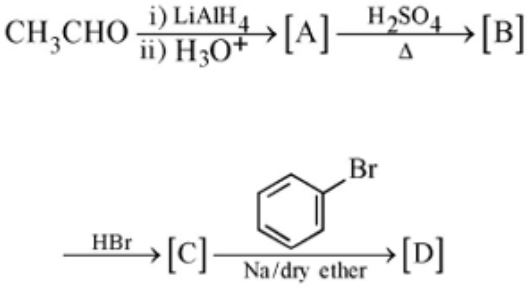
Pumice stone is a volcanic glass that forms a porous structure, hence it is an example of foam.

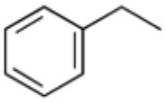
Quick Tip

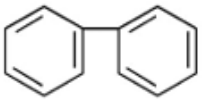
Foams have gas bubbles trapped in a solid or liquid matrix.

---

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



(1) 

(2) 

(3) C_4H_{10}

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

Correct Answer: (1) C_6H_6

Solution:

The reactions suggest the reduction of an aldehyde to alcohol, followed by dehydration, bromination, and a reduction leading to benzene (C_6H_6).

Quick Tip

Follow the reaction sequence step by step, keeping track of reagents and products.

---

100. The reaction that does NOT take place in a blast furnace between 900 K to 1500 K

temperature range during extraction of iron is:

(1) $Fe_2O_3 + CO \rightarrow 2FeO + CO_2$

(2) $FeO + CO \rightarrow Fe + CO_2$

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

(4) $CaO + SiO_2 \rightarrow CaSiO_3$

Correct Answer: (3) $C + CO_2 \rightarrow 2CO$

Solution:

The reaction $C + CO_2 \rightarrow 2CO$ does not occur in a blast furnace. Instead, CO reduces Fe_2O_3 to Fe.

Quick Tip

In the blast furnace, carbon monoxide is the reducing agent that reduces iron oxides to iron.

SECTION-A

Botany

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

(1) GA_3

(2) Kinetin

(3) Ethylene

(4) 2, 4-D

Correct Answer: (1) GA_3

Solution:

GA_3 (Gibberellic acid) is the hormone known to promote internode and petiole elongation in deep water rice.

Quick Tip

Gibberellic acid is widely involved in cell elongation and growth.

---

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

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

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

ATP is used in both steps of glycolysis: glucose is phosphorylated to glucose-6-phosphate and fructose-6-phosphate is converted to fructose-1,6-diphosphate.

Quick Tip

In glycolysis, ATP is consumed in the initial steps for phosphorylation of glucose and fructose.

---

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

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

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

In late wood, there are fewer xylary elements and narrower vessels, and this is attributed to the reduced activity of cambium in winter.

Quick Tip

The growth of plants during winter is slowed, leading to fewer xylary elements and narrower vessels.

---

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

(1) 680 nm

(2) 700 nm

(3) 660 nm

(4) 780 nm

Correct Answer: (1) 680 nm

Solution:

The absorption maxima for Photosystem II is around 680 nm, also known as P680.

Quick Tip

PS II absorbs light at 680 nm, which is crucial for the light-dependent reactions of photosynthesis.

---

105. 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) Diadelphous and Ditegous anthers

(2) Polyadelphous and epitepalous stamens

(3) Monoadelphous and Monothecous anthers

(4) Epiphyllous and Ditechous anthers

Correct Answer: (2) Polyadelphous and epitepalous stamens

Solution:

The Fabaceae family is known for its polyadelphous stamens and epitepalous stamens, unlike the stamens found in Solanaceae and Liliaceae.

Quick Tip

Look for polyadelphous stamens as a distinguishing feature of Fabaceae.

---

106. 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.

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

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

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

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

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

Solution:

In mosses, protonema stage is the first stage of gametophyte development, and it directly arises from spores released from the capsule.

Quick Tip

In mosses, the protonema stage is crucial for the development of the gametophyte from spores.

---

107. Axile placentation is observed in:

(1) Mustard, Cucumber and Primrose

(2) China rose, Beans and Lupin

(3) Tomato, Dianthus and Pea

(4) China rose, Petunia and Lemon

Correct Answer: (2) China rose, Beans and Lupin

Solution:

Axile placentation is found in plants like China rose, Beans, and Lupin, where the ovules are attached to a central column inside the ovary.

Quick Tip

Axile placentation is characterized by ovules arranged on a central column.

---

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

(1) Differentiation

(2) Dedifferentiation

(3) Development

(4) Senescence

Correct Answer: (2) Dedifferentiation

Solution:

In tissue culture, when somatic cells like leaf mesophyll cells revert to a more embryonic state and start dividing to form callus, this process is called dedifferentiation.

Quick Tip

Dedifferentiation is a crucial process in plant tissue culture for regeneration.

---

109. 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) Thomas Hunt Morgan

(2) Sutton and Boveri

(3) Alfred Sturtevant

(4) Henking

Correct Answer: (3) Alfred Sturtevant

Solution:

Alfred Sturtevant first used recombination frequencies to map the relative positions of genes on chromosomes, laying the foundation for the concept of genetic maps.

Quick Tip

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

---

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

(1) Indole-3-butyric Acid

(2) Gibberellic Acid

(3) Zeatin

(4) Abscisic Acid

Correct Answer: (2) Gibberellic Acid

Solution:

Gibberellic acid is used to promote the early maturity and seed production in juvenile conifers.

Quick Tip

Gibberellins are often used in promoting seed germination and early fruiting.

---

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

(1) Insect pollinated plants

(2) Bird pollinated plants

(3) Bat pollinated plants

(4) Wind pollinated plants

Correct Answer: (1) Insect pollinated plants

Solution:

Insect-pollinated plants often have large, colorful, and fragrant flowers to attract pollinators like bees.

Quick Tip

Insect-pollinated plants tend to have attractive flowers and produce nectar.

112. How many ATP and $NADPH_2$ are required for the synthesis of one molecule of Glucose during Calvin cycle?

(1) 12 ATP and 12 $NADPH_2$

(2) 18 ATP and 12 $NADPH_2$

(3) 12 ATP and 16 $NADPH_2$

(4) 18 ATP and 16 $NADPH_2$

Correct Answer: (4) 18 ATP and 16 $NADPH_2$

Solution:

The Calvin cycle requires 18 ATP and 16 $NADPH_2$ to synthesize one molecule of glucose.

Quick Tip

The Calvin cycle uses ATP and $NADPH_2$ in the reduction phase to produce glucose.

---

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

(1) Metaphase I

(2) Metaphase II

(3) Anaphase I

(4) Telophase

Correct Answer: (3) Anaphase I

Solution:

During Anaphase I, the centromere divides, allowing the separation of homologous chromosomes.

Quick Tip

Centromere division and separation of sister chromatids occur during anaphase.

---

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

(1) Manganese

(2) Molybdenum

(3) Magnesium

(4) Copper

Correct Answer: (1) Manganese

Solution:

Manganese plays a crucial role in the splitting of water molecules during the light reaction of photosynthesis.

Quick Tip

Manganese is an essential component of the oxygen-evolving complex in photosystem II.

---

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

(1) RNA

(2) DNA

(3) Histones

(4) Polysaccharides

Correct Answer: (2) DNA

Solution:

Chilled ethanol is used to precipitate DNA during the purification process in recombinant DNA technology.

Quick Tip

Ethanol precipitation is commonly used to purify DNA after extraction.

---

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

(1) Transcription of rRNAs (28S, 18S and 5.8S)

(2) Transcription of tRNA, 5rRNA and snRNA

(3) Transcription of precursor of mRNA

(4) Transcription of only snRNAs

Correct Answer: (1) Transcription of rRNAs (28S, 18S and 5.8S)

Solution:

RNA polymerase III is responsible for transcribing rRNAs including 28S, 18S, and 5.8S.

Quick Tip

RNA polymerase III plays a key role in synthesizing non-coding RNAs in eukaryotes.

---

117. Cellulose does not form blue colour with Iodine because

(1) It is a disaccharide.

(2) It is a helical molecule.

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

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

Correct Answer: (3) It does not contain complex helices and hence cannot hold iodine molecules.

Solution:

Unlike starch, cellulose does not form a helical structure, and thus does not react with iodine to form a blue color.

Quick Tip

Iodine stains starch due to its ability to bind to helical structures.

---

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

(1) Lycopodium and Selaginella

(2) Selaginella and Salvinia

(3) Psilotum and Salvinia

(4) Equisetum and Salvinia

Correct Answer: (2) Selaginella and Salvinia

Solution:

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

Quick Tip

Heterosporous plants are capable of producing two distinct types of spores.

---

119. Expressed Sequence Tags (ESTs) refers to:

(1) All genes that are expressed as RNA.

(2) All genes that are expressed as proteins.

(3) All genes whether expressed or unexpressed.

(4) Certain important expressed genes.

Correct Answer: (4) Certain important expressed genes.

Solution:

Expressed Sequence Tags (ESTs) are short sub-sequences of cDNA that represent the expressed portion of the genome.

Quick Tip

ESTs are widely used for gene discovery and gene expression profiling.

---

120. Identify the correct statements:

A. Detritivores 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) A, B, C only

(2) B, C, D only

(3) C, D, E only

(4) D, E, A only

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

Solution:

Detritivores break down organic matter into smaller pieces. Mineralization further degrades humus, and leaching causes soluble nutrients to move into the soil.

Quick Tip

Detritivores and decomposers play key roles in nutrient cycling.

---

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

(1) Habitat loss and fragmentation

(2) Over exploitation for economic gain

(3) Alien species invasions

(4) Co-extinctions

Correct Answer: (1) Habitat loss and fragmentation

Solution:

The most critical factor in species extinction is habitat loss and fragmentation, which leads to a reduction in biodiversity.

Quick Tip

Habitat destruction is the primary cause of biodiversity loss worldwide.

---

122. The phenomenon of pleiotropism refers to:

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

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

(3) A single gene affecting multiple phenotypic expression.

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

Correct Answer: (3) A single gene affecting multiple phenotypic expression.

Solution:

Pleiotropism refers to a single gene affecting multiple phenotypic traits, often in a manner that seems unrelated.

Quick Tip

Pleiotropism is a common phenomenon where one gene influences multiple traits.

---

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

(1) M phase

(2) S phase

(3) G1 phase

(4) G2 phase

Correct Answer: (2) S phase

Solution:

DNA replication occurs during the S phase of the cell cycle.

Quick Tip

The S phase is specifically dedicated to DNA synthesis.

---

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

(1) Zygotene

(2) Pachytene

(3) Diplotene

(4) Diakinesis

Correct Answer: (2) Pachytene

Solution:

Recombination nodules appear during the pachytene stage of prophase I in meiosis.

Quick Tip

Pachytene is characterized by crossing over and the formation of recombination nodules.

---

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

(1) Bright red colour

(2) Bright blue colour

(3) Bright yellow colour

(4) Bright orange colour

Correct Answer: (2) Bright blue colour

Solution:

Ethidium bromide stains DNA and fluoresces under UV light, emitting a bright blue colour.

Quick Tip

Ethidium bromide is commonly used for visualizing DNA in gels.

---

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

(1) 1985

(2) 1992

(3) 1986

(4) 2002

Correct Answer: (2) 1992

Solution:

The Earth Summit, which led to the creation of the Convention on Biological Diversity, took place in Rio de Janeiro in 1992.

Quick Tip

The Earth Summit was a significant event for environmental policies globally.

127. In the equation

GPP - R = NPP

GPP is Gross Primary Productivity

NPP is Net Primary Productivity

R here is -

(1) Photosynthetically active radiation

(2) Respiratory quotient

(3) Respiratory loss

(4) Reproductive allocation

Correct Answer: (3) Respiratory loss

Solution:

In the equation, R represents the respiratory loss, which is the amount of energy consumed by organisms for respiration.

Quick Tip

The difference between GPP and R gives NPP, the energy available for growth and reproduction.

---

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

(1) Frederick Griffith

(2) Alfred Hershey and Martha Chase

(3) Avery, Macleoid and McCarthy

(4) Wilkins and Franklin

Correct Answer: (2) Alfred Hershey and Martha Chase

Solution:

Alfred Hershey and Martha Chase provided the first unequivocal proof that DNA is the genetic material through their work with bacteriophages.

Quick Tip

Hershey and Chase used radioactive isotopes to trace DNA in their experiments with bacteriophages.

---

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

(1) Dobson units

(2) Decibels

(3) Decameter

(4) Kilobase

Correct Answer: (1) Dobson units

Solution:

The thickness of ozone in the atmosphere is measured in Dobson units, which indicate the concentration of ozone in a given column of air.

Quick Tip

One Dobson unit corresponds to a thickness of 0.01 millimeters of ozone at standard pressure and temperature.

---

130. Given below are two statements:

Statement I: 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 true.

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

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

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

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

Solution:

Endarch and exarch describe the position of xylem in the plant body. Exarch condition, where xylem develops from the outermost part of the vascular cylinder, is most common in roots.

Quick Tip

Exarch condition is typical of roots, while endarch condition is characteristic of stems.

---

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

(1) Osmosis

(2) Facilitated Diffusion

(3) Passive Transport

(4) Active Transport

Correct Answer: (4) Active Transport

Solution:

Active transport refers to the process by which ions are moved across a membrane against their concentration gradient, using energy in the form of ATP.

Quick Tip

Active transport requires energy to move ions against their concentration gradient.

---

132. Given below are two statements:

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

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

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

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

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

Solution:

Both statements are correct. Transpiration pulls water up through the xylem, generating capillary forces. Also, transpiration cools the leaf through evaporative cooling.

Quick Tip

Transpiration plays a key role in both nutrient transport and temperature regulation in plants.

---

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

(1) Copper

(2) Zinc

(3) Tungsten or gold

(4) Silver

Correct Answer: (3) Tungsten or gold

Solution:

In gene gun methods, tungsten or gold microparticles are coated with DNA and fired into plant cells for transformation.

Quick Tip

Gold and tungsten are often used in gene gun methods due to their dense and inert properties.

---

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

(1) Synergids, Primary endosperm nucleus and zygote

(2) Antipodals, synergids, and primary endosperm nucleus

(3) Synergids, Zygote and Primary endosperm nucleus

(4) Synergids, antipodals and Polar nuclei

Correct Answer: (1) Synergids, Primary endosperm nucleus and zygote

Solution:

The correct sequence is the synergids, primary endosperm nucleus, and the zygote which are formed during fertilization in angiosperms.

Quick Tip

Remember that the zygote is formed after fertilization, while the endosperm provides nourishment.

---

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

(1) To attract insects

(2) To trap pollen grains

(3) To disperse pollen grains

(4) To protect seeds

Correct Answer: (3) To disperse pollen grains

Solution:

Tassels in corn are the male flower structures that release pollen, which is then carried by wind to fertilize the female flowers (ears).

Quick Tip

The tassel is the main source of pollen for corn plants.

---

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

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

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

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

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

Solution:

Iron is a component of nitrate reductase, Zinc plays a role in cell elongation, Boron is essential for auxin synthesis, and Molybdenum activates catalase.

Quick Tip

Trace elements like iron, zinc, and molybdenum play crucial roles in plant metabolic processes.

---

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

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

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

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

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

Correct Answer: (2) Algal blooms caused by excess of organic matter in water improve water quality and promote fisheries.

Solution:

Excessive algal blooms deplete oxygen in water, negatively affecting aquatic life. They do not improve water quality.

Quick Tip

Algal blooms often result in eutrophication, reducing water quality and harming aquatic ecosystems.

---

138. Match List I with List II:

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

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-I, C-IV, D-II

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

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

Solution:

Mutualism involves both species benefiting, Commensalism benefits one species without harming the other, Amensalism harms one species while the other is unaffected, and Parasitism benefits one species at the expense of the other.

Quick Tip

Understanding these interactions is key to understanding ecological relationships.

---

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

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

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Both statements are true. In gymnosperms, pollen grains are released from the microsporangium and transported by air currents. The pollen tube forms after the pollen grain lands near the archegonia.

Quick Tip

In gymnosperms, fertilization involves air-borne pollen grains reaching the archegonia.

---

140. Match List I with List II:

List I

A. Oxidative decarboxylation

B. Glycolysis

C. Oxidative phosphorylation

D. Tricarboxylic acid cycle

List II

I. Citrate synthase

II. Pyruvate dehydrogenase

III. Electron transport system

IV. EMP pathway acid cycle

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Oxidative decarboxylation involves pyruvate dehydrogenase, glycolysis involves the EMP pathway, oxidative phosphorylation takes place at the electron transport system, and the tricarboxylic acid cycle involves citrate synthase.

Quick Tip

Understanding the metabolic pathways can help in connecting enzymes with their respective processes.

---

141. 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) B, C, D, E only

(2) B, C and E only

(3) A and D only

(4) B and C only

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

Solution:

The correct statements are B, C, and E. Lenticels are involved in gas exchange, bark is all tissues exterior to vascular cambium, and phellogen is single-layered.

Quick Tip

In woody plants, bark refers to all tissues outside the vascular cambium.

---

142. 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) B, C, D, A

(2) C, B, D, A

(3) C, D, B, A

(4) B, D, C, A

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

Solution:

The sequence starts with the cutting of DNA by restriction enzymes, then the isolation of the desired gene, followed by amplification using PCR, and finally inserting the recombinant DNA into the host cell.

Quick Tip

The correct sequence of steps in recombinant DNA technology is critical for successful gene cloning.

---

143. Match List I with List II:

List I

A. Cohesion

B. Adhesion

C. Surface tension

D. Guttation

List II

I. More attraction in liquid phase

II. Mutual attraction among water molecules

III. Water loss in liquid phase

IV. Attraction towards polar surfaces

Choose the correct answer from the options given below:

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Cohesion refers to mutual attraction between water molecules, adhesion refers to attraction to polar surfaces, surface tension is related to water's resistance to spreading, and guttation involves the loss of water through pores.

Quick Tip

These forces are vital for water movement and transport in plants.

144. 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) A and B only

(2) C and D only

(3) B and C only

(4) D and E only

Correct Answer: (4) D and E only

Solution:

Klinefelter's syndrome results in sterility, retarded physical and mental development, and feminine traits in individuals with overall masculine development.

Quick Tip

Klinefelter's syndrome is a genetic disorder affecting males, leading to developmental and reproductive challenges.

---

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

(1) 80

(2) 60

(3) 40

(4) 20

Correct Answer: (2) 60

Solution:

Ribosomes are made up of a large number of proteins, approximately 60 in total. These

proteins form the structure and aid in the function of the ribosome.

Quick Tip

The ribosome consists of ribosomal RNA (rRNA) and proteins, with around 60 proteins in total.

---

146. Match List I with List II:

List I

A. M Phase

B. G2 Phase

C. Quiescent stage

D. G1 Phase

List II

I. Proteins are synthesized

II. Inactive phase

III. Interval between mitosis and initiation of DNA replication

IV. Equational division

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

M Phase involves equational division, G2 Phase is the interval before DNA replication, the

Quiescent stage is inactive, and G1 Phase involves the synthesis of proteins.

Quick Tip

Each phase of the cell cycle has a distinct function related to cell division and preparation.

---

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

(1) membrane, proton pump, proton gradient, ATP synthase

(2) membrane, proton pump, proton gradient, NADP synthase

(3) proton pump, electron gradient, ATP synthase

(4) proton pump, electron gradient, NADP synthase

Correct Answer: (1) membrane, proton pump, proton gradient, ATP synthase

Solution:

Chemiosmosis requires a membrane with proton pumps that create a proton gradient, which then drives ATP synthesis via ATP synthase.

Quick Tip

Chemiosmosis is essential for energy production in both cellular respiration and photosynthesis.

---

148. Melonate inhibits the growth of pathogenic bacteria by inhibiting the activity of

(1) Succinic dehydrogenase

(2) Amylase

(3) Lipase

(4) Dinitrogenase

Correct Answer: (1) Succinic dehydrogenase

Solution:

Melonate inhibits bacterial growth by targeting succinic dehydrogenase, a key enzyme in the electron transport chain.

Quick Tip

Inhibiting enzymes like succinic dehydrogenase can disrupt bacterial metabolism and growth.

---

149. 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 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 and R is the correct explanation of A.

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Both statements are true. Flowers are modified shoots, and internodes condense to form floral appendages.

Quick Tip

Flowers represent modified stems that have adapted to reproduction.

---

150. 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 true.

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

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

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

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

Solution:

Statement I is correct; however, Statement II is false because herbivores are typically more affected by competition than carnivores, as they compete for food resources.

Quick Tip

The Competitive Exclusion Principle emphasizes that two species cannot occupy the same niche indefinitely.

SECTION-A

Zoology

151. 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 true.

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

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

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

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

Solution:

Ligaments are dense irregular connective tissue, while cartilage is a type of dense regular connective tissue.

Quick Tip

Ligaments connect bone to bone and are made of dense irregular connective tissue, while cartilage forms flexible support structures.

---

152. Match List I with List II with respect to human eye.

List I	List II
$A. Fovea$	$III. Point of greatest visual acuity or resolution.$
$B. Iris$	$I. Visible coloured portion of eye that regulates diameter of pupil.$
$C. Blind spot$	$IV. Point where optic nerve leaves the eyeball and photoreceptor cells are absent.$
$D. Sclera$	$II. External layer of eye formed of dense connective tissue.$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The fovea is the point of greatest visual acuity, the iris controls pupil size, the blind spot is where the optic nerve exits, and the sclera is the tough outer layer.

Quick Tip

The fovea has the highest concentration of cones, providing sharp vision.

---

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

(1) T cells

(2) B-lymphocytes

(3) Basophils

(4) Eosinophils

Correct Answer: (1) T cells

Solution:

HIV specifically targets CD4+ T cells, where it replicates and produces progeny viruses that spread to infect other cells.

Quick Tip

T cells are key players in the immune response, and their depletion is a hallmark of HIV infection.

---

154. Match List I with List II:

List I	List II
$A. Heroin$	$III. Painkiller$
$B. Marijuana$	$II. Slowdownbodyfunction$
$C. Cocaine$	$I. Effectoncardiovascularsystem$
$D. Morphine$	$IV. Interferewithtransportofdopamine$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Heroin is a painkiller, marijuana slows down body function, cocaine affects the cardiovascular system, and morphine interferes with dopamine transport.

Quick Tip

These substances have varying effects on the nervous and cardiovascular systems.

---

155. Match List I with List II:

List I	List II
$A.Gene`a'$	$I.\beta$-galactosidase
$B.Gene`y'$	$II.Transacetylase$
$C.Gene`i'$	$III.Permease$
$D.Gene`z'$	$IV.Repressorprotein$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Gene a codes for β-galactosidase, gene y codes for transacetylase, gene i codes for permease, and gene z codes for the repressor protein.

Quick Tip

The lac operon in bacteria controls the metabolism of lactose.

156.

List I	List II
$A.CartilaginousJoint$	$III.Betweenadjacentvertebraeinvertebralcolumn$
$B.BallandSocketJoint$	$II.Betweenhumerusandscapula$
$C.FibrousJoint$	$I.Betweenflatskullbones$
$D.SaddleJoint$	$IV.Betweencarpalandmetacarpalofthumb$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Cartilaginous joints are between adjacent vertebrae, ball and socket joints are in the shoulder, fibrous joints are between skull bones, and saddle joints are in the thumb.

Quick Tip

Joints in the body allow for different types of movement and are classified based on structure and function.

---

157. Which of the following statements is correct?

(1) Eutrophication refers to increase in domestic sewage and waste water in lakes.

(2) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.

(3) Presence of large amount of nutrients in water restricts 'Algal Bloom'.

(4) Algal Bloom decreases fish mortality

Correct Answer: (2) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.

Solution:

Biomagnification is the increase in concentration of toxic substances as they move up the food chain.

Quick Tip

In the process of biomagnification, toxins increase in concentration as they move through each trophic level.

---

158. 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 the correct explanation of A.

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Amniocentesis is a method used for sex determination and the ban on this method helps control female foeticide.

Quick Tip

The ban on amniocentesis aims to prevent discrimination against female fetuses.

---

159. 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. Pepsinogen

D. Chief cells IV. HCl and intrinsic factor for absorption of vitamin B12

Choose the correct answer from the options given below:

List I	List II
$A. Peptic cells$	$III. Pepsinogen$
$B. Goblet cells$	$I. Mucus$
$C. Oxyntic cells$	$IV. HCl and intrinsic factor for absorption of vitamin B12$
$D. Chief cells$	$II. Bile juice$

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

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

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

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

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

Solution:

Peptic cells secrete pepsinogen, goblet cells secrete mucus, oxyntic cells secrete HCl and intrinsic factor, and chief cells secrete bile juice.

Quick Tip

Understand the function of cells in the stomach for digestion and absorption.

---

160. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

(1) Tasmanian wolf, Bocat, Marsupial mole

(2) Numbat, Spotted cuscus, Flying phalanger

(3) Mole, Flying squirrel, Tasmanian tiger cat

(4) Lemur, Anateer, Wolf

Correct Answer: (2) Numbat, Spotted cuscus, Flying phalanger

Solution:

These marsupials are examples of adaptive radiation, where species evolve differently to adapt to diverse environments.

Quick Tip

Adaptive radiation occurs when organisms evolve different forms to occupy various ecological niches.

---

161. Match List I with List II:

List I	List II
$A. Vasectomy$	$III. Surgical method$
$B. Coitus interruptus$	$IV. Natural method$
$C. Cervical caps$	$II. Barrier method$
$D. Saheli$	$I. Oral method$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Vasectomy is a surgical method, coitus interruptus is a natural method, cervical caps are a barrier method, and Saheli is an oral method.

Quick Tip

Different contraceptive methods work in different ways to prevent pregnancy.

---

162. 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 true.

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

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

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

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

Solution:

RNA does indeed mutate at a faster rate, and viruses with RNA genomes do tend to mutate more rapidly due to their shorter life span.

Quick Tip

RNA viruses tend to evolve quickly due to higher mutation rates.

---

163. Which of the following functions is carried out by cytoskeleton in a cell?

(1) Nuclear division

(2) Protein synthesis

(3) Motility

(4) Transportation

Correct Answer: (3) Motility

Solution:

The cytoskeleton is responsible for maintaining cell shape, allowing cell movement (motility), and facilitating intracellular transport.

Quick Tip

The cytoskeleton plays a vital role in maintaining the structure and motility of the cell.

---

164. Vital capacity of lung is ___.

(1) IRV + ERV

(2) IRV + ERV + TV + RV

(3) IRV + ERV + TV - RV

(4) IRV + ERV + TV

Correct Answer: (2) IRV + ERV + TV + RV

Solution:

Vital capacity is the total amount of air that can be exhaled after a maximal inhalation and is equal to IRV + ERV + TV + RV.

Quick Tip

Vital capacity is a key indicator of lung health and respiratory function.

---

165. 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 D only

(2) A and B only

(3) A, B and C only

(4) A, C and D only

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

Solution:

The correct statements are A, C, and D. Non-primate mammals undergo oestrus cycle, lack of menstruation can indicate pregnancy, and menstruation occurs from menarche to menopause.

Quick Tip

In primates, the menstrual cycle differs from the oestrus cycle observed in many other mammals.

---

166. 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 true.

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

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

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

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

Solution:

Both statements are correct. Vas deferens does receive a duct from the seminal vesicle and leads to the urethra, while the cervical canal is part of the birth canal.

Quick Tip

The cervix and vagina together form the birth canal in females.

167. Given below are two statements:

Statement I: Electrostatic precipitator is most widely used in thermal power plant.

Statement II: Electrostatic precipitator in thermal power plant removes ionising 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 correct.

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

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

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

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

Solution:

Electrostatic precipitators are widely used in thermal power plants to remove particulate matter, but they do not remove ionizing radiation.

Quick Tip

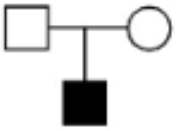
Electrostatic precipitators help reduce air pollution by removing dust particles from exhaust gases.

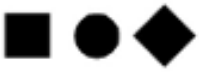
---

168. Which one of the following symbols represents mating between relatives in human pedigree analysis?

(1) 

(2) 

(3) 

(4) 

Correct Answer: (3)

Solution:

In pedigree analysis, mating between relatives is represented by a symbol showing mating between affected individuals. The symbol represents mating between relatives.

Quick Tip

In human pedigree analysis, symbols help represent relationships and genetic inheritance patterns.

---

169. Match List I with List II:

List I	List II
$A. P-wave$	$III. Depolarisation of atria$
$B. Q-wave$	$I. Beginning of systole$
$C. QRS complex$	$IV. Depolarisation of ventricles$
$D. T-wave$	$II. Repolarisation of ventricles$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

The P-wave represents atrial depolarisation, the Q-wave represents the beginning of systole, the QRS complex represents ventricular depolarisation, and the T-wave represents ventricular repolarisation.

Quick Tip

Electrocardiograms (ECGs) are used to monitor electrical activity in the heart.

---

170. 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

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

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

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

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

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

Solution:

The correct matching is as follows: - A. Taenia $\rightarrow$ I. Nephridia - B. Paramoecium $\rightarrow$ II. Contractile vacuole - C. Periplaneta $\rightarrow$ III. Flame cells - D. Pheretima $\rightarrow$ IV. Urecose gland

Explanation:

Taenia is a parasitic flatworm and uses nephridia for excretion. Paramoecium uses contractile vacuoles for osmoregulation, and Periplaneta (cockroach) uses flame cells. Pheretima (earthworm) has an excretory system with urecose glands.

Quick Tip

When studying excretory systems in different organisms, focus on the variations in their structures and the functions they serve, such as osmoregulation and waste removal.

---

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

(1) Genital herpes

(2) Gonorrhoea

(3) Hepatitis-B

(4) HIV Infection

Correct Answer: (2) Gonorrhoea

Solution:

Gonorrhoea is a bacterial infection and is completely treatable with antibiotics if detected early. Genital herpes, Hepatitis-B, and HIV are viral infections that are not curable but can be managed with medication.

Quick Tip

When learning about sexually transmitted diseases, focus on differentiating between bacterial and viral infections, as bacterial infections like Gonorrhoea are curable with antibiotics, while viral infections are managed but not curable.

---

172. 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

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

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

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

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

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

Solution:

The correct matching is as follows: - A. CCK $\rightarrow$ IV. Pancreas - B. GIP $\rightarrow$ III. Gastric gland - C. ANF $\rightarrow$ II. Kidney - D. ADH $\rightarrow$ I. Pancreas

Explanation:

CCK (Cholecystokinin) plays a role in pancreatic enzyme secretion. GIP (Gastric Inhibitory Peptide) affects gastric function. ANF (Atrial Natriuretic Factor) works on kidney functions, while ADH (Antidiuretic Hormone) regulates water balance in the pancreas.

Quick Tip

Focus on the hormones' roles in regulating different organ systems, especially the digestive, excretory, and endocrine functions.

173. 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 true.

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

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

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

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

Solution:

Statement I is true as low temperatures typically slow down enzyme activity, while high temperatures can denature enzymes. Statement II is also true, as competitive inhibitors resemble the substrate and compete for the enzyme's active site.

Quick Tip

When studying enzymes, focus on the effects of temperature and inhibitors on enzyme activity. Competitive inhibitors affect the active site, while temperature extremes can denature the enzyme.

---

174. 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 true.

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

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

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

Correct Answer: (4) Statement I is false but Statement II is true.

Solution:

Statement I is false because the C-terminal is the right end of the protein, while the N-terminal is the left. Statement II is correct as human haemoglobin consists of four subunits—two and two subunits.

Quick Tip

When studying proteins, focus on their structure, including the N-terminal and C-terminal ends, and the function of multi-subunit proteins like haemoglobin.

---

175. Radial symmetry is NOT found in adults of phylum ___.

(1) Ctenophora

(2) Hemichordata

(3) Coelenterata

(4) Echinodermata

Correct Answer: (2) Hemichordata

Solution:

Hemichordates, such as acorn worms, do not exhibit radial symmetry in their adult form, unlike other phyla such as Echinodermata, which show radial symmetry in adults.

Quick Tip

When studying symmetry in animals, focus on the differences between types, such as radial and bilateral symmetry, and identify the phyla that exhibit each.

---

176. Which one of the following techniques does not serve the purpose of early diagnosis of a disease for its early treatment?

(1) Recombinant DNA Technology

(2) Serum and Urine analysis

(3) Polymerase Chain Reaction (PCR) technique

(4) Enzyme Linked Immuno-Sorbent Assay (ELISA) technique

Correct Answer: (1) Recombinant DNA Technology

Solution:

Recombinant DNA technology is not typically used for early disease diagnosis but rather for genetic research and therapeutic purposes. Serum and urine analysis, PCR, and ELISA techniques are commonly used for diagnosing diseases early to allow timely treatment.

Quick Tip

When learning about diagnostic techniques, focus on understanding which techniques are used for genetic analysis (e.g., Recombinant DNA Technology) versus those used for early disease detection (e.g., PCR, ELISA).

---

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

(1) Sphincter of Oddi

(2) Ileo-caecal valve

(3) Gastro-oesophageal sphincter

(4) Pyloric sphincter

Correct Answer: (2) Ileo-caecal valve

Solution:

The Ileo-caecal valve prevents the backflow of undigested and unabsorbed substances from the caecum back into the ileum. The Sphincter of Oddi regulates bile and pancreatic juices, while the gastro-oesophageal sphincter controls food flow between the esophagus and stomach, and the pyloric sphincter regulates the flow of chyme from the stomach to the small intestine.

Quick Tip

Understand the role of various sphincters in digestive anatomy, particularly those that prevent backflow, such as the Ileo-caecal valve, which regulates flow between the small intestine and the caecum.

178. Which of the following are NOT considered as part of the 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) B and D only

(2) A, C and E only

(3) A and D only

(4) A, D and E only

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

Solution:

Mitochondria, chloroplasts, and peroxisomes are not part of the endomembrane system. They are functionally related to cellular energy production and detoxification but are not membrane-bound organelles that directly interact with the endomembrane system. The Endoplasmic Reticulum and Golgi Complex are part of the endomembrane system.

Quick Tip

Understand the relationship and function of organelles in the cell, especially how the endomembrane system contributes to protein and lipid synthesis.

---

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

(1) Down's syndrome

(2) Turner's syndrome

(3) Klinefelter's syndrome

(4) Thalassemia

Correct Answer: (1) Down's syndrome

Solution:

A broad palm with a single crease is a common characteristic of Down's syndrome, which is caused by the presence of an extra 21st chromosome. Turner's syndrome, Klinefelter's syndrome, and Thalassemia do not typically present with this characteristic.

Quick Tip

When studying genetic disorders, pay attention to physical and developmental signs that can help in the diagnosis.

---

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

Assertion A: Nephrons are of two types: Cortical and 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 and R is the correct explanation of A.

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Assertion A is correct as nephrons are classified based on their location in the kidney. Juxta medullary nephrons are located close to the medulla and have long loops of Henle, not short. Hence, Reason R is false.

Quick Tip

Understand the types of nephrons and their role in filtration. Juxta medullary nephrons play a key role in concentrating urine due to their long loops of Henle.

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181. 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-IV, D-I

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

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

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

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

Solution:

The correct matching is: - A. Ringworm → II. Trichophyton - B. Filariasis → III. Wuchereria bancrofti - C. Malaria → IV. Plasmodium vivax - D. Pneumonia → I. Haemophilus influenzae

Explanation:

Ringworm is caused by Trichophyton, Filariasis is caused by Wuchereria bancrofti, Malaria is caused by Plasmodium vivax, and Pneumonia is caused by Haemophilus influenzae.

Quick Tip

When studying diseases, pay attention to the pathogens responsible for different conditions and understand their classifications (fungal, bacterial, parasitic).

---

182. Which of the following is not a cloning vector?

(1) BAC

(2) YAC

(3) pBR322

(4) Probe

Correct Answer: (4) Probe

Solution:

BAC, YAC, and pBR322 are cloning vectors used in genetic engineering. A probe is used for

detecting specific DNA sequences, not for cloning.

Quick Tip

Cloning vectors such as BAC, YAC, and pBR322 are used to carry foreign DNA into host cells.

---

183. 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 and R is the correct explanation of A.

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

(3) A is true but R is false.

(4) A is false but R is true.

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

Solution:

Endometrium is essential for the implantation of a blastocyst, and in the absence of fertilization, the corpus luteum degenerates, causing the endometrium to disintegrate.

Quick Tip

The corpus luteum secretes progesterone to maintain the endometrium for pregnancy. If pregnancy does not occur, it degenerates, causing menstruation.

---

184. Given below are two statements:

Statement I: 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 true.

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

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

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

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

Solution:

Both statements are correct. In prokaryotes, the DNA is held by positively charged proteins, while in eukaryotes, DNA is wrapped around histones to form nucleosomes.

Quick Tip

In eukaryotes, nucleosomes play a crucial role in the packing and regulation of DNA.

---

185. Match List I with List II:

List I	List II
$A. A Leopard and a Lion$	$I. Competition$
$B. A Cuckoo laying egg in a Crow's nest$	$II. Brood parasitism$
$C. Fungi and root of a higher plant in Mycorrhizae$	$III. Mutualism$
$D. A cattle egret and a Cattle in a field$	$IV. Commensalism$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Leopard and lion compete for food (Competition), cuckoo lays eggs in crow's nest (Brood parasitism), fungi form mutual relationships with plant roots (Mutualism), and cattle egret follows cattle for food (Commensalism).

Quick Tip

Commensalism benefits one organism while the other is not affected.

SECTION-B

Zoology

186. 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) A and D only

(2) B and C only

(3) C and D only

(4) D and E only

Correct Answer: (4) D and E only

Solution:

Thyroid hormones primarily affect metabolic processes and the maintenance of water and electrolyte balance, but do not have a significant role in the immune system or RBC formation.

Quick Tip

Thyroid hormones regulate the metabolic rate and influence growth and development.

---

187. In cockroach, excretion is brought about by:

A. Phallic gland

B. Urecose gland

C. Nephrocytes

D. Fat body

E. Collateral glands

Choose the correct answer from the options given below:

(1) A and E only

(2) A, B and E only

(3) B, C and D only

(4) B and D only

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

Solution:

Excretion in cockroaches involves the use of nephrocytes, fat body, and urecose glands to eliminate waste products.

Quick Tip

Insects like cockroaches use malpighian tubules and fat bodies for excretion.

---

188. Match List I with List II:

List I	List II
$A. Mast cells$	$IV. Specialised connective tissue$
$B. Inner surface$	$II. Areolar connective tissue$
$C. Blood$	$III. Cuboidal epithelium$
$D. Tubular parts$	$I. Ciliated epithelium$

Choose the correct answer from the options given below:

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

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

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

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

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

Solution:

Mast cells are part of specialised connective tissue, inner surfaces are lined with areolar tissue, blood contains cuboidal epithelium in blood vessels, and tubular parts have ciliated

epithelium.

Quick Tip

Epithelium types and their locations in tissues are important for understanding their function in the body.

---

189. The unique mammalian characteristics are:

(1) Hairs, tympanic membrane and mammary glands

(2) Hairs, pinna and mammary glands

(3) Hairs, pinna and indirect development

(4) Pinna, monocondylic skull and mammary glands

Correct Answer: (2) Hairs, pinna and mammary glands

Solution:

The key characteristics of mammals include hair, the presence of the pinna (external ear), and mammary glands for lactation.

Quick Tip

Mammalian features such as hair and mammary glands distinguish them from other animal groups.

---

190. 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) A, C and D only

(2) B and C only

(3) B, D and E only

(4) C, D and E only

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

Solution:

Chordates have a solid, dorsal nerve cord, paired pharyngeal gill slits, and a dorsal heart. The circulatory system is not always closed in all chordates, and they are not all pseudocoelomate.

Quick Tip

The key features of chordates include the notochord, dorsal nerve cord, and gill slits.

---

191. 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 chromosome.

Choose the correct answer from the options given below:

(1) A and C only

(2) B and D only

(3) A, C and E only

(4) B and E only

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

Solution:

Tetrad formation occurs during Leptotene, terminalization takes place in Pachytene, and crossing over occurs between homologous chromosomes, not between sister chromatids.

Quick Tip

In meiosis, homologous chromosomes undergo recombination (crossing over) during Pachytene.

---

192. The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are:

(1) Limbic system & hypothalamus

(2) Corpora quadrigemina & hippocampus

(3) Brain stem & epithalamus

(4) Corpus callosum and thalamus

Correct Answer: (1) Limbic system & hypothalamus

Solution:

The Limbic system and hypothalamus are involved in regulating emotional responses and behaviors, including sexual behavior.

Quick Tip

The Limbic system is crucial for processing emotions and motivation, while the hypothalamus controls autonomic functions.

---

193. 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 correct.

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

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

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

Correct Answer: (4) Statement I is incorrect but Statement II is correct.

Solution:

During G0 phase, the cell is not metabolically inactive but rather in a resting or quiescent state. The centrosome duplication occurs during S phase.

Quick Tip

The G0 phase is a resting phase, while S phase is when DNA replication and centrosome duplication occur.

---

194. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows:

5' AUGCAUGCAUGCAUGC 3'

(1) 5' UAGUAGCUAGCUAGCU 3'

(2) 3' UAGTCAGTCAGTCAG 5'

(3) 5' ATGCATGCATGCATGC 3'

(4) 3' ATGCATGCATGCATGC 5'

Correct Answer: (3) 5' ATGCATGCATGCATGC 3'

Solution:

The sequence on the coding strand is complementary to the mRNA sequence and thus the correct answer is 5' ATGCATGCATGCATGC 3'.

Quick Tip

The mRNA is synthesized in the 5' to 3' direction and is complementary to the DNA coding strand.

---

195. 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) A, B and C only

(2) B and C only

(3) A, C and D only

(4) C and D only

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

Solution:

Skeletal muscle fibers contain sarcoplasmic reticulum, and the striations are caused by the arrangement of actin and myosin. Sarcomeres are functional units of contraction, and muscle bundles are held together by connective tissue.

Quick Tip

Remember that sarcomeres are the repeating units in muscle fibers that allow contraction.

---

196. Match List I with List II:

List I

A. Logistic growth

B. Exponential growth

C. Expanding age pyramid

D. Stable age pyramid

List II

I. Unlimited resource availability condition

II. Limited resource availability condition

III. The percent individuals of pre-reproductive age is largest followed by reproductive and post-reproductive age groups

IV. The percent individuals of pre-reproductive and reproductive age group are same

Choose the correct answer from the options given below:

List I	List II
$A. Logistic growth$	$II. Limited resource availability condit$
$B. Exponential growth$	$I. Unlimited resource availability condi$
$C. Expanding age pyramid$	$III. The percent individuals of pre-reproductive age is largest followed by repr$
$D. Stable age pyramid$	$IV. The percent individuals of pre-reproductive and reprod$

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-III

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

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

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

Solution:

Logistic growth occurs under limited resource availability conditions, exponential growth happens under unlimited resources, expanding age pyramids show a large pre-reproductive group, and stable age pyramids show even proportions across age groups.

Quick Tip

In population dynamics, logistic and exponential growth represent different resource availability conditions.

---

197. Which one of the following is NOT an advantage of inbreeding?

(1) It decreases homozygosity.

(2) It exposes harmful recessive genes that are eliminated by selection.

(3) Elimination of less desirable genes and accumulation of superior genes takes place due to it.

(4) It decreases the productivity of inbred population, after continuous inbreeding.

Correct Answer: (1) It decreases homozygosity.

Solution:

Inbreeding typically increases homozygosity and exposes harmful recessive genes, which

may be eliminated by selection. Continuous inbreeding often leads to a reduction in genetic diversity and productivity.

Quick Tip

Inbreeding can lead to the expression of harmful recessive traits due to increased homozygosity.

---

198. Which of the following is characteristic feature of cockroach regarding sexual dimorphism?

(1) Dark brown body colour and anal cerci

(2) Presence of anal styles

(3) Presence of sclerites

(4) Presence of anal cerci

Correct Answer: (4) Presence of anal cerci

Solution:

Sexual dimorphism in cockroaches can be observed in the presence of anal cerci, which differ between males and females.

Quick Tip

Insects like cockroaches often show sexual dimorphism in secondary sexual traits such as cerci.

---

199. 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) D and E only

(2) C and D only

(3) B and C only

(4) A and B only

Correct Answer: (3) B and C only

Solution:

Basophils are involved in inflammatory responses, and they secrete histamine, serotonin, and heparin. However, they are not the most abundant cells in WBCs and are not agranulocytes.

Quick Tip

Basophils are granulocytes that play a key role in inflammatory responses.

---

200. 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.

Choose the correct answer from the options given below:

(1) A and B only

(2) B, C and D only

(3) A, B and E only

(4) C, D and E only

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

Solution:

ADH helps in water reabsorption, and ANF causes vasodilation. ADH can also increase blood pressure by promoting fluid retention. The excessive loss of body fluid does not switch off osmoreceptors.

Quick Tip

ADH is crucial for regulating water balance in the body and helps prevent dehydration.
