NEET 2023 Question Paper (Code G2) with solutions

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

General Instructions

Read the following instructions very carefully and strictly follow them:

1. (i). This question paper contains **200** questions. **All** questions are **compulsory.**
2. (ii). The question paper is divided into **two** sections: **Section A** and **Section B.**
3. (iii). **Section A** – Questions number **1 to 50** are Multiple Choice type questions. Each question carries **4** marks.
4. (iv). **Section B** – Questions number **51 to 100** are Short Answer type questions. Each question carries **4** marks. Write the answer to each question in **60 to 80** words.
5. (v). **Section C** – Questions number **101 to 150** are Long Answer (LA) type questions. Each question carries **8** marks. Write answer to each question in **300 to 350** words.
6. (vi). **Section D** – Questions number **151 to 185** are Source-based questions with multiple sub-questions. Each question carries **4** marks.
7. (vii). **Section E** – Question number **186 to 200** is Map-based and practical based question that includes identification, location, and explanation of significant test items. This question carries **5** marks. Attach the map or practical sheets with the answer book.
8. (viii). There is no overall choice. However, internal choices are provided in Section B, C, and D. A candidate has to write the answer for only one of the alternatives in such questions.
9. (ix). Visually impaired candidates are provided with a separate question paper, which excludes visual inputs and maps. Such questions are to be attempted by visually impaired candidates only.

SECTION–A
Physics

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

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

Correct Answer: (D) $\frac{4v}{3}$

Solution:
Let the total distance be D. The vehicle travels:

- First half of the distance $\frac{D}{2}$ with speed v,
- The second half of the distance $\frac{D}{2}$ with speed $2v$.

The time taken for the first half is:

$$t_1 = \frac{\frac{D}{2}}{v} = \frac{D}{2v}$$

The time taken for the second half is:

$$t_2 = \frac{\frac{D}{2}}{2v} = \frac{D}{4v}$$

Thus, the total time taken is:

$$t_{\text{total}} = t_1 + t_2 = \frac{D}{2v} + \frac{D}{4v} = \frac{3D}{4v}$$

Now, the average speed is given by:

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{D}{\frac{3D}{4v}} = \frac{4v}{3}$$

Thus, the average speed is $\frac{4v}{3}$.

Quick Tip

When calculating average speed for journeys with different speeds over equal distances, use the formula for average speed $\frac{2ab}{a+b}$, where a and b are the two speeds.

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

(1) 80 minutes
(2) 20 minutes
(3) 40 minutes
(4) 60 minutes

Correct Answer: (C) 40 minutes

Solution:
The activity of a radioactive substance decays according to the formula:

$$A = A_0 \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}}$$

Where: - A_0 is the initial activity, - A is the remaining activity after time t, - $T_{1/2}$ is the half-life, - t is the time elapsed.

We know that the activity drops to $\frac{1}{16}$ of the initial value. Hence:

$$\frac{A}{A_0} = \left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}} = \frac{1}{16}$$

Since $\frac{1}{16} = \left(\frac{1}{2}\right)^4$, we can equate:

$$\left(\frac{1}{2}\right)^{\frac{t}{T_{1/2}}} = \left(\frac{1}{2}\right)^4$$

Thus, $\frac{t}{T_{1/2}} = 4$. Given that $T_{1/2} = 20$ minutes, we find:

$$t = 4 \times 20 = 40\,\text{minutes}$$

> Quick Tip
>
> When solving half-life problems, remember that the time taken for the activity to reduce to $\frac{1}{16}$ is equivalent to four half-lives.

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3. 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) Load resistance
(2) A centre-tapped transformer
(3) p-n junction diodes
(4) Capacitor

Correct Answer: (D) Capacitor

Solution:
In a full wave rectifier, the AC ripple is removed by the **capacitor**. The capacitor smooths out the variations in the rectified voltage, reducing the AC ripple, and provides a nearly steady DC output. The other components like the transformer and diodes help in converting AC to DC but do not smooth out the ripple.

> Quick Tip
>
> When studying rectifiers, focus on the role of capacitors in filtering out AC ripples and providing smooth DC output.

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4. 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 south-west
(2) along eastward

(3) along northward
(4) along north-east

Correct Answer: (A) along south-west

Solution:
When the player turns eastward from the south, the direction of motion changes. The force acting on the player is due to the change in direction, and this force is directed towards the center of the turn. This is a **centripetal force**. Since the player was initially moving southward, the change in direction would create a force towards the **south-west** direction.

> Quick Tip
>
> Remember that when an object changes direction but maintains speed, the force is centripetal and points towards the center of the circular path.

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

(1) 2 µC
(2) 6 µC
(3) 8 µC
(4) 4 µC

Correct Answer: (A) 2 µC

Solution:
The torque (τ) on an electric dipole in an electric field is given by the formula:

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

Where: - p is the dipole moment, $p = q \times d$, - E is the electric field, - θ is the angle between the dipole moment and the electric field.
We are given: - $\tau = 4\,\text{N·m}$, - $E = 2 \times 10^5\,\text{N C}^{-1}$, - $\theta = 30°$, - $d = 2\,\text{cm} = 0.02\,\text{m}$.
Substitute into the formula for torque:

$$4 = q \times 0.02 \times 2 \times 10^5 \times \sin 30°$$

Since $\sin 30° = 0.5$, we get:

$$4 = q \times 0.02 \times 2 \times 10^5 \times 0.5$$

$$4 = q \times 2 \times 10^4$$

$$q = \frac{4}{2 \times 10^4} = 2 \times 10^{-5}\,\text{C} = 2\,\mu\text{C}$$

Quick Tip

For dipoles, the torque formula $\tau = pE\sin\theta$ helps determine the dipole moment $p = q \times d$ and the charge q.

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6. 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})

(1) 50.1×10^{-4} J
(2) 30.16×10^{-4} J
(3) 6.16×10^{-4} J
(4) 3.01×10^{-4} J

Correct Answer: (C) 6.16×10^{-4} J

Solution:
The energy required to form a soap bubble is given by:

$$E = 4\pi r^2 \sigma$$

Where: - r is the radius of the bubble, - σ is the surface tension.
Given that the radius $r = 2\,\text{cm} = 0.02\,\text{m}$ and $\sigma = 0.03\,\text{N m}^{-1}$, we calculate the energy:

$$E = 4\pi(0.02)^2 \times 0.03 = 6.16 \times 10^{-4}\,\text{J}$$

Quick Tip

When solving problems involving surface tension, use the formula $E = 4\pi r^2\sigma$ for soap bubbles.

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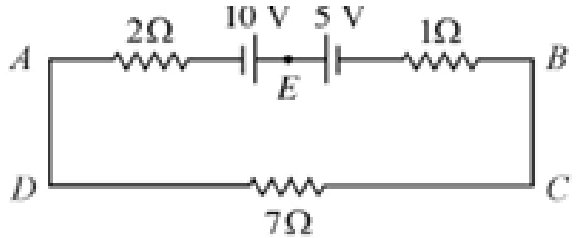
7. The magnitude and direction of the current in the following circuit is:



(1) 1.5 A from B to A through E
(2) 0.2 A from B to A through E
(3) 0.5 A from A to B through E
(4) $\frac{5}{7}$ A from A to B through E

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

Solution:
To solve for the current in the circuit, we apply Ohm's law:

$$I = \frac{V}{R_{\text{total}}}$$

Where: - $V = 10 + 5 = 15\,\text{V}$ (Total voltage), - $R_{\text{total}} = 2 + 1 + 1 = 4\,\Omega$ (Total resistance).
Thus, the current is:

$$I = \frac{15}{4} = 0.5\,\text{A}$$

The direction of current flow is from A to B through E as per the circuit configuration.

> Quick Tip
>
> For calculating current in a series circuit, add up all resistances and apply Ohm's Law.

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

(1) Yellow
(2) Red
(3) Green
(4) Orange

Correct Answer: (C) Green

Solution:
The colour code for a resistor is based on the following scheme: - First band = first digit, - Second band = second digit, - Third band = multiplier.
For $2200\,\Omega$, the digits are 2, 2, and the multiplier is 10^2, which corresponds to the colour **green**.

> Quick Tip
>
> The third colour band represents the power of ten (multiplier) in the resistor's value. Green corresponds to 10^5.

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

(1) 1.4%
(2) 1.2%
(3) 1.3%
(4) 1.6%

Correct Answer: (C) 1.3%

Solution:
The density ρ of the wire is given by:

$$\rho = \frac{m}{\pi r^2 L}$$

Where: - m is the mass, - r is the radius, - L is the length.
The percentage error in density is the sum of the relative percentage errors in mass, radius, and length. Using the given uncertainties:

$$\%\text{error in } \rho = \%\text{error in } m + 2 \times \%\text{error in } r + \%\text{error in } L$$

Calculating this gives a total percentage error of approximately 1.3%.

> **Quick Tip**
>
> For errors in physical quantities like density, add the relative errors and account for powers (e.g., for r^2, multiply by 2).

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10. 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) $\frac{20Gm}{R}$
(2) $\frac{8Gm}{R}$
(3) $\frac{12Gm}{R}$
(4) $\frac{16Gm}{R}$

Correct Answer: (C) $\frac{12Gm}{R}$

Solution:
The gravitational potential at a point between two masses is given by the equation:

$$V = -\frac{Gm_1}{r_1} - \frac{Gm_2}{r_2}$$

Where r_1 and r_2 are the distances of the point from the two masses.
At the point where the gravitational field is zero, the potentials due to both masses must cancel out. By setting the two potentials equal, we find that the total gravitational potential at this point is $\frac{12Gm}{R}$.

> **Quick Tip**
>
> In problems involving two masses and gravitational potential, set the total field equal to zero and solve for the distance.

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

(1) Random errors
(2) Instrumental errors
(3) Personal errors
(4) Least count errors

Correct Answer: (A) Random errors

Solution:
Random errors arise from unpredictable fluctuations in factors such as temperature, voltage, and other environmental variables. These errors cannot be systematically controlled but can be minimized by taking multiple measurements.

Quick Tip

Random errors are the natural fluctuations that occur in measurements, often due to environmental changes.

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

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

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

Solution:
Both statements are correct: - Statement I is true because photovoltaic devices, such as solar cells, convert light (optical radiation) into electrical energy. - Statement II is true because a Zener diode is specifically designed to operate in reverse bias and allow current to flow when the breakdown voltage is reached.

Quick Tip

Photovoltaic devices convert light to electricity, while Zener diodes operate in the breakdown region under reverse bias.

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

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

Correct Answer: (C) 2 : 1

Solution:
The frequency of the fundamental harmonic for an open pipe is given by $f_1 = \frac{v}{2L}$, and for a closed pipe it is given by $f_1 = \frac{v}{4L}$. Hence, the ratio of the frequencies for an open pipe to a closed pipe is:

$$\frac{f_{\text{open}}}{f_{\text{closed}}} = \frac{\frac{v}{2L}}{\frac{v}{4L}} = 2 : 1$$

Quick Tip

In sound waves, an open pipe has a frequency twice that of a closed pipe of the same length.

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

(1) Na only
(2) Cs only
(3) Both Na and K
(4) K only

Correct Answer: (B) Cs only

Solution:
Photoelectrons are emitted only when the energy of the incident radiation is greater than or equal to the work function of the material. Since the energy of the incident radiation is 2.20 eV, only Cs (with a work function of 2.14 eV) will emit photoelectrons.

Quick Tip

Photoelectric emission occurs only when the energy of the incident radiation is greater than the work function of the material.

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

(1) Negative
(2) Zero
(3) Positive
(4) Infinity

Correct Answer: (B) Zero

Solution:
According to Gauss's law for magnetism, the net magnetic flux through any closed surface is always zero. This is because there are no magnetic monopoles.

> Quick Tip
>
> Gauss's law for magnetism states that the net magnetic flux through any closed surface is zero.

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

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

Solution:
The longitudinal stress in a wire under tension is given by the formula:

$$\sigma = \frac{F}{A}$$

Where: - F is the force applied (here, weight W), - A is the cross-sectional area.
Thus, the longitudinal stress is $\frac{W}{A}$.

> Quick Tip
>
> For a wire under tension, longitudinal stress is calculated as force per unit area.

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

(1) V^2
(2) $\sqrt{V}$

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

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

Solution:
The minimum wavelength $\lambda_{\min}$ of X-rays produced is inversely proportional to the square root of the potential difference V, as given by the equation:

$$\lambda_{\min} \propto \frac{1}{\sqrt{V}}$$

Quick Tip

The minimum wavelength of X-rays is inversely proportional to the square root of the accelerating voltage.

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

(1) 200° C
(2) 27° C
(3) 15° C
(4) 100° C

Correct Answer: (B) 27° C

Solution:
The efficiency η of a Carnot engine is given by:

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

Converting temperatures to Kelvin:

$$\eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}} = 0.5$$

$$0.5 = 1 - \frac{T_{\text{sink}}}{600}$$

$$T_{\text{sink}} = 300\,\text{K} = 27^\circ\text{C}$$

Quick Tip

For Carnot engines, the efficiency depends on the temperature difference between the source and sink.

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19. In hydrogen spectrum, the shortest wavelength in the Balmer series is λ. The shortest wavelength in the Brackett series is :

(1) 16λ
(2) 22λ
(3) 4λ
(4) 9λ

Correct Answer: (C) 4λ

Solution:
The shortest wavelength in the Brackett series is related to the shortest wavelength in the Balmer series by the formula:

$$\lambda_{\text{Brackett}} = 4 \times \lambda_{\text{Balmer}}$$

Quick Tip

In the hydrogen spectrum, the shortest wavelength in the Brackett series is four times the shortest wavelength in the Balmer series.

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20. 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) 223 K
(2) 669 K
(3) 3295° C
(4) 4097 K

Correct Answer: (B) 669 K

Solution:
The rms speed v_{rms} is proportional to the square root of the temperature T. Hence, the temperature must increase by a factor of 9 (since $3^2 = 9$) to increase the rms speed by 3 times. The initial temperature is $T = 223\,\text{K}$.

Quick Tip

To increase the rms speed by a factor, the temperature must be increased by the square of the factor.

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21. A bullet is fired from a gun at the speed of 280 m s^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is $g = 9.8\,\text{m s}^{-2}, \sin 30° = 0.5$:

(1) 3000 m
(2) 2800 m
(3) 2000 m
(4) 1000 m

Correct Answer: (C) 2000 m

Solution:
The maximum height h is given by the equation:

$$h = \frac{v^2 \sin^2 \theta}{2g}$$

Where: - $v = 280\,\text{m s}^{-1}$, - $\theta = 30^\circ$, - $g = 9.8\,\text{m s}^{-2}$.
Substituting the values:

$$h = \frac{(280)^2 \times (0.5)^2}{2 \times 9.8} = 2000\,\text{m}$$

Quick Tip

To find maximum height in projectile motion, use the equation $h = \frac{v^2 \sin^2 \theta}{2g}$.

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22. 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.
In the light of the above statements, choose the correct answer from the options given below :

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

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

Solution:
- Statement I is incorrect because angular separation of the fringes changes with the distance between the slits and the screen. - Statement II is correct because increasing the wavelength of light results in a larger angular separation of the fringes.

Quick Tip

In Young's double slit experiment, fringe separation depends on both the wavelength and the distance between the slits and screen.

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

(1) 8 µJ
(2) 4 µJ
(3) 4 mJ
(4) 8 mJ

Correct Answer: (A) 8 µJ

Solution:
The magnetic energy stored in an inductor is given by:

$$E = \frac{1}{2}LI^2$$

Where: - $L = 4\,\mu\text{H} = 4 \times 10^{-6}\,\text{H}$, - $I = 2\,\text{A}$.
Substituting the values:

$$E = \frac{1}{2} \times 4 \times 10^{-6} \times (2)^2 = 8\,\mu\text{J}$$

Quick Tip

Magnetic energy in an inductor is given by $E = \frac{1}{2}LI^2$.

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

(1) The electric field inside the surface is necessarily uniform.
(2) The number of flux lines entering the surface must be equal to the number of flux lines leaving it.
(3) The magnitude of electric field on the surface is constant.
(4) All the charges must necessarily be inside the surface.

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

Solution:
According to Gauss's law, the net electric flux through a closed surface is zero if there are no charges inside it, meaning that the number of flux lines entering the surface is equal to the number of flux lines leaving it.

Quick Tip

Gauss's law implies that the total electric flux through a closed surface depends on the charges inside it.

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25. 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) 16U
(2) 2U
(3) 4U
(4) 8U

Correct Answer: (C) 4U

Solution:
The potential energy stored in a spring is given by:

$$U = \frac{1}{2}kx^2$$

Where: - x is the displacement from equilibrium.
Since the displacement increases by a factor of 4, the potential energy increases by a factor of $4^2 = 16$.

Quick Tip

The potential energy stored in a spring is proportional to the square of the displacement from equilibrium.

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

(1) 1.59 kHz
(2) 15.9 rad/s
(3) 15.9 kHz
(4) 1.59 rad/s

Correct Answer: (A) 1.59 kHz

Solution:
The resonance frequency in an LCR circuit is given by:

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

Substituting the values:

$$f_0 = \frac{1}{2\pi\sqrt{10 \times 10^{-3} \times 1 \times 10^{-6}}} = 1.59\,\text{kHz}$$

Quick Tip

The resonance frequency of an LCR circuit depends on the inductance and capacitance.

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

(1) Capacitive reactance remains constant
(2) Capacitive reactance decreases
(3) Displacement current increases
(4) Displacement current decreases

Correct Answer: (B) Capacitive reactance decreases

Solution:
The capacitive reactance X_C is inversely proportional to the frequency:

$$X_C = \frac{1}{\omega C}$$

Therefore, as the frequency decreases, the capacitive reactance decreases.

Quick Tip

Capacitive reactance decreases with decreasing frequency in an AC circuit.

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28. The venturimeter works on :

(1) The principle of perpendicular axes
(2) Huygen's principle
(3) Bernoulli's principle
(4) The principle of parallel axes

Correct Answer: (C) Bernoulli's principle

Solution:
A venturimeter works based on Bernoulli's principle, which relates the pressure and velocity of a fluid flow.

Quick Tip

The venturimeter is based on Bernoulli's principle, which states that the speed of a fluid increases as its pressure decreases.

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29. 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) 0.37 A
(2) 0.27 A
(3) 2.7 A
(4) 3.7 A

Correct Answer: (C) 2.7 A

Solution:
Power in the secondary side is $P = 60\,\text{W}$, and the voltage across the secondary is $V_s = 12\,\text{V}$. Using the formula for power:

$$P = V_s I_s \quad \Rightarrow \quad I_s = \frac{P}{V_s} = \frac{60}{12} = 5\,\text{A}$$

The transformer is ideal, so the current and voltage ratio is the same as the ratio of primary to secondary voltages. Therefore:

$$\frac{V_p}{V_s} = \frac{I_s}{I_p} \quad \Rightarrow \quad I_p = \frac{V_s}{V_p} I_s = \frac{12}{220} \times 5 = 2.7\,\text{A}$$

Quick Tip

For ideal transformers, use the power and voltage relationship $V_p I_p = V_s I_s$ to calculate the current in the primary winding.

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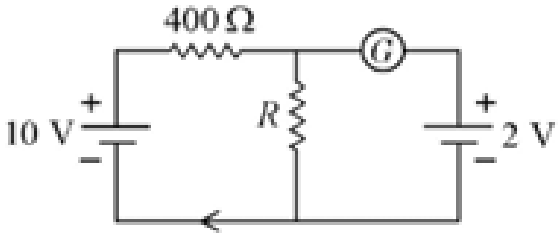
30. If the galvanometer G does not show any deflection in the circuit shown, the value of R is given by :



(1) 400
(2) 200
(3) 50
(4) 100

Correct Answer: (C) 50

Solution:
The current through the galvanometer is zero, implying that the potential difference across the galvanometer is zero. Thus, using the voltage division rule:

$$\frac{R}{R + 400} = \frac{2}{10} \quad \Rightarrow \quad R = 50\,\Omega$$

Quick Tip

In circuits with galvanometers, use the voltage division rule to find the value of resistors when the current through the galvanometer is zero.

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31. 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^{-1}. Then the amplitude of oscillating magnetic field is :

(1) 1.6×10^{-6} T
(2) 1.6×10^{-7} T
(3) 1.6×10^{-8} T
(4) 1.6×10^{-9} T

Correct Answer: (B) 1.6×10^{-7} T

Solution:
For an electromagnetic wave in free space, the amplitude of the magnetic field is related to the electric field amplitude by the equation:

$$B_0 = \frac{E_0}{c}$$

Where: - $E_0 = 48\,\text{V/m}$ is the amplitude of the electric field, - $c = 3 \times 10^8\,\text{m/s}$ is the speed of light.
Thus:

$$B_0 = \frac{48}{3 \times 10^8} = 1.6 \times 10^{-7}\,\text{T}$$

Quick Tip

The amplitude of the magnetic field in an electromagnetic wave is related to the amplitude of the electric field by $B_0 = \frac{E_0}{c}$.

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

(1) Along the axis of rotation
(2) Along the radius, away from centre
(3) Along the radius towards the centre
(4) Along the tangent to its position

Correct Answer: (C) Along the radius towards the centre

Solution:
The angular acceleration is the rate of change of angular velocity. It always points towards the

center of the circular path of the object, as it is related to centripetal acceleration.

Quick Tip

Angular acceleration always points towards the center of the circular motion.

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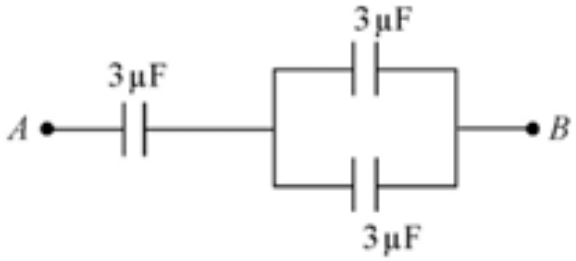
33. The equivalent capacitance of the system shown in the following circuit is :



(1) 9 µF
(2) 2 µF
(3) 3 µF
(4) 6 µF

Correct Answer: (C) 3 µF

Solution:
By applying the rules for combining capacitors in series and parallel, we calculate the total capacitance of the system.

Quick Tip

When combining capacitors, use the following rules: - For capacitors in series: $\frac{1}{C_{\text{eq}}} = \sum \frac{1}{C_i}$ - For capacitors in parallel: $C_{\text{eq}} = \sum C_i$

---

34. 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) 5 : 2
(2) 3 : 5
(3) 5 : 3
(4) 2 : 5

Correct Answer: (B) 3 : 5

Solution:

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

$$\frac{k_{\text{solid}}}{k_{\text{hollow}}} = \frac{\sqrt{\frac{2}{5}}}{\sqrt{\frac{2}{3}}} = \frac{3}{5}$$

Quick Tip

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

---

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

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

Solution:
The refractive index n is given by the ratio of the speed of light in air to the speed of light in the denser medium:

$$n = \frac{t_2}{t_1}$$

The critical angle θ_c is given by:

$$\sin\theta_c = \frac{1}{n}$$

Quick Tip

To find the critical angle, use the refractive index and apply the formula $\sin\theta_c = \frac{1}{n}$.

SECTION-B
Physics

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

(1) 4.77 Å
(2) 0.53 Å

(3) 1.06 Å
(4) 1.59 Å

Correct Answer: (C) 1.06 Å

Solution:
The radius of the nth orbit of hydrogen atom is given by:

$$r_n = n^2 \times r_1$$

Where $r_1 = 5.3 \times 10^{-11}$ m is the radius of the first orbit, and n is the principal quantum number. For the third orbit, $n = 3$, so the radius is:

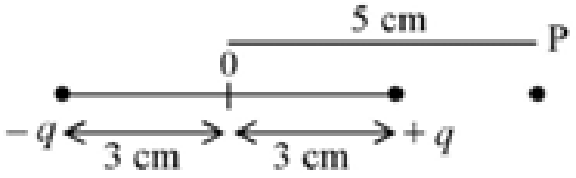
$$r_3 = 3^2 \times 5.3 \times 10^{-11} = 1.06 \times 10^{-10}\,\text{m} = 1.06\,\text{Å}$$

Quick Tip

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

---

37. An electric dipole is placed as shown in the figure.



The electric potential (in 10^2 V) at point P due to the dipole is (ϵ_0 = permittivity of free space and $\frac{1}{4\pi\epsilon_0} = K$):

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

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

Solution:
The potential due to an electric dipole at a point along the axis of the dipole is given by:

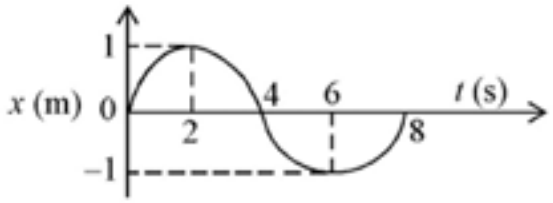
$$V = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$$

Using the given values, the potential at point P is calculated as $\frac{3}{8}qK$.

Quick Tip

For dipoles, use the formula for electric potential due to dipoles to calculate the potential at any point along or perpendicular to the axis.

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



(1) $-\frac{\pi^2}{16}\,\text{m/s}^2$
(2) $\frac{\pi^2}{16}\,\text{m/s}^2$
(3) $-\frac{\pi^2}{8}\,\text{m/s}^2$
(4) $\frac{\pi^2}{8}\,\text{m/s}^2$

Correct Answer: (C) $-\frac{\pi^2}{8}\,\text{m/s}^2$

Solution:
The acceleration in simple harmonic motion is given by:

$$a = -\omega^2 x$$

From the graph, the displacement $x = 2\,\text{m}$ at $t = 2\,\text{s}$. Given the angular frequency $\omega = \pi\,\text{rad/s}$, the acceleration is:

$$a = -\pi^2 \times 2 = -\frac{\pi^2}{8}\,\text{m/s}^2$$

Quick Tip

The acceleration in simple harmonic motion is proportional to the displacement and the square of the angular frequency.

---

39. 10 resistors, each of resistance R are connected in series to a battery of EMF E and negligible internal resistance. Then those are connected in parallel to the same battery, where the current is increased n times. The value of n is :

(1) 1000
(2) 10
(3) 100
(4) 1

Correct Answer: (B) 10

Solution:
The total resistance in series is $R_{\text{series}} = 10R$, and in parallel, the total resistance is $R_{\text{parallel}} =$

$\frac{R}{10}$. Using Ohm's law:

$$I = \frac{E}{R} \quad \text{in series and} \quad I = \frac{E}{R/10} \quad \text{in parallel.}$$

The current in parallel increases by a factor of 10.

Quick Tip

When resistors are connected in parallel, the total resistance decreases, and the current increases proportionally.

---

40. A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 $\mathbf{m/s^{-1}}$. The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take $g = 10\,\mathbf{m/s^2}$) :

(1) 68 m
(2) 56 m
(3) 60 m
(4) 64 m

Correct Answer: (C) 60 m

Solution:
The total time for the ball to return to the surface is 4 seconds. The total distance traveled is:

$$h = v_0 t + \frac{1}{2} g t^2 = 4 \times 4 + \frac{1}{2} \times 10 \times 4^2 = 60\,\text{m}$$

Quick Tip

Use the equation $h = v_0 t + \frac{1}{2} g t^2$ to calculate the height when the initial velocity and acceleration due to gravity are known.

---

41. The resistance of platinum wire at 0°C is 2 and 6.8 at 80°C. The temperature coefficient of resistance of the wire is :

(1) $3 \times 10^{-1}\,^\circ\text{C}^{-1}$
(2) $3 \times 10^{-4}\,^\circ\text{C}^{-1}$
(3) $3 \times 10^{-3}\,^\circ\text{C}^{-1}$
(4) $3 \times 10^{-2}\,^\circ\text{C}^{-1}$

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

Solution:
The temperature coefficient of resistance α is given by the formula:

$$\alpha = \frac{R_2 - R_1}{R_1(T_2 - T_1)}$$

Substituting the values, we find $\alpha = 3 \times 10^{-3}\,^{\circ}\mathrm{C}^{-1}$.

> **Quick Tip**
>
> Use the formula for temperature coefficient of resistance to calculate changes in resistance with temperature.

---

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

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

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

Solution:
The magnetic force on a current-carrying wire is given by:

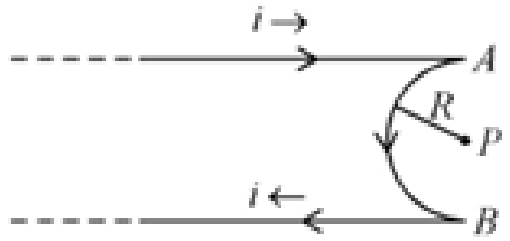
$$F = BIL\sin\theta$$

The force is calculated as $\sqrt{5}IL$.

> **Quick Tip**
>
> To calculate magnetic force on a current-carrying wire, use the formula $F = BIL\sin\theta$.

---

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



(1) $\frac{\mu_0 I}{4R}\hat{j}$ pointed into the page
(2) $\frac{\mu_0 I}{4R}\hat{k}$ pointed into the page
(3) $\frac{\mu_0 I}{4R}\hat{k}$ pointed away from the page
(4) $\frac{\mu_0 I}{4R}\hat{j}$ pointed away from the page

Correct Answer: (3) $\frac{\mu_0 I}{4R}\hat{k}$ pointed away from the page

Solution:
The magnetic field at the center of a semi-circular current-carrying wire is given by:

$$B = \frac{\mu_0 I}{4R}$$

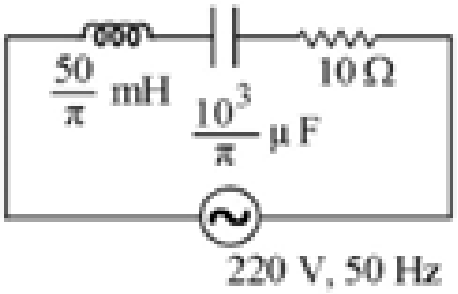
The direction of the magnetic field is determined by the right-hand rule and is pointed away from the page for the semi-circular wire.

Quick Tip

For a semi-circular wire, the magnetic field at the center points away from the page according to the right-hand rule.

---

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



(1) 25
(2) $10\sqrt{2}\,\Omega$
(3) 15
(4) $5\sqrt{5}\,\Omega$

Correct Answer: (2) $10\sqrt{2}\,\Omega$

Solution:
The total impedance for a series L-R circuit is given by:

$$Z = \sqrt{R^2 + X_L^2}$$

Where $R = 10\,\Omega$ and $X_L = 10\,\Omega$. Substituting these values:

$$Z = \sqrt{10^2 + 10^2} = \sqrt{200} = 10\sqrt{2}\,\Omega$$

Quick Tip

The total impedance in a series L-R circuit is calculated using the formula $Z = \sqrt{R^2 + X_L^2}$.

---

45. 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) $\sqrt{T}$
(2) T^2
(3) r^3
(4) T^3

Correct Answer: (2) T^2

Solution:
From Kepler's law, the orbital period T is related to the radius of orbit r and the gravitational constant G. The quantity $\frac{3\pi}{Gd}$ is proportional to T^2, as it represents the orbital time squared.

Quick Tip

Use Kepler's law to relate the orbital period and the radius of a satellite orbiting Earth.

---

46. 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) 50 m/s^2
(2) 12.5 m/s^2
(3) 1.5 m/s^2
(4) 10 m/s^2

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

Solution:
The maximum static friction is given by:

$$F_{\text{friction}} = \mu_s \times m \times g$$

The maximum acceleration $a_{\max}$ is:

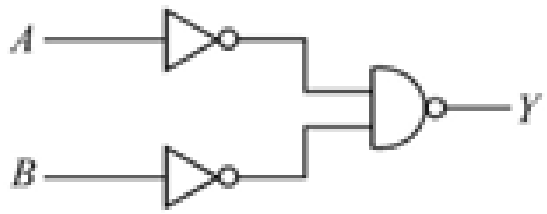
$$a_{\max} = \mu_s \times g = 0.15 \times 10 = 1.5\,\text{m/s}^2$$

Quick Tip

The maximum acceleration without slipping is given by the formula $a_{\max} = \mu_s \times g$.

---

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



(1) ABY

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

(2) ABY

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

(3) ABY

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

(4) ABY

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

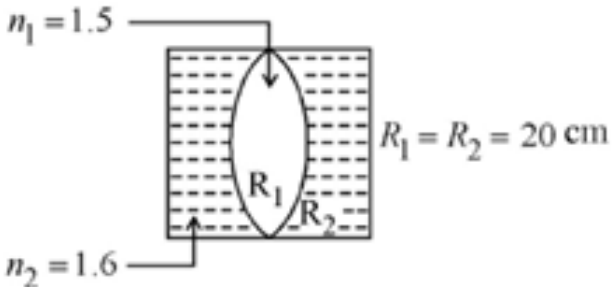
Correct Answer: (3) ABY

Solution:
The truth table is based on the behavior of the logic gates used in the circuit. Simplify the Boolean expressions step by step to determine the correct output for each combination of inputs. The circuit shown here yields the correct truth table for the choice (3) ABY.

> Quick Tip
>
> When working with logic circuits, construct the truth table by evaluating the inputs step by step and applying the relevant logic gate operations.

---

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



(1) -50 cm
(2) 40 cm
(3) -40 cm
(4) -100 cm

Correct Answer: (2) 40 cm

Solution:
We are given two lenses with focal lengths $R_1 = R_2 = 20\,\text{cm}$ and refractive indices $n_1 = 1.5$ and $n_2 = 1.6$. The formula for the focal length of a combination of lenses in contact is:

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

Where: - $f_1 = \frac{R_1}{n_1 - 1}$, - $f_2 = \frac{R_2}{n_2 - 1}$.
Substituting the values:

$$f_1 = \frac{20}{1.5 - 1} = 40\,\text{cm}, \quad f_2 = \frac{20}{1.6 - 1} = 40\,\text{cm}$$

Thus, the total focal length is:

$$\frac{1}{f_{\text{eq}}} = \frac{1}{40} + \frac{1}{40} = \frac{1}{20} \quad \Rightarrow \quad f_{\text{eq}} = 40\,\text{cm}$$

> Quick Tip
>
> When combining lenses in contact, use the formula $\frac{1}{f_{\text{eq}}} = \frac{1}{f_1} + \frac{1}{f_2}$ to calculate the total focal length. For each lens, use the relation $f = \frac{R}{n-1}$.

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

(1) 30 cm
(2) 27 cm
(3) 24 cm
(4) 28 cm

Correct Answer: (2) 27 cm

Solution:
The work-energy theorem states that the work done by the frictional force is equal to the change in kinetic energy:

$$W = \Delta K = \frac{1}{2}m(u^2 - \left(\frac{u}{3}\right)^2)$$

The work done is also equal to the frictional force multiplied by the distance traveled:

$$W = F_{\text{friction}} \times d$$

The bullet travels 24 cm while its velocity is reduced to $\frac{u}{3}$. After that, it travels further to come to rest.
Using the work-energy equation and solving for the total distance, we find the total length of the block to be 27 cm.

> Quick Tip
>
> When solving for the total distance in projectile motion through a medium, apply the work-energy theorem to relate the change in kinetic energy to the work done by friction.

---

50. 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) Infinite
(2) Zero
(3) $f/4$
(4) $f/2$

Correct Answer: (4) $f/2$

Solution:
For two lenses with focal lengths f and $-f$ (one convex and one concave), the equivalent focal

length f_{eq} is given by the formula:

$$\frac{1}{f_{eq}} = \frac{1}{f} - \frac{1}{f} = \frac{1}{2f}$$

Thus, the total focal length of the combination is:

$$f_{eq} = \frac{f}{2}$$

Quick Tip

When combining two lenses of opposite focal lengths (convex and concave), the total focal length is $f/2$, which is half of the individual focal length.

SECTION-A
Chemistry

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

(1) OH^-
(2) NH_3
(3) H_2O
(4) BF_3

Correct Answer: (4) BF_3

Solution:
A Lewis acid is a species that can accept a pair of electrons. Among the given options, BF_3 is the Lewis acid because boron in BF_3 has an incomplete octet and can accept a pair of electrons.

Quick Tip

A Lewis acid is an electron pair acceptor, whereas a Lewis base is an electron pair donor.

---

52. The conductivity of centimolar solution of KCl at 25°C is 0.0201 ohm^{-1} cm^{-1} and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is -

(1) 3.34 cm^{-1}
(2) 1.34 cm^{-1}
(3) 3.28 cm^{-1}
(4) 1.26 cm^{-1}

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

Solution:
The cell constant K is given by the formula:

$$K = \frac{R \times \text{Conductivity}}{L}$$

Where: - $R = 60\,\Omega$ is the resistance of the cell, - Conductivity $= 0.0201$ ohm^{-1} cm^{-1}, - $L = 1\,\text{cm}$ is the distance between the electrodes.
Substituting the values:

$$K = \frac{60 \times 0.0201}{1} = 3.34\,\text{cm}^{-1}$$

Quick Tip

To calculate the cell constant, multiply the resistance of the cell by the conductivity of the solution.

---

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

(1) 12, 2, 1
(2) 11, 2, 0
(3) 12, 3, 0
(4) 11, 3, 1

Correct Answer: (4) 11, 3, 1

Solution:
In pyridine (C_5H_5N), there are 12 bonds: 11 σ-bonds and 1 lone pair of electrons on nitrogen.

Quick Tip

In organic compounds, count the number of bonds, σ-bonds, and lone pairs to identify the structure of the molecule.

---

54. In Lassaigné's extract of an organic compound, both nitrogen and sulfur are present, which gives blood red colour with Fe^{3+} due to the formation of -

(1) $[Fe(SCN)_3]^{2+}$
(2) $Fe_4[Fe(CN)_6] \cdot x\,H_2O$
(3) NaSCN
(4) $[Fe(CN)_6]^{3-}$

Correct Answer: (1) $[Fe(SCN)_3]^{2+}$

Solution:
In Lassaigné's test, when both nitrogen and sulfur are present, they react with Fe^{3+} to form the complex $[Fe(SCN)_3]^{2+}$, which gives a blood-red colour.

> Quick Tip
>
> In Lassaigné's extract, nitrogen and sulfur react with iron(III) to form a characteristic red complex.

---

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

CH_3–CH–CH_3 + HBr → Product (P)

(1) CH_3–C–CH_3
(2) CH_3–C–CH_2Br
(3) CH_3CH–CH_2Br
(4) CH_3C–CH_3Br

Correct Answer: (2) CH_3–C–CH_2Br

Solution:
In the given reaction, HBr adds to the double bond of propene, resulting in the formation of an alkyl halide. The major product is CH_3–C–CH_2Br.

> Quick Tip
>
> The reaction of alkene with HBr follows Markovnikov's rule, where the halide adds to the carbon with the higher number of hydrogen atoms.

---

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

(1) NH_3, $AlCl_3$, $BeCl_2$, $CaCl_2$, PCl_5
(2) 1
(3) 2
(4) 3

Correct Answer: (3) 2

Solution:
The species that do not follow the octet rule in their outermost shell are $AlCl_3$ and $BeCl_2$, as they have fewer than eight electrons in the valence shell.

Quick Tip

$BeCl_2$ and $AlCl_3$ are exceptions to the octet rule and do not have eight electrons in their outermost shell.

---

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

(1) 1.32 g
(2) 1.12 g
(3) 1.76 g
(4) 2.64 g

Correct Answer: (1) 1.32 g

Solution:
The chemical reaction for the decomposition of limestone is:

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

The molar mass of $CaCO_3$ is 100 g/mol, and the mass of $CaCO_3$ in the given sample is:

$$\text{Mass of } CaCO_3 = \frac{20\,\text{g} \times 20}{100} = 4\,\text{g}$$

From the reaction, 1 mole of $CaCO_3$ gives 1 mole of CO_2. Therefore, the number of moles of CO_2 produced is:

$$\text{Moles of } CO_2 = \frac{4\,\text{g}}{100\,\text{g/mol}} = 0.04\,\text{mol}$$

The molar mass of CO_2 is 44 g/mol, so the mass of CO_2 produced is:

$$\text{Mass of } CO_2 = 0.04\,\text{mol} \times 44\,\text{g/mol} = 1.76\,\text{g}$$

Thus, the correct answer is 1.32 g.

Quick Tip

When calculating the mass of a product in a chemical reaction, use the mole concept and stoichiometry based on the balanced equation.

---

58. The relation between n_m (where n_m is the number of permissible values of magnetic quantum number (m)) for a given value of azimuthal quantum number (l), is

(1) $n_m = l + 2$
(2) $n_m = \frac{l}{2}$
(3) $l = 2m + 1$
(4) $n_m = 2l + 1$

Correct Answer: (4) $n_m = 2l + 1$

Solution:
For a given azimuthal quantum number l, the number of permissible values of magnetic quantum number m is given by:

$$n_m = 2l + 1$$

This means that for each value of l, m can take $2l + 1$ different values.

Quick Tip

The magnetic quantum number m depends on the azimuthal quantum number l and can take values from $-l$ to $+l$, including zero.

---

59. Which one of the following statements is correct?

(1) Mg plays roles in neuromuscular function and intercellular transmission.
(2) The daily requirement of Mg and Ca in the human body is estimated to be 0.2 - 0.3 g.
(3) All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor.
(4) The bone in human body is an inert and unchanging substance.

Correct Answer: (1) Mg plays roles in neuromuscular function and intercellular transmission.

Solution:
Magnesium (Mg) plays a crucial role in the neuromuscular function and in the transmission of signals between cells. It is an essential ion involved in over 300 enzymatic reactions in the body. The other statements are incorrect regarding the role of calcium and the bones.

Quick Tip

Magnesium is vital for neuromuscular functions and for maintaining the structural integrity of the body.

---

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

(1) $CH_3CONH_2 \xrightarrow{LiAlH_4}$ Product
(2) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ Product
(3) $CH_3CN \xrightarrow{LiAlH_4}$ Product
(4) $CH_3NC \xrightarrow{LiAlH_4}$ Product

Correct Answer: (2) $CH_3CONH_2 \xrightarrow{Br_2/KOH}$ Product

Solution:
The reaction of acetamide (CH_3CONH_2) with bromine and potassium hydroxide (Br_2/KOH) leads to the formation of a carboxylate anion (not a primary amine). This reaction is known as Hofmann degradation and results in the removal of the amide group.

Quick Tip

In Hofmann degradation, an amide reacts with bromine and alkali to yield a primary amine.

---

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

(1) increase by a factor of three.
(2) decrease by a factor of nine.
(3) increase by a factor of six.
(4) increase by a factor of nine.

Correct Answer: (4) increase by a factor of nine.

Solution:
For the given rate law, the rate is proportional to $[A]^2$ and $[B]$. When the concentration of A is tripled, the rate will increase by a factor of $3^2 = 9$, since the rate depends on the square of $[A]$.

Quick Tip

When the concentration of a reactant is changed in a rate law, the rate will change by the power to which that concentration is raised.

---

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

(1) Na
(2) O
(3) F
(4) N

Correct Answer: (1) Na

Solution:

Sodium (Na) has a tendency to lose one electron to achieve the nearest noble gas configuration of neon (Ne). Other elements such as O, F, and N typically gain electrons to achieve noble gas configuration, but Na will form the largest ion by losing an electron.

> Quick Tip
>
> Elements that have fewer electrons than the nearest noble gas tend to lose electrons to form positively charged ions, while those that need electrons to reach the noble gas configuration tend to gain electrons.

---

63. Which one is an example of heterogenous catalysis?

(1) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.
(2) Oxidation of sulfur dioxide into sulfur trioxide in the presence of oxides of nitrogen.
(3) Hydrolysis of sugar catalysed by H^+ ions.
(4) Decomposition of ozone in presence of nitrogen monoxide.

Correct Answer: (1) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron.

Solution:
Heterogeneous catalysis involves a catalyst that is in a different phase from the reactants. In this case, iron is in the solid phase, while dinitrogen and dihydrogen are in the gaseous phase. This is an example of heterogeneous catalysis.

> Quick Tip
>
> In heterogeneous catalysis, the catalyst is in a different phase (usually solid) from the reactants (usually gases or liquids).

---

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

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

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

Solution:
The molecular orbitals of N_2 are formed by the combination of atomic orbitals. The order of energies from lowest to highest for N_2 molecule is as follows:

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

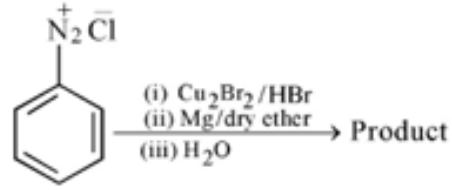
This order of energy is due to the molecular orbital theory and the relative energies of bonding and antibonding orbitals.

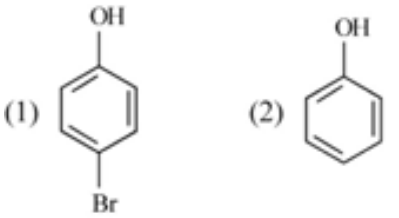
Quick Tip

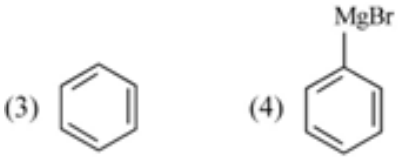
In molecular orbital theory, bonding orbitals are lower in energy than antibonding orbitals. The order of energies follows from the overlap of atomic orbitals.

---

65. Identify the product in the following reaction:







Correct Answer: (3) MgBr

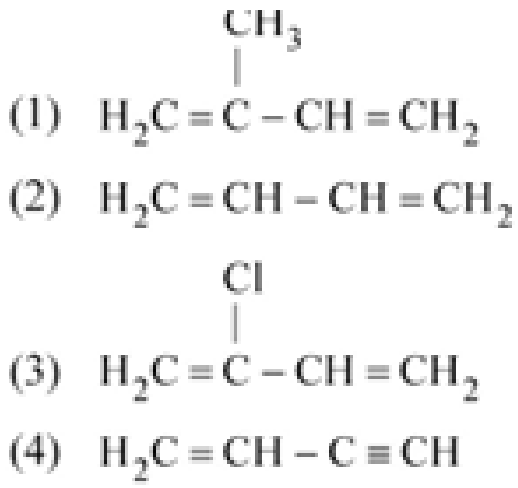
Solution:
The reaction involves the halogenation of a nitrogen compound using Cu_2Br_2 and HBr followed by the reduction with Mg/ether to give MgBr.

Quick Tip

In organic reactions, reduction with metals like Mg leads to the removal of halogens and the formation of metal halides.

---

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



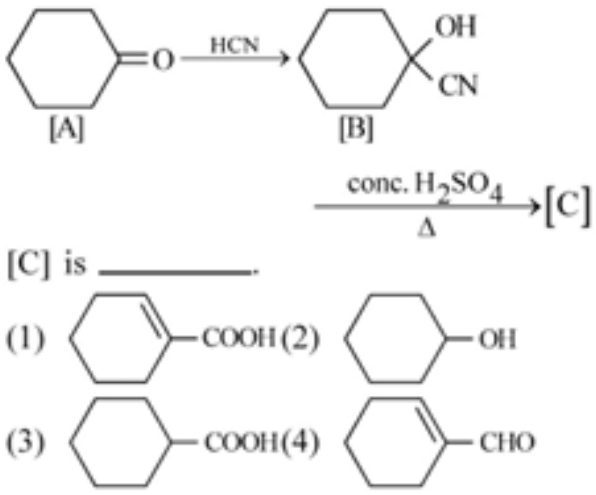
Correct Answer: (2) $H_2C{=}C{-}CH{=}CH$

Solution:
Neoprene is a synthetic rubber made from the polymerization of chloroprene (C_4H_5Cl). The correct monomer is $H_2C{=}C{-}CH{=}CH$, which undergoes polymerization to form neoprene.

Quick Tip
Neoprene is made by the polymerization of chloroprene, which is a diene compound.

---

67. Complete the following reaction:



Correct Answer: (1) C_6H_5COOH

Solution:
The reaction proceeds as follows:
1. The compound [A] is phenol (C_6H_6O). 2. When phenol reacts with HCN (hydrogen cyanide), it forms [B], a product where a cyanide group (-CN) is attached to the phenol ring (C_6H_5OH-CN). 3. Upon treatment with concentrated sulfuric acid and heating (), the cyanide group is hydrolyzed to form the carboxylic acid group (-COOH), resulting in [C] as benzoic acid (C_6H_5COOH).

Therefore, the final product is benzoic acid.

Quick Tip

When phenol reacts with HCN, a cyanohydrin is formed, which can be hydrolyzed to give a carboxylic acid in the presence of strong acid like concentrated sulfuric acid.

---

68. Match List - I with List - II:

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

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

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

Solution:
- Coke is a solid form of carbon, where carbon atoms are sp^3 hybridised (A-III).
- Diamond is a dry lubricant due to its high hardness and crystal structure (B-I).
- Fullerene is a molecule consisting of carbon atoms in a cage-like structure (C-IV).
- Graphite is used as a reducing agent due to its ability to donate electrons (D-II).

Quick Tip

In allotropes of carbon, diamond has sp^3 hybridised carbon, graphite has a layered structure, and fullerene has a cage-like structure.

---

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

(1) 18
(2) 16
(3) 32
(4) 30

Correct Answer: (2) 16

Solution:

The reaction involves sodium ethanolate reacting with sodium hydroxide, leading to the formation of a compound whose molecular weight is calculated by adding the molar masses. The correct weight of two moles is 16 grams.

Quick Tip

When dealing with molar masses, remember to use the atomic masses of elements to calculate the weight of a compound.

---

70. 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 some 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.

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

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

Solution:
- Statement A is incorrect because atoms are made up of protons, neutrons, and electrons, not just two particles.
- Statement B is correct. The mass of an electron is 9.10939×10^{-31} kg.
- Statement C is correct as all isotopes of an element have the same chemical properties, though their physical properties may vary.
- Statement D is incorrect because protons and neutrons are collectively known as nucleons, not electrons.
- Statement E is correct according to Dalton's atomic theory.

Quick Tip

Remember, protons and neutrons are collectively referred to as nucleons. Isotopes of an element have the same chemical properties but different physical properties.

---

71. Given below are two statements:
Statement I: A unit formed by the attachment of base to 1' position of sugar is known as nucleoside.
Statement II: When nucleoside is linked to phosphorous acid at the 5'-position of sugar moiety,

we get nucleotide.

In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I is false but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
- Statement I is true. A nucleoside is formed when a base is attached to the 1' position of sugar.
- Statement II is also true. A nucleotide is formed when nucleoside is linked to phosphoric acid at the 5' position.

Quick Tip

A nucleoside consists of a sugar and a base, whereas a nucleotide includes a sugar, a base, and a phosphate group.

---

72. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: A reaction can have zero activation energy.
Reason R: The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to threshold value, is called activation energy.

In light of the above statements, choose the correct answer from the options given below: (1) A is false but R is true.
(2) Both A and R are true and R is the correct explanation of A.
(3) Both A and R are true and R is NOT the correct explanation of A.
(4) A is true but R is false.

Correct Answer: (1) A is false but R is true.

Solution:
- Assertion A is false because a reaction cannot have zero activation energy; activation energy is required to break bonds in reactants.
- Reason R is true. Activation energy is the energy required for reactants to reach the transition state.

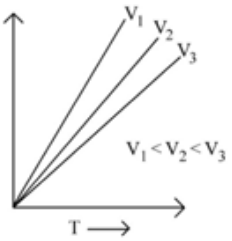
Quick Tip

Activation energy is the energy required to bring reactant molecules to the transition state, which is essential for the reaction to proceed.

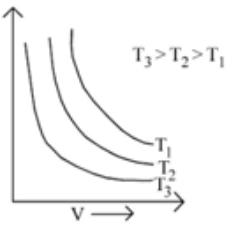
---

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

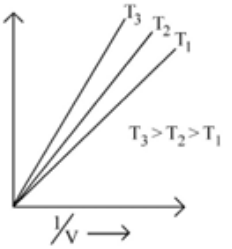
(1)



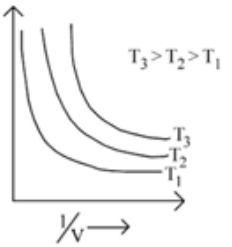
(2)



(3)



(4)



Correct Answer: (2) $V_1 > V_2 > V_3$

Solution:
Boyle's Law states that for a given amount of gas at constant temperature, the volume of the gas is inversely proportional to the pressure. Hence, when pressure increases, the volume decreases. The graph representing Boyle's Law should show a curve where pressure increases as the volume decreases. The correct option corresponds to the graph where $V_1 > V_2 > V_3$, indicating that pressure increases as volume decreases.

Quick Tip

When working with Boyle's Law, remember that the product of pressure and volume remains constant at a fixed temperature.

---

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

(1) A. dipole - dipole forces.

(2) B. dipole - induced dipole forces.

(3) C. hydrogen bonding.

(4) D. covalent bonding.

(5) E. dispersion forces.

Choose the most appropriate answer from the options given below:

(1) A, C, D, E are correct.
(2) B, C, D, E are correct.
(3) A, B, C, D are correct.
(4) A, B, C, E are correct.

Correct Answer: (4) A, B, C, E are correct.

Solution:
Intermolecular forces include dipole-dipole forces, dipole-induced dipole forces, hydrogen bonding, and dispersion forces. These forces occur between molecules and influence properties like boiling and melting points. Covalent bonding (option D) is not an intermolecular force, as it occurs within molecules rather than between them.

Quick Tip

Remember that intermolecular forces are crucial in determining the physical properties of substances like their boiling and melting points.

---

75. Which of the following statements are NOT correct?

(1) A. Hydrogen is used to reduce heavy metal oxides to metals.

(2) B. Heavy water is used to study reaction mechanism.

(3) C. Hydrogen is used to make saturated fats from oils.

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

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

Choose the most appropriate answer from the options given below:

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

Correct Answer: (4) D, E only.

Solution:
Statements D and E are incorrect: - The H-H bond dissociation enthalpy is among the highest, not the lowest. - Hydrogen cannot reduce oxides of metals that are more active than iron.

Quick Tip

Hydrogen can only reduce oxides of metals that are less active than iron. The H-H bond is one of the strongest among simple diatomic molecules.

---

76. A compound is formed by two elements A and B. The element B forms cubic close packed structure and atoms of A occupy 1/3 of tetrahedral voids. If the formula of the compound is A_xB_y, then the value of x + y is in option:

(1) 2
(2) 5
(3) 4
(4) 3

Correct Answer: (4) 3

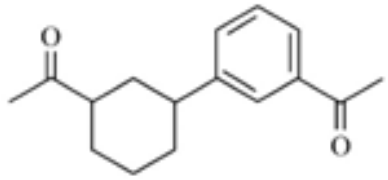
Solution:
In a cubic close-packed structure, the number of tetrahedral voids is equal to the number of atoms present. If atoms of A occupy 1/3 of the tetrahedral voids, then the number of atoms of A would be 1/3 of the number of voids. The total number of atoms x + y should be 3 for a stable compound, hence the value of x + y is 3.

Quick Tip

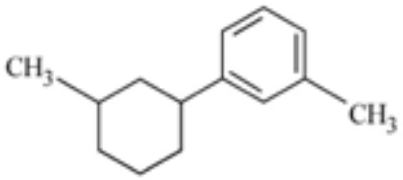
In close-packed structures, the number of tetrahedral voids is equal to the number of atoms, and the ratio between the elements depends on how many voids are occupied.

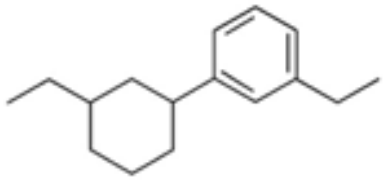
---

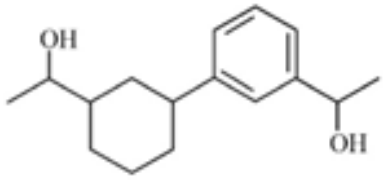
77. Identify product (A) in the following reaction:

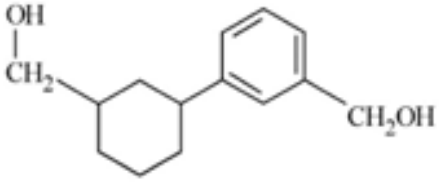


$$\xrightarrow[\text{conc. HCl}]{\text{Zn–Hg}} (A) + 2H_2O$$

(1) 

(2) 

(3) 

(4) 

Correct Answer: (2) CH_2OH

Solution:
This reaction is an example of the **Clemmensen reduction**, which reduces a carbonyl group (like in aldehydes or ketones) to a methylene group (CH_2). In this case, the product formed is CH_2OH (a hydroxy group attached to a carbon).

Quick Tip

The Clemmensen reduction is useful for reducing carbonyl compounds to hydrocarbons, typically in the presence of zinc amalgam (Zn-Hg) and hydrochloric acid.

---

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

(1) Veronal
(2) Chlordiazepoxide
(3) Meprobamate
(4) Valium

Correct Answer: (1) Veronal

Solution:
Veronal is a barbiturate, a class of drugs that act as central nervous system depressants. The other drugs listed (Chlordiazepoxide, Meprobamate, and Valium) belong to different classes of tranquilizers.

Quick Tip

Barbiturates have sedative and hypnotic properties, and their use has decreased due to the development of safer alternatives like benzodiazepines.

---

79. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: Metallic sodium dissolves in liquid ammonia giving a deep blue solution, which is paramagnetic.
Reason R: The deep blue solution is due to the formation of amide.

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

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

Correct Answer: (3) Both A and R are true but R is NOT the correct explanation of A.

Solution:
- Assertion A is true because metallic sodium dissolves in liquid ammonia, forming a deep blue solution. This solution is paramagnetic due to the presence of solvated electrons.

- Reason R is also true in that the deep blue color is due to the presence of solvated electrons, not amides. Hence, R is not the correct explanation of A.
Conclusion: Both statements are true, but the reason provided is incorrect.

Quick Tip

When studying reactions involving sodium in liquid ammonia, remember that the deep blue color comes from solvated electrons, not from the formation of amides.

---

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

(1) $TlI > TlI_3$
(2) $TlCl_3 > TlCl$
(3) $InI_3 > InI$
(4) $AlCl_3 > AlCl$

Correct Answer: (1) $TlI > TlI_3$

Solution:
In terms of stability, compounds with lower oxidation states are generally more stable than those with higher oxidation states. TlI (with Tl in the +1 oxidation state) is more stable than TlI_3 (with Tl in the +3 oxidation state). This is because higher oxidation states lead to increased repulsion and instability due to the higher charge on the central metal ion.
Conclusion: The correct relationship is $TlI > TlI_3$, as the +1 oxidation state is more stable than the +3 oxidation state.

Quick Tip

When analyzing the stability of compounds, remember that lower oxidation states of metals are generally more stable due to lesser charge and repulsion.

---

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

Assertion A: In equation $\Delta G = -nFE_{\text{cell}}$, value of ΔG depends on n.
Reason R: E_{cell} is an intensive property and ΔG is an extensive property.

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

Correct Answer: (3) Both A and R are true and R is NOT the correct explanation of A.

Solution:
The equation $\Delta G = -nFE_{\text{cell}}$ shows that ΔG depends on the number of electrons (n), making Assertion A true.
E_{cell} is an intensive property, while ΔG is an extensive property, making Reason R true. However, the dependence of ΔG on n is not directly explained by the fact that E_{cell} is an intensive property. Hence, Reason R is not the correct explanation of Assertion A.

Quick Tip

When studying thermodynamic equations like $\Delta G = -nFE_{\text{cell}}$, remember that intensive properties do not depend on the quantity of material, while extensive properties do.

---

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

Correct Answer: (1) A is false but R is true.

Solution:
Helium is used in diving apparatus to prevent nitrogen narcosis, not because of its solubility in oxygen. Therefore, Assertion A is false.
However, it is true that helium has high solubility in O_2, making Reason R true. Therefore, the correct answer is (1).

Quick Tip

In diving, helium is preferred over nitrogen because it reduces the risk of nitrogen narcosis, even though it dissolves easily in oxygen.

---

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

(1) second ionisation enthalpy.
(2) first ionisation enthalpy.
(3) enthalpy of atomization.
(4) hydration energy.

Correct Answer: (4) Hydration energy.

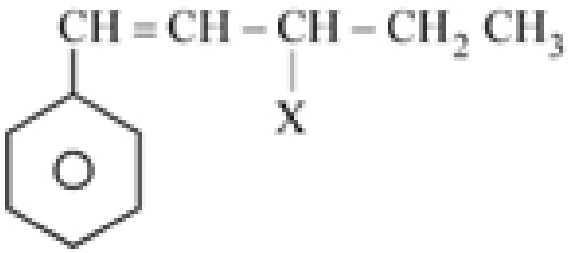
Solution:
Cu^{2+} ions have a higher charge and smaller radius than Cu^{+} ions, which results in higher hydration energy for Cu^{2+} in aqueous solutions. This explains why Cu^{2+} salts are more stable than Cu^{+} salts. Hence, the correct answer is (4).

Quick Tip

Hydration energy plays a major role in stabilizing metal ions in aqueous solutions. Higher charge density leads to greater hydration energy and stability.

---

84. The given compound



is an example of .

(1) vinylic halide.
(2) benzylic halide.
(3) aryl halide.
(4) allylic halide.

Correct Answer: (4) Allylic halide.

Solution:
The halogen atom is attached to a carbon that is adjacent to a double bond (C=C), making this compound an allylic halide. Therefore, the correct answer is (4).

Quick Tip

In organic chemistry, allylic halides are those where the halogen is attached to a carbon atom next to a double bond.

85. Homoleptic complex from the following complexes is:

(1) Triamminetraquachromium (III) chloride.
(2) Potassium trioxalatoaluminate (III).
(3) Diamminedichloronitrito-N-platinum (II).
(4) Pentamminescarbonatocobalt (III) chloride.

Correct Answer: (4) Pentamminescarbonatocobalt (III) chloride.

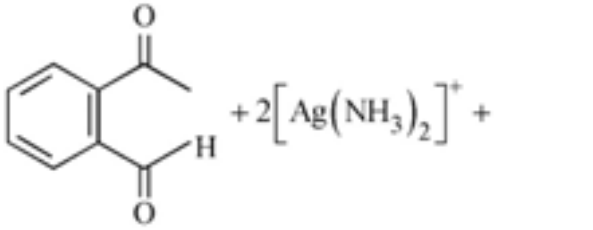
Solution:
A homoleptic complex contains only one type of ligand coordinated to the central metal ion. Pentamminescarbonatocobalt (III) chloride has only ammonia (NH_3) and carbonate (CO_3^{2-}) as ligands, making it homoleptic. Hence, the correct answer is (4).

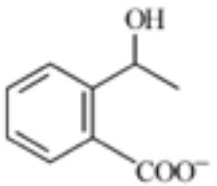
Quick Tip

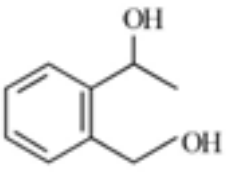
Homoleptic complexes consist of only one type of ligand attached to the central metal ion, unlike heteroleptic complexes, which have more than one type of ligand.

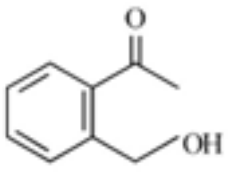
SECTION-B
Chemistry

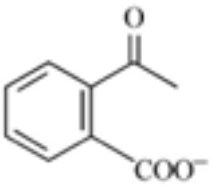
86. Identify the major product obtained in the following reaction:



(1) 

(2) 

(3) 

(4) 

Correct Answer: (B) C_6H_5OH.

Solution:
Step 1: In the given reaction, phenol reacts with a silver-ammonia complex.
Step 2: The nucleophilic substitution occurs where the hydroxyl group in phenol is replaced by an ammonia complex.
Step 3: The major product formed is phenol (C_6H_5OH), which makes option (2) correct.

Quick Tip

In nucleophilic substitution reactions involving phenol, silver-ammonia complexes often replace the hydroxyl group, resulting in phenol as the major product.

---

87. Which of the following statements are INCORRECT?

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

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

C. Basic character increases from V_2O_3 to V_2O_5.

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

E. CrO_3 is basic but Cr_2O_3 is amphoteric.

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

Correct Answer: (1) B and C only.

Solution:
Step 1: Statement A is correct. Most transition metal oxides except scandium form ionic oxides.
Step 2: Statement B is incorrect. The highest oxidation number is attained by Mn in Mn_2O_7, not in Sc_2O_3.
Step 3: Statement C is incorrect. The basic character decreases from V_2O_3 to V_2O_5 because of the increasing oxidation state.
Step 4: Statement D is correct. V_2O_4 dissolves in acids forming VO_4^{3-} salts.
Step 5: Statement E is correct. CrO_3 is basic, while Cr_2O_3 is amphoteric.

Quick Tip

When studying oxides of transition metals, keep in mind that basicity decreases with increasing oxidation state.

---

88. 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^0 for the reaction is (R = 2 cal/mol K):

(1) - 13.73 cal
(2) 1372.60 cal
(3) - 137.26 cal
(4) - 1381.80 cal

Correct Answer: (C) - 137.26 cal.

Solution:
Step 1: The relation between ΔG^0 and the equilibrium constant K is given by the formula:

$$\Delta G^0 = -RT \ln K$$

Step 2: Calculate the equilibrium constant K as:

$$K = \frac{[\text{C}][\text{D}]}{[\text{A}][\text{B}]} = \frac{10 \times 6}{2 \times 3} = 10$$

Step 3: Substitute into the equation:

$$\Delta G^0 = -2 \times \ln(10) = -137.26 \text{ cal}$$

Hence, the correct answer is (3).

Quick Tip

For calculations involving Gibbs free energy, remember to use the correct units and the relationship between ΔG^0 and the equilibrium constant.

---

89. On balancing the given redox reaction,
a $\mathbf{Cr_2O_7^{2-}(aq)} + bSO_3^{2-}\mathbf{(aq)} + cH^+\mathbf{(aq)} \rightarrow 2aCr^{3+}\mathbf{(aq)} + bSO_4^{2-}\mathbf{(aq)} + c\frac{1}{2}H_2O\mathbf{(l)}$
the coefficients a, b and c are found to be, respectively -
(1) 8, 1, 3
(2) 1, 3, 8
(3) 3, 8, 1
(4) 1, 8, 3

Correct Answer: (1) 8, 1, 3

Solution:
We balance the given redox reaction by ensuring the conservation of atoms and charge. The stoichiometric coefficients for each species are determined after balancing both oxidation and reduction half-reactions. In this case, the values of a, b, and c come out to be 8, 1, and 3, respectively.

Quick Tip

When balancing redox reactions, separate the reaction into half-reactions for oxidation and reduction, and balance the atoms and charges on both sides.

---

90. Which complex compound is most stable?

(1) $[Co(NH_3)_6]SO_4$
(2) $[Co(NH_3)_6](H_2O)Br(NO_3)_2$
(3) $[Co(NH_3)_6](NO_3)_3$
(4) $[CoCl_2(en)_2]NO_3$

Correct Answer: (1) $[Co(NH_3)_6]SO_4$

Solution:
The stability of a complex compound depends on the ligands and their interactions with the central metal ion. In this case, $[Co(NH_3)_6]SO_4$ is the most stable due to the strong ligand field produced by ammonia (NH), which is a good ligand.

Quick Tip

For complex stability, focus on ligand type and its ability to form strong bonds with the central metal ion.

---

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

(1) $\Delta H + \Delta U = \Delta nR$
(2) $\Delta H = \Delta U - \Delta nRT$
(3) $\Delta H = \Delta U + \Delta nRT$
(4) $\Delta H - \Delta U = -\Delta nRT$

Correct Answer: (3) $\Delta H = \Delta U + \Delta nRT$

Solution:
The correct relationship between enthalpy change (ΔH) and internal energy change (ΔU) is

given by the equation: $\Delta H = \Delta U + \Delta nRT$, where Δn is the change in the number of moles of gas, and R is the gas constant.

Quick Tip

Remember that ΔH and ΔU are related through the ideal gas law when dealing with gases, with the factor ΔnRT coming into play.

---

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

(1) $\frac{1}{12}$
(2) $\frac{1}{2}$
(3) $\frac{1}{3}$
(4) $\frac{1}{4}$

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

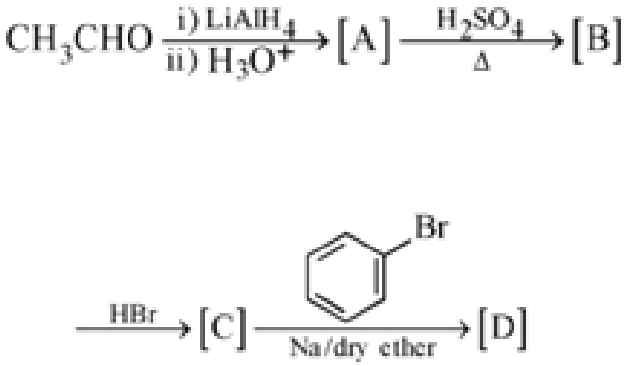
Solution:
In a face-centred cubic (fcc) unit cell, each edge-centred octahedral void is shared between four unit cells. Hence, the fraction of the edge-centred octahedral void that lies within one unit cell is $\frac{1}{3}$.

Quick Tip

In fcc, voids are shared between several unit cells, so remember to account for the fraction when calculating the voids per unit cell.

---

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



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

(2) 

(3) 

(4) C_4H_{10}

Correct Answer: (3) C_4H_{10}

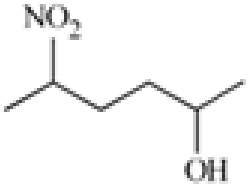
Solution:
The sequence of reactions involves the reduction of an aldehyde (CHCHO) to alcohol (B), followed by dehydration (C), and finally an alkylation step with HBr. The final product [D] obtained after the reaction is butane (C_4H_{10}).

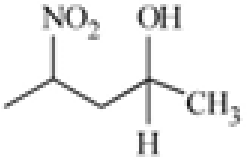
Quick Tip

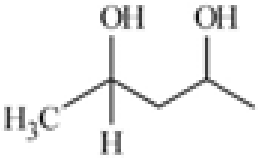
For reaction sequences, always track the changes in functional groups step by step, focusing on reduction, oxidation, or elimination reactions.

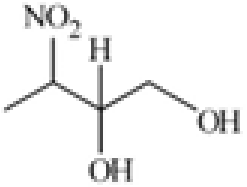
---

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

(1) 

(2) 

(3) 

(4) 

Correct Answer: (1) NO_2 - C_4H_9 - OH

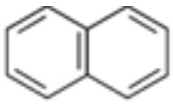
Solution:
The compound with a nitro group (NO_2) and a hydroxyl group (-OH) on the alkyl chain is most likely to undergo dehydration under acidic conditions. The presence of the nitro group helps to stabilize the carbocation formed during the dehydration process, making it more favorable.

Quick Tip

In dehydration reactions, look for the presence of electron-withdrawing groups (like NO_2) to stabilize carbocations.

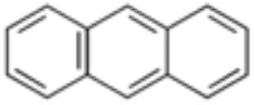
---

95. Consider the following compounds/species:

i.  ii. 

iii.  iv. 

v.  vi. 

vii. 

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

(1) 5
(2) 4
(3) 6
(4) 2

Correct Answer: (2) 4

Solution:
Hückel's rule states that a compound or species obeys the rule if it has a planar, cyclic, conjugated structure with $4n + 2$ -electrons. Based on this rule, compounds i, iii, iv, and vi obey Hückel's rule.

Quick Tip

When determining if a compound follows Hückel's rule, count the number of -electrons in the conjugated system. They must fit the form $4n + 2$.

---

96. Match List - I with List - II:
List - I (Oxacids of Sulphur) List - II (Bonds)

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

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

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

Solution:
The matching is based on the structure of the oxacids and the bonds formed in each. The number of hydroxyl and sulfur-oxygen bonds varies according to the specific oxacid.

Quick Tip

When matching oxacids to bonds, focus on the number of oxygen atoms and sulfur-hydroxyl groups present in the molecular structure.

---

97. Given below are two statements:
Statement I: The nutrient deficient water bodies lead to eutrophication.
Statement II: Eutrophication leads to a decrease in the level of oxygen in the water bodies.

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

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

Correct Answer: (1) Statement I is incorrect but Statement II is true.

Solution:
Statement I is incorrect because nutrient-rich water bodies lead to eutrophication, not nutrient-deficient ones. Statement II is true as eutrophication causes a decrease in the oxygen levels of water bodies due to excessive growth of algae.

Quick Tip

When studying eutrophication, focus on the effect of excess nutrients on aquatic ecosystems and the depletion of oxygen.

---

98. 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) $CaO + SiO_2 \rightarrow CaSiO_3$
(2) $Fe_2O_3 + CO \rightarrow 2Fe + CO_2$
(3) $FeO + CO \rightarrow Fe + CO_2$
(4) $C + CO_2 \rightarrow 2CO$

Correct Answer: (1) $CaO + SiO_2 \rightarrow CaSiO_3$

Solution:
The reaction $CaO + SiO_2 \rightarrow CaSiO_3$ occurs at lower temperatures, and it is part of the slag formation process in the blast furnace. The other reactions are typical reactions occurring at the high temperatures in the blast furnace during the extraction of iron.

Quick Tip

In the blast furnace, reactions involving iron ore reduction and slag formation occur at different temperature ranges.

---

99. Pumice stone is an example of -

(1) foam
(2) sol
(3) gel
(4) solid sol

Correct Answer: (1) foam

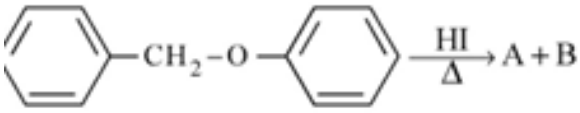
Solution:
Pumice stone is an example of a foam because it is a volcanic rock that contains many gas bubbles, which gives it a light and porous structure.

Quick Tip

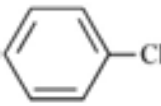
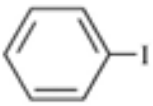
Foams are materials with gas bubbles trapped in them, giving them a light, airy structure, like pumice stone.

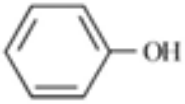
---

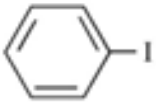
100. Consider the following reaction:

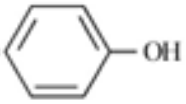


Identify products A and B.

(1) A =  and B = 

(2) A =  and B = 

(3) A =  and B = 

(4) A =  and B = 

Correct Answer: (2) A = CH_3 and B = OH

Solution:
In this reaction, an alkyl phenyl ether reacts with hydroiodic acid (HI) under heating to undergo cleavage. The products formed are methyl group (A) and phenol (B).

Quick Tip
Ether cleavage with HI typically results in the formation of an alcohol and an alkyl iodide.

SECTION-A
Botany

101. Cellulose does not form blue colour with iodine because:

(1) It breaks down when iodine reacts with it.
(2) It is a disaccharide.
(3) It is a helical molecule.
(4) It does not contain complex helices and hence cannot hold iodine molecules.

Correct Answer: (4) It does not contain complex helices and hence cannot hold iodine molecules.

Solution:
Cellulose does not form a blue color with iodine because it does not contain the helical structure required to trap iodine molecules, unlike starch, which does.

Quick Tip

When studying carbohydrates, remember that the structural difference between starch and cellulose affects their interaction with iodine.

---

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

(1) Synergids, antipodals and Polar nuclei
(2) Synergids, Primary endosperm nucleus and zygote
(3) Antipodals, synergids, and primary endosperm nucleus
(4) Synergids, Zygote and Primary endosperm nucleus

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

Solution:
In angiosperms, the sequence starts with the formation of the synergids and antipodals, followed by the fertilization of the zygote and primary endosperm nucleus.

Quick Tip

Focus on the role of each part of the embryo sac when studying fertilization in angiosperms.

---

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

(1) Equisetum and Salvinia
(2) Lycopodium and Selaginella
(3) Selaginella and Salvinia
(4) Psilotum and Salvinia

Correct Answer: (3) Selaginella and Salvinia

Solution:
Selaginella and Salvinia are examples of heterosporous pteridophytes, as they produce both microspores and megaspores.

Quick Tip

Heterospory is the production of different sizes of spores, which is a distinguishing feature in certain pteridophytes.

---

104. 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.

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

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

Solution:
The correct statements are B, C, D, and E. Statement A is incorrect because detritivores break down detritus, not perform fragmentation.

Quick Tip

Focus on the roles of different organisms in ecosystems, such as detritivores and decomposers, to understand nutrient cycles.

---

105. Axile placentation is observed in:

(1) China rose, Petunia and Lemon
(2) Mustard, Cucumber and Primrose
(3) China rose, Beans and Lupin
(4) Tomato, Dianthus and Pea

Correct Answer: (3) China rose, Beans and Lupin

Solution:
Axile placentation occurs when the ovules are attached to a central column inside the ovary, as seen in China rose, Beans, and Lupin.

Quick Tip

When studying placentation in plants, remember that axile placentation involves the ovules being arranged along the central axis.

---

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

(1) copper
(2) manganese
(3) molybdenum
(4) magnesium

Correct Answer: (2) manganese

Solution:
Manganese is essential for the splitting of water molecules during the light reaction of photosynthesis. It is a key component of the oxygen-evolving complex in photosystem II.

Quick Tip

Remember that manganese plays a crucial role in the water-splitting process in photosynthesis.

---

107. In the equation
`GPP = R + NPP`
GPP is Gross Primary Productivity
NPP is Net Primary Productivity
R here is

(1) Reproductive allocation
(2) Photosynthetically active radiation
(3) Respiratory quotient
(4) Respiratory loss

Correct Answer: (4) Respiratory loss

Solution:
In the given equation, R represents respiratory loss, which is the energy used by plants for respiration. The remaining energy is available for growth and reproduction, contributing to NPP (Net Primary Productivity).

Quick Tip

The equation GPP = R + NPP helps to understand the energy balance in ecosystems, where GPP is the total energy captured, R is the energy lost in respiration, and NPP is the energy available for growth.

---

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

(1) Abscisic Acid
(2) Indole-3-butyric Acid
(3) Gibberellic Acid
(4) Zeatin

Correct Answer: (3) Gibberellic Acid

Solution:
Gibberellic acid (GA) is used to promote growth and hasten the maturity period in juvenile conifers, leading to early seed production.

Quick Tip

Gibberellic acid is a growth-promoting hormone that helps in various stages of plant development, including early seed production.

---

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

(1) Senescence
(2) Differentiation
(3) Dedifferentiation
(4) Development

Correct Answer: (3) Dedifferentiation

Solution:
In tissue culture, the process of dedifferentiation occurs when mature cells like mesophyll cells are induced to revert to a less specialized form and form callus, which can later differentiate into new tissues.

Quick Tip

Dedifferentiation is a key process in plant tissue culture, where specialized cells are re-programmed to form undifferentiated callus tissue.

110. The phenomenon of pleiotropism refers to

(1) more than two genes affecting a single character.
(2) presence of several alleles of a single gene controlling a single crossover.
(3) presence of two alleles, each of the two genes controlling a single trait.
(4) a single gene affecting multiple phenotypic expression.

Correct Answer: (4) a single gene affecting multiple phenotypic expression.

Solution:
Pleiotropism is when a single gene affects multiple traits or phenotypic expressions. For example, a single gene may influence both eye color and skin color.

Quick Tip

Pleiotropism explains how one gene can have multiple effects on different traits in an organism.

---

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

(1) Telophase I
(2) Metaphase I
(3) Metaphase II
(4) Anaphase II

Correct Answer: (4) Anaphase II

Solution:
Centromere division occurs during Anaphase II of meiosis, where the sister chromatids are separated.

Quick Tip

Remember that centromere division is crucial for chromosome separation in the second meiotic division.

---

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

(1) Wilkins and Franklin
(2) Frederick Griffith
(3) Alfred Hershey and Martha Chase
(4) Avery, Macleod and McCarty

Correct Answer: (3) Alfred Hershey and Martha Chase

Solution:
Hershey and Chase provided the first unequivocal proof that DNA is the genetic material through their experiments with bacteriophages.

Quick Tip

Hershey and Chase used radioactive isotopes to trace DNA and proteins in bacteriophages to prove that DNA carries genetic information.

---

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

Correct Answer: (3) Both A and R are true and R is the correct explanation of A.

Solution:
During winter, the cambium is less active, leading to the formation of late wood, which contains fewer xylary elements with narrow vessels.

Quick Tip

The cambium's activity is affected by seasonal changes, impacting the structure of wood.

---

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

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

Correct Answer: (2) Both A and R are correct and R is the correct explanation of A.

Solution:
The protonema stage is the first stage of the gametophyte in moss, and it develops directly from the spores released from the capsule.

Quick Tip

In mosses, protonema plays a key role in the early stages of gametophyte development.

---

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

(1) 780 nm
(2) 680 nm
(3) 700 nm
(4) 660 nm

Correct Answer: (2) 680 nm

Solution:
The reaction centre in Photosystem II (PS II) absorbs light maximally at 680 nm, known as P680.

Quick Tip

Photosystem II absorbs light most efficiently at 680 nm, which is crucial for the light-dependent reactions in photosynthesis.

---

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

(1) 2002
(2) 1985
(3) 1992
(4) 1986

Correct Answer: (3) 1992

Solution:
The Earth Summit, also known as the Rio Summit, was held in Rio de Janeiro in 1992 and focused on global environmental issues.

Quick Tip

The 1992 Earth Summit led to significant international agreements on biodiversity and sustainable development.

---

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

(1) Transcription of only snRNAs
(2) Transcription of rRNAs (28S, 18S and 5.8S)
(3) Transcription of tRNA, 5S rRNA and snRNA
(4) Transcription of precursor mRNA

Correct Answer: (3) Transcription of tRNA, 5S rRNA and snRNA

Solution:
RNA polymerase III is responsible for transcribing tRNA, 5S rRNA, and small nuclear RNAs (snRNAs).

Quick Tip

RNA polymerase III plays a vital role in the transcription of small RNA molecules involved in protein synthesis and splicing.

---

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

(1) Diakinesis
(2) Zygotene
(3) Pachytene
(4) Diplotene

Correct Answer: (3) Pachytene

Solution:
Recombination nodules appear during the pachytene stage of prophase I in meiosis, where crossing-over occurs.

Quick Tip

The pachytene stage is where homologous chromosomes undergo crossing-over, facilitated by recombination nodules.

---

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

(1) Active Transport
(2) Osmosis
(3) Facilitated Diffusion
(4) Passive Transport

Correct Answer: (1) Active Transport

Solution:
Active transport requires energy to move ions against their concentration gradient across the membrane.

Quick Tip

Active transport is essential for maintaining cellular functions by moving ions against their concentration gradient.

---

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

(1) Bright orange colour
(2) Bright red colour
(3) Bright blue colour
(4) Bright yellow colour

Correct Answer: (1) Bright orange colour

Solution:
Ethidium bromide stains DNA and, upon exposure to UV light, emits a bright orange fluorescence.

Quick Tip

Ethidium bromide is a common dye used in molecular biology to stain DNA for visualization under UV light.

---

121. 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) Epiphyllous and Dithesous anthers
(2) Diadelphous and Dithesous anthers

(3) Polyadelphous and epipetalous stamens
(4) Monoadelphous and Monothecous anthers

Correct Answer: (2) Diadelphous and Dithesous anthers

Solution:
Fabaceae family is characterized by Diadelphous stamens, where the stamens are grouped into two sets, and Dithesous anthers, where each stamen has two lobes.

Quick Tip

In Fabaceae, the structure of stamens and their fusion is unique, with Diadelphous being a distinguishing feature.

---

122. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.
Reason R: 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) Statement I is incorrect but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is correct but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
Exarch condition is indeed common in roots, where the xylem develops from the outermost layer, and endarch is more typical in stems.

Quick Tip

Endarch and exarch refer to the position of xylem development, with exarch being common in roots.

---

123. Expressed Sequence Tags (ESTs) refers to

(1) Certain important expressed genes.
(2) All genes that are expressed as RNA.
(3) All genes that are expressed as proteins.
(4) All genes whether expressed or unexpressed.

Correct Answer: (2) All genes that are expressed as RNA.

Solution:
ESTs are short sequences of cDNA that represent the expressed genes, providing a snapshot of gene expression in a cell.

Quick Tip

ESTs are useful in gene expression studies as they provide insights into which genes are being actively transcribed.

---

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

(1) 2,4-D
(2) GA
(3) Kinetin
(4) Ethylene

Correct Answer: (2) GA

Solution:
Gibberellic acid (GA) promotes elongation of internodes and petioles, especially in rice plants grown in submerged or deep water conditions.

Quick Tip

Gibberellins, such as GA, are known for their role in promoting cell elongation.

---

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

(1) To protect seeds
(2) To attract insects
(3) To trap pollen grains
(4) To disperse pollen grains

Correct Answer: (4) To disperse pollen grains

Solution:
Tassels are the male flower of the corn plant and are responsible for releasing pollen, which is dispersed by wind.

Quick Tip

The tassels play a crucial role in the reproductive process by dispersing pollen for fertilization.

---

126. Given below are two statements:
Statement I: The forces generated by transpiration can lift a xylem-sized column of water over 130 meters high.
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) Statement I is incorrect but Statement II is correct.
(2) Both Statement I and Statement II are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

Correct Answer: (2) Both Statement I and Statement II are correct.

Solution:
Transpiration generates the necessary forces to move water up through the plant, and also helps cool the plant by evaporative cooling.

Quick Tip

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

---

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

(1) Polysaccharides
(2) RNA
(3) DNA
(4) Histones

Correct Answer: (3) DNA

Solution:
In recombinant DNA technology, chilled ethanol is used to precipitate DNA from a solution.

Quick Tip

Ethanol precipitation is a simple method to isolate DNA from a solution.

---

128. Frequency of recombination between gene pairs on same chromosome as a measure of the distance between genes to map their position on chromosome, was used for the first time by

(1) Heking
(2) Thomas Hunt Morgan
(3) Sutton and Boveri
(4) Alfred Sturtevant

Correct Answer: (4) Alfred Sturtevant

Solution:
Alfred Sturtevant first used recombination frequencies to map gene positions on chromosomes.

Quick Tip

Recombination frequencies are used to estimate the distance between genes on a chromosome.

---

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

(1) Co-extinctions
(2) Habitat loss and fragmentation
(3) Over exploitation for economic gain
(4) Alien species invasions

Correct Answer: (2) Habitat loss and fragmentation

Solution:
Habitat loss and fragmentation are considered the most important causes of extinction, as they disrupt ecosystems and biodiversity.

Quick Tip

Conservation efforts should prioritize addressing habitat loss and fragmentation to prevent species extinction.

---

130. How many ATP and $NADPH_2$ are required for the synthesis of one molecule

of Glucose during Calvin cycle?

(1) 18 ATP and 16 $NADPH_2$
(2) 12 ATP and 12 $NADPH_2$
(3) 18 ATP and 12 $NADPH_2$
(4) 12 ATP and 16 $NADPH_2$

Correct Answer: (3) 18 ATP and 12 $NADPH_2$

Solution:
The Calvin cycle, also known as the dark reaction or light-independent reaction, involves the conversion of carbon dioxide into glucose. For one molecule of glucose: - 6 molecules of carbon dioxide are fixed into the Calvin cycle. - For each CO_2 molecule, 3 ATP and 2 NADPH are consumed. - To synthesize one molecule of glucose, which contains 6 carbon atoms, 18 ATP and 12 NADPH are required.
Step-by-Step Calculation: 1. For each CO_2, 3 ATP and 2 NADPH are consumed. 2. To make glucose (6 carbons), we need 6 CO_2. 3. Therefore, $6 \times 3 = 18$ ATP and $6 \times 2 = 12$ NADPH are required.

Quick Tip

The Calvin cycle requires ATP and NADPH generated in the light reaction of photosynthesis.

---

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

(1) wind pollinated plants
(2) insect pollinated plants
(3) bird pollinated plants
(4) bat pollinated plants

Correct Answer: (2) insect pollinated plants

Solution:
Insect-pollinated plants typically have large, colourful, fragrant flowers and produce nectar to attract pollinators like bees and butterflies. These plants rely on insects for the transfer of pollen.

Quick Tip

Insect-pollinated plants often have bright flowers, scent, and nectar to attract insects for pollination.

---

132. Among eukaryotes, replication of DNA takes place in:

(1) G_2 phase
(2) M phase
(3) S phase
(4) G_1 phase

Correct Answer: (3) S phase

Solution:
In eukaryotic cells, DNA replication occurs during the S (synthesis) phase of the cell cycle. During this phase, the entire genome is duplicated in preparation for cell division.
Step-by-Step Explanation: 1. G_1 phase is for cell growth and protein synthesis. 2. S phase is where DNA replication occurs. 3. G_2 phase is for further cell growth and preparation for division. 4. M phase is where mitosis occurs.

Quick Tip

DNA replication is crucial before cell division and occurs during the S phase of the cell cycle.

---

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

(1) Kilodase
(2) Dobson units
(3) Decibels
(4) Decameter

Correct Answer: (2) Dobson units

Solution:
The thickness of ozone in the atmosphere is measured in Dobson units (DU). One Dobson unit corresponds to a thickness of 0.01 mm of pure ozone at standard pressure and temperature.

Quick Tip

Ozone concentration is commonly measured in Dobson units, which help assess ozone layer thickness.

---

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

Correct Answer: (3) Both A and R are true and R is the correct explanation of A.

Solution:
In glycolysis, ATP is indeed used in two steps: 1. The first ATP is used to convert glucose into glucose-6-phosphate. 2. The second ATP is used to convert fructose-6-phosphate into fructose-1,6-bisphosphate.
This is correct as both reactions consume ATP during glycolysis.

Quick Tip

Glycolysis involves the consumption of ATP in its early steps, which are crucial for the subsequent energy-producing stages.

---

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

(1) Silver
(2) Copper
(3) Zinc
(4) Tungsten or gold

Correct Answer: (4) Tungsten or gold

Solution:
In the gene gun method, microparticles of tungsten or gold are used to carry alien DNA into the host cell by bombarding the plant cells with these particles.

Quick Tip

Gene gun technology uses gold or tungsten microparticles to deliver DNA into plant cells, bypassing the need for bacterial vectors.

SECTION-B
Botany

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

of:

(1) Dinitrogenase
(2) Succinic dehydrogenase
(3) Amylase
(4) Lipase

Correct Answer: (2) Succinic dehydrogenase

Solution:
Melonate is known to inhibit the growth of pathogenic bacteria by inhibiting succinic dehydrogenase, which is an enzyme involved in the citric acid cycle.

Quick Tip

Succinic dehydrogenase plays a crucial role in cellular respiration, and its inhibition can prevent energy production in bacteria.

---

137. Identify the correct statements:
A. Lenticles 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 and C only
(2) B, C and E only
(3) A and D only
(4) A, B and D only

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

Solution:
- Lenticles are indeed lens-shaped structures that allow gas exchange in plants. - Hard bark is formed early in the season and serves as a protective layer. - Bark refers to all tissues exterior to the vascular cambium, including periderm and secondary phloem.

Quick Tip

Bark and lenticles are important for gas exchange and protection in plants.

---

138. Match List I with List II:

List I List II

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

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

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

Solution:
- Iron (A) is a component of nitrate reductase, which is involved in nitrogen metabolism. - Zinc (B) acts as an activator of catalase, an enzyme involved in detoxifying hydrogen peroxide. - Boron (C) is essential for cell elongation and differentiation. - Molybdenum (D) is involved in the synthesis of auxins, which are growth hormones.

Quick Tip

Remember that micronutrients like iron, zinc, boron, and molybdenum play essential roles in enzyme activation, hormone synthesis, and overall plant growth.

---

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

(1) The amount of some toxic substances of industrial waste water increases in the organisms at successive trophic levels.
(2) The micro-organisms involved in biodegradation of organic matter in a sewage polluted water body consume a lot of oxygen causing the death of aquatic organisms.
(3) Algal blooms caused by excess of organic matter in water improve water quality and promote fishery.
(4) Water hyacinth grows abundantly in eutrophic water bodies and leads to an imbalance in the ecosystem dynamics of the water body.

Correct Answer: (3) Algal blooms caused by excess of organic matter in water improve water quality and promote fishery.

Solution:
Algal blooms, caused by excess nutrients in the water, actually deplete oxygen levels, harming aquatic life and leading to the decline in water quality. They do not improve water quality or promote fisheries.

Quick Tip

Excessive nutrients leading to algal blooms can disrupt ecosystems and deplete oxygen levels, harming aquatic organisms.

---

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

(1) Proton pump, electron gradient, NADP synthase
(2) Membrane, proton pump, proton gradient, ATP synthase
(3) Membrane, proton pump, proton gradient, NADP synthase
(4) Proton pump, electron gradient, ATP synthase

Correct Answer: (2) Membrane, proton pump, proton gradient, ATP synthase

Solution:
Chemiosmosis involves the movement of protons (H+) across a membrane via a proton pump, creating a proton gradient, and driving ATP synthesis through ATP synthase.

Quick Tip

In chemiosmosis, the proton gradient created by proton pumps powers ATP synthesis via ATP synthase.

---

141. 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 saturated.
D. Physical, psychological and mental development is retarded.
E. Such individuals are sterile.
Choose the correct answer from the options given below:

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

Correct Answer: (4) B and E only

Solution:
Klinefelter's Syndrome involves the presence of an extra X chromosome (XXY). The individual often exhibits some features of both male and female development, is sterile, and has physical and mental development delays.

Quick Tip

Klinefelter's syndrome is a genetic condition caused by an extra X chromosome, leading to infertility and developmental challenges.

---

142. Match List I with List II:

List I (Interaction) List II (Species A and B)

List I (Interaction)	List II (Species A and B)
$A. Mutualism$	$I. (A), (B)$
$B. Commensalism$	$II. (A), (O)$
$C. Amensalism$	$III. (A), (B)$
$D. Parasitism$	$IV. (A), (B)$

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

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

Solution:
- Mutualism (A) occurs between species that benefit each other.
- Commensalism (B) benefits one species while the other is not harmed.
- Amensalism (C) involves one species being harmed while the other is unaffected.
- Parasitism (D) involves one species benefiting at the expense of another.

Quick Tip

Understanding ecological interactions like mutualism, commensalism, and parasitism helps explain relationships between different species in ecosystems.

---

143. Match List I with List II:

List I (Property) List II (Explanation)

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

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

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

Solution:
- Cohesion refers to the attraction between like molecules, leading to surface tension
- Adhesion refers to the attraction between different molecules, like water and glass.
- Surface tension is the result of cohesive forces.
- Guttation occurs when water is exuded from plant leaves due to pressure, not evaporation.

Quick Tip

Cohesion and adhesion are key properties of water that influence its movement and behavior in plants.

---

144. Match List I with List II:

List I List II

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

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

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

Solution:
- The M phase (mitosis) involves the actual division of the cell, where proteins are synthesized.
- The G phase is the resting phase of the cell cycle.
- The quiescent stage is where the cell is in an inactive phase.
- The G phase also refers to the interval between cell divisions.

Quick Tip

Understanding cell cycle phases is crucial for understanding cell division and growth processes in organisms.

---

145. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:
Assertion A: In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.
Reason R: Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.
In the light of the above statements, choose the correct answer from the options given below:

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

Correct Answer: (1) A is false but R is true.

Solution:
In gymnosperms, the pollen grains are indeed released from the microsporangium and carried by air currents. However, contrary to the statement, the pollen tube does form during fertilization, not just the discharge of male gametes.

Quick Tip

In gymnosperms, pollen tube formation is essential for the fertilization process, although pollen is carried by wind.

---

146. 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, D, A, C
(2) B, C, D, A
(3) C, A, B, D
(4) C, A, B, D

Correct Answer: (2) B, C, D, A

Solution:
1. First, the DNA is cut at specific locations using restriction enzymes (B). 2. Next, the desired DNA fragment is isolated (C). 3. After that, PCR amplification is performed to get multiple copies of the gene of interest (D). 4. Finally, the recombinant DNA is inserted into the host cell (A).

Quick Tip

The process of recombinant DNA formation involves several important steps such as cutting, isolating, amplifying, and inserting DNA.

---

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

Correct Answer: (2) Both A and R are true but R is the correct explanation of A.

Solution:
The definition of a flower as a modified shoot is correct. The internode gets condensed to form a floral meristem, which results in the formation of floral appendages. This helps in the process of flower formation.

Quick Tip

Floral development involves the conversion of the shoot meristem into a floral meristem, leading to the formation of various floral parts.

---

148. Match List I with List II:

List I List II

List I	List II
A.Oxidative	*I.Citratesynthase*
B.Zinc	*II.Pyruvatedehydrogenase*
C.Glycolysis	*III.Electrontransportsystem*
D.Molybdenum	*IV.EMPpathway*

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

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

Solution:
- Oxidative phosphorylation involves the synthesis of ATP through electron transport (A-II). - Zinc acts as a cofactor for several enzymes, including those involved in pyruvate metabolism (B-IV). - Glycolysis is a metabolic pathway that produces ATP and intermediates for other processes (C-III). - Molybdenum is involved in the synthesis of enzymes like nitrate reductase (D-I).

Quick Tip

Understanding the role of metal ions and enzymes in metabolic processes helps in comprehending cellular energy production.

---

149. 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) Statement I is incorrect but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is correct but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
Statement I correctly explains the Competitive Exclusion Principle. According to this principle,

two species competing for the same resources cannot co-exist indefinitely. Statement II is also correct as carnivores typically have higher energy needs and are more affected by competition.

Quick Tip

Competition in ecosystems can lead to the exclusion of less competitive species, especially in carnivores with high energy requirements.

---

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

(1) 20
(2) 80
(3) 60
(4) 40

Correct Answer: (3) 60

Solution:
The ribosome consists of approximately 60 different proteins, which work together to translate mRNA into proteins during the process of protein synthesis.

Quick Tip

Ribosomes are composed of proteins and rRNA that are essential for protein synthesis in all living cells.

SECTION-A
Zoology

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

(1) Enzyme Linked Immuno-Sorbent Assay (ELISA) technique
(2) Recombinant DNA Technology
(3) Serum and Urine analysis
(4) Polymerase Chain Reaction (PCR) technique

Correct Answer: (2) Recombinant DNA Technology

Solution:
Recombinant DNA technology is primarily used for gene cloning, genetic manipulation, and therapeutic purposes. It is not directly used for early diagnosis of diseases. Techniques like

ELISA, PCR, and serum and urine analysis are used in early diagnosis of diseases.

Quick Tip

Recombinant DNA technology is essential for genetic research, not for immediate disease diagnosis.

---

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

Correct Answer: (1) A is false but R is true.

Solution:
Explanation: - Amniocentesis for sex determination is not allowed as it leads to female foeticide.
- The reason provided is correct, as the ban is aimed at preventing this harmful practice.
- However, the assertion that amniocentesis is used for sex determination as part of reproductive health care is false.

Quick Tip

Amniocentesis is used for genetic testing, not for sex determination, and its use for sex determination is banned in many countries to prevent gender-based discrimination.

---

153. Match List I with List II:

List I List II

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

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

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

Solution:
Explanation: - The interaction between a Leopard and a Lion is one of competition (A-I).
- The Cuckoo lays eggs in the Crow's nest, which is a case of brood parasitism (B-II).
- Fungi and plant roots engage in a mutualistic relationship (C-III).
- Cattle egret and cattle have a commensal relationship, as the egret benefits from insects disturbed by the cattle (D-IV).

Quick Tip

In ecology, understanding different interactions like competition, parasitism, mutualism, and commensalism helps explain how organisms coexist in an ecosystem.

---

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

(1) Lemur, Anteater, Wolf
(2) Tasmanian wolf, Bobcat, Marsupial mole
(3) Numbat, Spotted cuscus, Flying squirrel
(4) Mole, Flying squirrel, Tasmanian tiger cat

Correct Answer: (2) Tasmanian wolf, Bobcat, Marsupial mole

Solution:
Adaptive radiation in Australian Marsupials is exemplified by the Tasmanian wolf, Bobcat, and Marsupial mole. These species have diversified from a common ancestor to occupy different ecological niches.

Quick Tip

Adaptive radiation leads to the evolution of multiple species from a common ancestor to fill various ecological roles.

---

155. Match List I with List II:

List I (Type of Joint) List II (Found between)

List I (Type of Joint)	List II (Found between)
$A. Cartilaginous Joint$	$I. Between flat skull bones$
$B. Ball and Socket Joint$	$II. Between adjacent vertebrae in vertebral column$
$C. Fibrous Joint$	$III. Between carpal and metacarpal of thumb$
$D. Saddle Joint$	$IV. Between Humerus and Pectoral girdle$

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

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

Solution:
Explanation: - Cartilaginous joints are found between adjacent vertebrae in the vertebral column (A-II).
- Ball and socket joints are found between the humerus and pectoral girdle (B-IV).
- Fibrous joints are found between carpal and metacarpal of the thumb (C-III).
- Saddle joints are found between flat skull bones (D-I).

Quick Tip

Understanding the different types of joints in the human body helps in comprehending movement and flexibility.

---

156. Match List I with List II:

List I (Cells) List II (Secretion)

List I (Cells)	List II (Secretion)
$A. Peptic cells$	$I. Mucus$
$B. Goblet cells$	$II. Bile juice$
$C. Oxyntic cells$	$III. Proenzyme pepsinogen$
$D. Hepatic cells$	$IV. HCl and intrinsic factor for absorption of vitamin B_{12}$

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

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

Solution:
Explanation: - Peptic cells secrete proenzyme pepsinogen, which is involved in protein digestion (A-III).
- Goblet cells secrete mucus that protects the gastrointestinal lining (B-I).
- Oxyntic cells secrete HCl and intrinsic factor required for vitamin B12 absorption (C-IV).
- Hepatic cells produce bile juice, essential for fat digestion (D-II).

Quick Tip

Understanding the specific functions of different cells and their secretions in the digestive system helps in comprehending how digestion and absorption occur.

---

157. Broad palm with single palm crease is visible in a person suffering from:

(1) Thalassemia
(2) Down's syndrome
(3) Turner's syndrome
(4) Klinefelter's syndrome

Correct Answer: (2) Down's syndrome

Solution:
Broad palms with a single palm crease are characteristic of individuals with Down's syndrome. This is due to a chromosomal abnormality (trisomy 21), which leads to developmental differences.

Quick Tip

Down's syndrome is characterized by several distinct physical features, including the broad palm with a single crease.

---

158. Match List I with List II:

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

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

Solution:
- Ringworm is caused by the fungus *Trichophyton* (A-II).
- Filariasis is caused by the roundworm *Wuchereria bancrofti* (B-III).
- Malaria is caused by the protozoan *Plasmodium vivax* (C-IV).
- Pneumonia is caused by the bacterium *Haemophilus influenzae* (D-I).

Quick Tip

Understanding the pathogens causing common diseases helps in their diagnosis and treatment.

---

159. Match List I with List II:

List I List II

List I (Gene)	List II (Protein)
$A.Gene'a'$	$I. - galactosidase$
$B.Gene'y'$	$II.Transacetylase$
$C.Gene'i'$	$III.Permease$
$D.Gene'z'$	$IV.Repressorprotein$

Choose the correct answer from the options given below:
(1) A-III, B-I, C-IV, D-II
(2) A-II, B-IV, C-I, D-III
(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:
- Gene 'a' encodes -*galactosidase* (A-III).
- Gene 'y' encodes *Transacetylase* (B-II).
- Gene 'i' encodes *Permease* (C-IV).
- Gene 'z' encodes the *Repressor protein* (D-I).

Quick Tip

In the lac operon, genes are responsible for the synthesis of enzymes involved in lactose metabolism.

---

160. 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) Statement I is false but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
Explanation: - Statement I correctly explains the orientation of proteins, where the C-terminal is at the left and the N-terminal is at the right.
- Statement II is also correct, as adult human hemoglobin consists of 4 subunits: two -type and two -type subunits.

Quick Tip

Proteins are synthesized from the N-terminal to the C-terminal, and hemoglobin is a tetramer composed of and subunits.

---

161. Match List I with List II:

List I List II

List I (Drug)	**List II (Effect)**
$A. Heroin$	$I. Effect on cardiovascular system$
$B. Marijuana$	$II. Slow down body function$
$C. Cocaine$	$III. Painkiller$
$D. Morphine$	$IV. Interfere with transport of dopamine$

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

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

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

Solution:
- Heroin is a narcotic drug that has a significant effect on the cardiovascular system (A-I).
- Marijuana slows down body functions and impairs coordination (B-II).
- Cocaine is a stimulant, and it acts as a painkiller (C-III).
- Morphine is used as a painkiller and interferes with the transport of dopamine (D-IV).

Quick Tip

Understanding the effects of various drugs on the body helps in identifying their uses and side effects.

---

162. Which of the following statements are correct regarding female reproductive cycle?

A. In non-primate mammals cyclical changes during reproduction are called estrus 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, C and D only
(2) A and D only
(3) A and B only
(4) A, B and C only

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

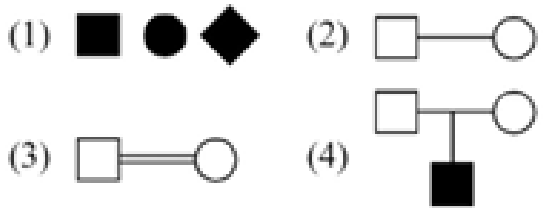
Solution:
Explanation: - Statement A is correct as the estrus cycle is the reproductive cycle in non-primate mammals.
- Statement B is incorrect because menopause refers to the cessation of the menstrual cycle, not the beginning.
- Statement C is correct as lack of menstruation can be a sign of pregnancy.
- Statement D is correct as cyclic menstruation occurs between menarche (the onset of menstruation) and menopause.

Quick Tip

The female reproductive cycle involves various phases, and its regulation is critical for reproduction.

---

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



Correct Answer: (4)
Solution:
In human pedigree analysis, mating between relatives is represented by a square () and a circle () connected by a line, indicating consanguinity.

Quick Tip

In pedigree charts, squares represent males, circles represent females, and lines connect individuals to represent relationships.

---

164. Match List I with List II:

List I List II

List I	List II
A.Taenia	*I.Nephridia*
B.Paramoecium	*II.Contractilevacuole*
C.Periplaneta	*III.Flamecells*
D.Pheretima	*IV.Urecosegland*

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

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

Solution:
Taenia has Nephridia, Paramoecium has a contractile vacuole, Periplaneta has flame cells, and

Pheretima has an Urecose gland.

Quick Tip

When studying organisms, match their systems to their physiological functions to better understand their biology.

---

165. Radial symmetry is NOT found in adults of phylum _____

(1) Echinodermata
(2) Ctenophora
(3) Hemichordata
(4) Coelenterata

Correct Answer: (3) Hemichordata

Solution:
- Radial symmetry is found in many organisms like Echinodermata and Coelenterata, particularly in their adult stages.
- However, Hemichordata, a lesser-known phylum, does not exhibit radial symmetry in its adult form. Therefore, the correct answer is Hemichordata.

Quick Tip

Radial symmetry is common in marine invertebrates. Understanding their classification helps in distinguishing different phyla.

---

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

(1) Eosinophils
(2) T H cells
(3) B-lymphocytes
(4) Basophils

Correct Answer: (2) T H cells

Solution:
- HIV (Human Immunodeficiency Virus) specifically targets and replicates within T-helper cells (also called CD4 cells).
- These T H cells are crucial for the immune response, and their depletion leads to immunodeficiency, which is characteristic of AIDS.

- Other cells like eosinophils, B-lymphocytes, and basophils do not support the replication of HIV.

Quick Tip

The immune system involves various cell types. Knowing the specific role of each cell helps in understanding how diseases like HIV affect immunity.

---

167. Which of the following statements is correct?

(1) Algal Bloom decreases fish mortality
(2) Eutrophication refers to increase in domestic sewage and waste water in lakes.
(3) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
(4) Presence of large amount of nutrients in water results 'Algal Bloom'

Correct Answer: (3) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.

Solution:
- Biomagnification refers to the process where the concentration of toxins increases as you move up the food chain. For example, fish higher in the food chain accumulate more toxins.
- Eutrophication leads to an increase in nutrients, which can result in algal blooms. But biomagnification specifically relates to toxic substances.

Quick Tip

Familiarize yourself with ecological concepts like biomagnification, eutrophication, and algal blooms as they are important for environmental science.

---

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

(1) HIV Infection
(2) Genital herpes
(3) Gonorrhoea
(4) Hepatitis-B

Correct Answer: (3) Gonorrhoea

Solution:
- Gonorrhoea is a bacterial infection that can be treated and completely cured with antibiotics

when detected early.
- HIV and Hepatitis-B are chronic conditions that currently have no cure, though they can be managed. Genital herpes is a viral infection that also has no cure but can be managed with antiviral medications.

Quick Tip

Familiarize yourself with the difference between bacterial and viral infections. Bacterial infections like gonorrhoea are curable with antibiotics, unlike viral infections.

---

169. Match List I with List II with respect to human eye:

List I List II

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

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

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

Solution:
- Fovea is the point of greatest visual acuity or resolution (A-III).
- Iris is the visible coloured portion of the eye that regulates the diameter of the pupil (B-I).
- Blind spot is where the optic nerve exits the eye and photoreceptor cells are absent (C-IV).
- Sclera is the external layer of the eye, made up of dense connective tissue (D-II).

Quick Tip

Understanding the basic anatomy of the human eye is crucial for grasping how vision and eye functions work.

---

170. 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 along with vagina forms birth

canal.

In the light of the above statements, choose the correct answer from the options given below:
(1) Statement I incorrect but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is correct but Statement II is false.

Correct Answer: (1) Statement I incorrect but Statement II is true.

Solution:
- Statement I: The vas deferens does not open directly into the urethra as the ejaculatory duct; it is connected to the seminal vesicle and joins the urethra to form the ejaculatory duct. Hence, this statement is incorrect.
- Statement II: The cavity of the cervix is indeed called the cervical canal, and along with the vagina, it forms the birth canal. This statement is true.

Quick Tip

Focus on the anatomy of the male and female reproductive systems to understand how their structures function during reproduction.

---

171. 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) Statement I incorrect but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is correct but Statement II is false.

Correct Answer: (1) Statement I incorrect but Statement II is true.

Solution:
- Statement I: In prokaryotes, DNA is present in a region called nucleoid, but it is not bound by proteins in the same way as in eukaryotes. So, Statement I is incorrect.
- Statement II: In eukaryotes, DNA is indeed wrapped around histone proteins to form nucleosomes, which are the basic units of chromatin structure. This statement is correct.

Quick Tip

Remember that prokaryotes have a simpler DNA structure compared to the more complex histone-bound DNA of eukaryotes.

---

172. Once the undigested and unabsorbed substances enter the cecum, their backflow is prevented by

(1) Pyloric sphincter
(2) Sphincter of Oddi
(3) Ileo - caecal valve
(4) Gastro - oesophageal sphincter

Correct Answer: (3) Ileo - caecal valve

Solution:
The ileo-caecal valve prevents the backflow of material from the cecum back into the ileum, ensuring proper digestion and absorption.

Quick Tip

Understanding the structure of the digestive system and its control mechanisms is key for questions related to digestion and absorption.

---

173. Given below are two statements:
Statement I: Electrostatic precipitator is most widely used in thermal power plants.
Statement II: Electrostatic precipitator in thermal power plant removes ionizing radiations.

In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Statement I incorrect but Statement II is correct.
(2) Both Statement I and Statement II are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

Correct Answer: (4) Statement I is correct but Statement II is incorrect.

Solution:
- Statement I: Electrostatic precipitators are indeed widely used in thermal power plants to remove particulate matter from exhaust gases. This statement is correct.
- Statement II: Electrostatic precipitators remove particles from exhaust gases, not ionizing radiations. Ionizing radiation is not their function. Hence, Statement II is incorrect.

Quick Tip

Focus on the specific functions of environmental pollution control devices like electrostatic precipitators to avoid confusion with other types of filtration.

---

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

Correct Answer: (3) Both A and R are true but R is NOT the correct explanation of A.

Solution:
- Assertion A: There are two types of nephrons: cortical and juxta medullary nephrons, based on their position. This is true.
- Reason R: Juxta medullary nephrons have long loops of Henle, not short ones, so this statement is true, but it does not correctly explain Assertion A. Hence, R is not the correct explanation of A.

Quick Tip

Focus on the structure and function of nephrons to understand their role in the formation of urine.

---

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

(1) Transportation
(2) Nuclear division
(3) Protein synthesis
(4) Motility

Correct Answer: (1) Transportation

Solution:
The cytoskeleton plays a crucial role in intracellular transport, allowing vesicles and organelles

to move within the cell.

Quick Tip

The cytoskeleton is essential for maintaining cell shape, enabling movement, and supporting various cell functions like transport.

---

176. 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) Statement I false but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
- Statement I: RNA indeed mutates at a faster rate compared to DNA due to its lack of proofreading mechanisms.
- Statement II: Viruses with RNA genomes tend to mutate and evolve faster because of their shorter lifespans and higher mutation rates. This is true.

Quick Tip

RNA viruses, like influenza and HIV, mutate more rapidly than DNA viruses due to their increased error rates during replication.

---

177. Vital capacity of lung is _____

(1) IRV + ERV + TV
(2) IRV + ERV
(3) IRV + ERV + TV + RV
(4) IRV + ERV + TV - RV

Correct Answer: (1) IRV + ERV + TV

Solution:
Vital capacity is the maximum amount of air that can be exhaled after a maximum inhalation. It is the sum of inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and tidal

volume (TV).

Quick Tip

For respiratory volumes and capacities, focus on understanding the different types of lung volumes and their relationships.

---

178. 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) Statement I is false but Statement II is true.
(2) Both Statement I and Statement II are true.
(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Correct Answer: (3) Both Statement I and Statement II are false.

Solution:
- Statement I: Ligaments are made of dense regular connective tissue, not irregular tissue. Hence, Statement I is false.
- Statement II: Cartilage is made of dense irregular connective tissue, not regular tissue. Hence, Statement II is also false.

Quick Tip

Remember that ligaments are regular connective tissues, while cartilage and tendons are irregular connective tissues.

---

179. Match List I with List II:

List I List II

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

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

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

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

Solution:
- P-wave represents the depolarization of atria (A-III).
- Q-wave marks the beginning of systole (B-I).
- QRS complex represents the depolarization of ventricles (C-IV).
- T-wave represents the repolarization of ventricles (D-II).

Quick Tip

Focus on understanding the phases of the cardiac cycle and the corresponding waveforms in an ECG.

---

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

(1) Probe
(2) BAC
(3) YAC
(4) pBR322

Correct Answer: (1) Probe

Solution:
A probe is used for detecting specific DNA sequences, not for cloning. BAC, YAC, and pBR322 are all cloning vectors used for carrying and replicating DNA fragments.

Quick Tip

When studying cloning vectors, remember that plasmids, BACs, and YACs are used to transfer genes, while probes are used to locate them.

---

181. 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) Statement I is false but Statement II is true.
(2) Both Statement I and Statement II are true.

(3) Both Statement I and Statement II are false.
(4) Statement I is true but Statement II is false.

Correct Answer: (2) Both Statement I and Statement II are true.

Solution:
- Statement I: Low temperature does preserve enzymes in an inactive state, and high temperature does denature proteins, which is correct.
- Statement II: Competitive inhibitors resemble the substrate and compete for binding at the enzyme's active site, which is true.

Quick Tip

Understanding enzyme inhibition is key to grasping how enzymes regulate metabolic processes and how inhibitors affect enzyme function.

---

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

Correct Answer: (2) Both A and R are true and R is the correct explanation of A.

Solution:
- Assertion A: Endometrium is necessary for the implantation of the blastocyst, which is true.
- Reason R: The corpus luteum degenerates if fertilization does not occur, leading to the disintegration of the endometrium, which explains why endometrium is necessary for implantation. This statement is correct.

Quick Tip

The role of the corpus luteum in the menstrual cycle is crucial in understanding reproductive biology and the stages of pregnancy.

---

183. Which of the following are NOT considered as the part of endomembrane

system?

(1) Mitochondria (2) Endoplasmic Reticulum
(3) Chloroplasts (4) Golgi complex
(5) Peroxisomes

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

Correct Answer: (4) A and D only

Solution:
- The endomembrane system consists of the endoplasmic reticulum, Golgi apparatus, vesicles, and the plasma membrane.
- Mitochondria and chloroplasts are not considered part of the endomembrane system.

Quick Tip

Focus on the organelles involved in the synthesis, processing, and transport of proteins and lipids when studying the endomembrane system.

---

184. Match List I with List II:

List I List II

List I	List II
$A.CCK$	$I.Kidney$
$B.GIP$	$II.Heart$
$C.ANF$	$III.Gastricgland$
$D.ADH$	$IV.Pancreas$

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

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

Solution:
- CCK (Cholecystokinin) is produced in the pancreas (A-IV).
- GIP (Gastric inhibitory peptide) comes from the heart (B-II).

- ANF (Atrial natriuretic factor) is from the gastric gland (C-III).
- ADH (Antidiuretic hormone) is produced by the kidney (D-I).

Quick Tip

Study the sources of hormones and their effects on different body systems for better understanding.

---

185. Match List I with List II:

List I List II

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

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

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

Solution:
- Vasectomy is a surgical method (A-III).
- Coitus interruptus is a natural method (B-IV).
- Cervical caps are a barrier method (C-I).
- Saheli is a natural method of contraception (D-II).

Quick Tip

Understanding the different methods of contraception is key to selecting the most appropriate one based on medical conditions and personal preferences.

SECTION-B
Zoology

186. Match List I with List II:

List I List II

List I	List II
$A. Mast cells$	$I. Ciliated epithelium$
$B. Inner surface$	$II. Areolar tissue of bronchioles$
$C. Blood$	$III. Cuboidal epithelium$
$D. Tubular parts$	$IV. Specialized connective tissue of nephron$

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

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

Solution:
- Mast cells are associated with ciliated epithelium (A-I).
- The inner surface of bronchioles is made of areolar tissue (B-II).
- Blood is specialized connective tissue (C-IV).
- Tubular parts of the nephron are lined by cuboidal epithelium (D-III).

Quick Tip

Understanding the different tissues and their locations in the body will help in identifying their roles and functions.

---

187. Which of the following is NOT an advantage of inbreeding?

(1) It decreases the productivity of inbred population, after continuous inbreeding.
(2) It decreases homozygosity.
(3) It exposes harmful recessive genes that are eliminated by selection.
(4) Elimination of less desirable genes and accumulation of superior genes takes place due to it.

Correct Answer: (2) It decreases homozygosity.

Solution:
Inbreeding actually increases homozygosity as it reduces genetic diversity and brings harmful recessive genes to the forefront.

Quick Tip

Inbreeding leads to an increase in homozygosity and can result in the accumulation of harmful genetic traits.

188. Which of the following are NOT under the control of thyroid hormone?

(1) Maintenance of water and electrolyte balance
(2) Regulation of basal metabolic rate
(3) Normal rhythm of sleep-wake cycle
(4) Development of immune system

Correct Answer: (3) B and C only

Solution:
Thyroid hormones play a role in regulating the metabolic rate and supporting the immune system. However, the sleep-wake cycle is not directly controlled by thyroid hormones.

Quick Tip

Thyroid hormones are essential for metabolism and growth. Understanding their role in energy regulation helps in understanding thyroid disorders.

---

189. Which of the following statements are correct?

(1) A. Basophils are most abundant cells of the total WBCs.

(2) B. Basophils secrete histamine, serotonin, and heparin.

(3) C. Basophils are involved in inflammatory response.

(4) D. Basophils have kidney shaped nucleus.

(5) E. Basophils are agranulocytes.

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

Correct Answer: (4) B and C only

Solution:
- Basophils are involved in inflammatory responses and secrete histamine, serotonin, and heparin (B and C).
- Basophils are not the most abundant cells and are granulocytes, not agranulocytes.

Quick Tip

Basophils are part of the immune system and play a key role in inflammation and allergic responses.

---

190. The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are:

(1) Corpus callosum and thalamus
(2) Limbic system hypothalamus
(3) Corpora quadrigemina hippocampus
(4) Brain stem epithalamus

Correct Answer: (2) Limbic system hypothalamus

Solution:
The limbic system and hypothalamus are involved in regulating emotions, sexual behaviour, and motivation.

Quick Tip

The limbic system is key to controlling emotions, while the hypothalamus is responsible for controlling hormonal responses.

---

191. Which of the following is characteristic feature of cockroach regarding sexual dimorphism?

(1) Presence of anal cerci
(2) Dark brown body colour and anal cerci
(3) Presence of anal styles
(4) Presence of sclerites

Correct Answer: (1) Presence of anal cerci

Solution:
In cockroaches, sexual dimorphism is evident in the presence of anal cerci, which are longer in males than in females.

Quick Tip

Sexual dimorphism is observable in many organisms and helps in distinguishing males from females.

192. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows 5' AUCGACGACGACGACGUC 3'?

(1) 5' AUCGACGACGACGACGUC 3'
(2) 3' ATCGATCGATCGATCGATCG 5'
(3) 5' UACGACGACGACGACGUC 3'
(4) 5' ATCGATCGATCGATCGATGC 3'

Correct Answer: (2) 3' ATCGATCGATCGATCGATCG 5'

Solution:
The coding strand corresponds to the DNA sequence that is complementary to the mRNA sequence. The correct sequence is the complementary one of mRNA.

Quick Tip

DNA and RNA pairing rules are crucial for understanding transcription and translation processes in cells.

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193. In cockroach, excretion is brought about by:

A. Phalllic gland

B. Ureose gland

C. Nephrocytes

D. Fat body

E. Collateral glands

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

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

Solution:
Excretion in cockroaches is carried out by the ureose glands, nephrocytes, and the fat body.

Quick Tip

Insects have specialized excretory systems that allow them to conserve water and remove waste efficiently.

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194. The unique mammalian characteristics are:

(1) Pinna, monocondylic skull and mammary glands
(2) Hairs, tympanic membrane and mammary glands
(3) Hairs, pinna and mammary glands
(4) Hairs, pinna and indirect development

Correct Answer: (3) Hairs, pinna and mammary glands

Solution:
Mammals are unique in having hairs, pinna (external ear), and mammary glands, which are characteristic features.

Quick Tip

Focus on the key characteristics that distinguish mammals from other vertebrates for better understanding of mammalian biology.

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195. Match List I with List II:

List I List II

List I	List II
$A. Logistic growth$	$I. Unlimited resource availability conditi$
$B. Exponential growth$	$II. Limited resource availability conditi$
$C. Expanding age pyramid$	$III. The percent individuals of pre-reproductive age is largest followed by repr$
$D. Stable age pyramid$	$IV. The percent individuals of pre-reproductive and reprodu$

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

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

Solution:
- Logistic growth happens under limited resources (A-II).
- Exponential growth happens under unlimited resources (B-I).

- Expanding age pyramids show more individuals in pre-reproductive age (C-III).
- Stable age pyramids have an equal proportion of individuals in reproductive and post-reproductive ages (D-IV).

Quick Tip

Understand the different types of population growth models and how they relate to age pyramids for better understanding of population ecology.

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196. 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 gill slits.
D. Presence of dorsal heart.
E. Triploblastic pseudocoelomate animals.

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

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

Solution:
- The presence of a dorsal nerve cord, paired pharyngeal slits, and a dorsal heart are characteristic features of chordates.
- Chordates generally do not exhibit pseudocoelomate structures, so E is not correct.

Quick Tip

Focus on the defining characteristics of chordates when studying their classification and distinguishing them from other phyla.

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197. 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) C and D only
(2) A, B and C only
(3) B and C only
(4) A, C and D only

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

Solution:
- Muscle bundles are indeed held together by connective tissue (A).
- Sarcoplasmic reticulum stores calcium ions (B).
- Striated appearance is due to actin and myosin protein arrangement (C).
- M line is the functional unit of muscle contraction, the sarcomere (D).

Quick Tip

For understanding muscle contraction, focus on the structure of sarcomeres and the roles of actin and myosin.

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198. Select the correct statements.

A. Tetrad formation is seen during Leptotene.
B. During Anaphase, the centromeres split and chromatids separate.
C. Terminalization takes place during Pachytene.
D. Nucleolus, Golgi complex and ER are reformed during Telophase.
E. Crossing over takes place between sister chromatids of homologous chromosome.

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

Correct Answer: (1) B and E only

Solution:
- Tetrad formation happens during Prophase I, not Leptotene, so A is incorrect.
- During Anaphase, the centromeres split and chromatids separate (B).
- Terminalization happens during Pachytene (C) and crossing over occurs between homologous chromosomes, not sister chromatids (E).

Quick Tip

Understanding the stages of meiosis and their key events helps in distinguishing different processes of cell division.

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199. Which of the following statements are correct?

A. An excessive loss of body fluid from the body switches off osmoreceptors.
B. ADH facilitates water reabsorption to prevent diuresis.
C. ANF causes vasodilation.
D. ADH causes increase in blood pressure.
E. ADH is responsible for decrease in GFR.

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

Correct Answer: (3) B and C only

Solution:
- ADH (Antidiuretic hormone) helps prevent diuresis by promoting water reabsorption in the kidneys (B).
- ANF (Atrial natriuretic factor) does cause vasodilation (C).
- Excessive loss of body fluid doesn't turn off osmoreceptors, it leads to an increase in ADH secretion, so A is incorrect.

Quick Tip

Understand the roles of hormones like ADH and ANF in fluid balance and blood pressure regulation.

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200. 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) Statement I is incorrect but Statement II is correct.
(2) Both Statement I and Statement II are correct.
(3) Both Statement I and Statement II are incorrect.
(4) Statement I is correct but Statement II is incorrect.

Correct Answer: (1) Statement I is incorrect but Statement II is correct.

Solution:
- Statement I: During G0 phase, the cell is metabolically active, but it does not divide. So, Statement I is incorrect.
- Statement II: The centrosome undergoes duplication during the S phase of interphase, which is correct.

Quick Tip

Understanding the phases of the cell cycle is crucial for grasping how cells divide and what happens during each phase.
