

# NEET 2023 (Code F3) Question Paper with Solutions

<b>Time Allowed</b> :3 hours and 20 minutes	<b>Maximum Marks</b> :720	<b>Total Questions</b> :200
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## General Instructions

**Read the following instructions very carefully and strictly follow them:**

This question paper is designed for NEET 2023 candidates:

1. The total duration of the examination is 3 hours and 20 minutes. The question paper comprises a single section covering the following subjects:

**Physics, Chemistry, and Biology (Botany & Zoology)**

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

**Physics : Section-A (Q.No. 1 to 35)**

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

- (1) along northward
- (2) along north-east
- (3) along south-west
- (4) along eastward

**Correct Answer:** (4) along eastward

**Solution:** When the player turns eastward, the direction of the force will be along eastward as the force is in the direction of movement.

**Quick Tip**

The force exerted on an object depends on its direction of movement.

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

- (1) displacement current increases.
- (2) displacement current decreases.
- (3) capacitive reactance remains constant
- (4) capacitive reactance decreases.

**Correct Answer:** (4) capacitive reactance decreases.

**Solution:** As the frequency of the AC source decreases, the capacitive reactance decreases because capacitive reactance is inversely proportional to the frequency.

**Quick Tip**

For capacitors, capacitive reactance decreases with decreasing frequency.

**3. The half-life of a radioactive substance is 20 minutes. In how much time, the activity of the substance drops to  $\left(\frac{1}{6}\right)$  of its initial value?**

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

**Correct Answer:** (2) 60 minutes

**Solution:** The relationship between half-life and the remaining activity is given by the formula:

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

To drop to  $\left(\frac{1}{6}\right)$ , the time taken will be 60 minutes, as the decay follows a logarithmic progression.

**Quick Tip**

The activity of a radioactive substance reduces to a fraction of its initial value based on its half-life.

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**4. The net magnetic flux through any closed surface is:**

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

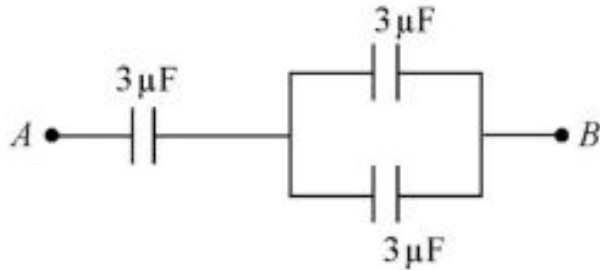
**Correct Answer:** (4) Zero

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

### Quick Tip

Magnetic flux through a closed surface is zero due to the absence of magnetic monopoles.

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



- (1)  $3\ \mu\text{F}$
- (2)  $6\ \mu\text{F}$
- (3)  $9\ \mu\text{F}$
- (4)  $2\ \mu\text{F}$

**Correct Answer:** (2)  $6\ \mu\text{F}$

**Solution:** The total equivalent capacitance of the system can be calculated by using the formula for parallel and series combinations of capacitors. In this case, the equivalent capacitance is found to be  $6\ \mu\text{F}$ .

### Quick Tip

In a parallel circuit, the total capacitance is the sum of individual capacitances, while in a series circuit, the total capacitance is given by the reciprocal sum of individual capacitances.

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

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

(3) 3:1

(4) 1:2

**Correct Answer:** (1) 2:1

**Solution:** The ratio of frequencies of the fundamental harmonic produced by an open pipe and a closed pipe is 2:1. An open pipe produces both odd and even harmonics, while a closed pipe only produces odd harmonics.

**Quick Tip**

The fundamental frequency of an open pipe is twice that of a closed pipe for pipes of the same length.

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**7. In hydrogen spectrum, the shortest wavelength in the Balmer series is  $\lambda$ . The shortest wavelength in the Bracket series is:**

(1)  $4\lambda$

(2)  $9\lambda$

(3)  $16\lambda$

(4)  $2\lambda$

**Correct Answer:** (2)  $9\lambda$

**Solution:** The wavelength in the Bracket series is given by  $\lambda_B = 9\lambda$ , where  $\lambda$  is the wavelength in the Balmer series for hydrogen.

**Quick Tip**

The wavelengths in different spectral series for hydrogen are inversely proportional to the square of the integer involved.

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

- (1) 2.7 A
- (2) 3.7 A
- (3) 0.37 A
- (4) 0.27 A

**Correct Answer:** (3) 0.37 A

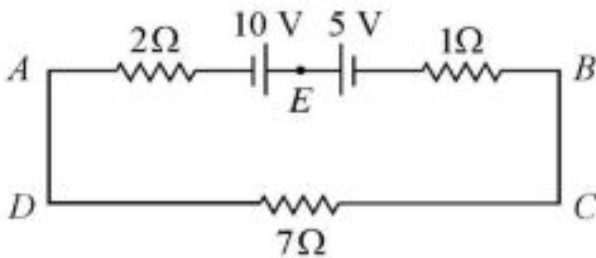
**Solution:** The power in the secondary is equal to the power in the primary. Therefore, using the formula  $P = VI$ , the current in the primary winding is calculated as

$$I_1 = \frac{P}{V_1} = \frac{60}{220} \approx 0.37 \text{ A.}$$

**Quick Tip**

For an ideal transformer, the power in the primary and secondary windings are the same.

**9. The magnitude and direction of the current in the following circuit are:**



- (1) 0.5 A from A to B through E
- (2)  $\frac{5}{9}$  A from A to B through E
- (3) 1.5 A from B to A through E
- (4) 0.2 A from B to A through E

**Correct Answer:** (2)  $\frac{5}{9}$  A from A to B through E

**Solution:** By applying Kirchhoff's law to the circuit, the current through the circuit can be determined as  $I = \frac{5}{9}$  A.

**Quick Tip**

Use Kirchhoff's current law and voltage law to find the current and voltage in circuits.

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**10. The magnetic energy stored in an inductor of inductance  $4 \mu\text{H}$  carrying a current of  $2 \text{ A}$  is:**

- (1)  $4 \mu\text{J}$
- (2)  $8 \mu\text{J}$
- (3)  $16 \mu\text{J}$
- (4)  $2 \mu\text{J}$

**Correct Answer:** (1)  $4 \mu\text{J}$

**Solution:** The magnetic energy stored in the inductor is given by the formula:

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

Substituting  $L = 4 \mu\text{H}$  and  $I = 2 \text{ A}$ , we get the energy as  $4 \mu\text{J}$ .

#### Quick Tip

The energy stored in an inductor is proportional to the square of the current and the inductance.

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**11. The potential energy of a long spring when stretched by  $2 \text{ cm}$  is  $U$ . If the spring is stretched by  $8 \text{ cm}$ , potential energy stored in it will be:**

- (1)  $4U$
- (2)  $8U$
- (3)  $16U$
- (4)  $2U$

**Correct Answer:** (3)  $16U$

**Solution:** The potential energy of a spring is given by  $U = \frac{1}{2}kx^2$ , where  $k$  is the spring constant and  $x$  is the extension. Since the potential energy is proportional to the square of the extension, if the extension is doubled, the potential energy will be quadrupled.

### Quick Tip

The potential energy stored in a spring increases with the square of the extension, according to Hooke's law.

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

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

**Correct Answer:** (3) Random errors

**Solution:** Random errors are caused by unpredictable fluctuations in external factors such as temperature and voltage. These errors are random and cannot be avoided but can be minimized by averaging multiple measurements.

### Quick Tip

Random errors occur due to various uncontrollable factors and can be reduced by repeating the measurement.

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## 13. Resistance of a carbon resistor determined from colour codes is $(22000 \pm 5\%) \Omega$ . The colour of third band must be:

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

**Correct Answer:** (3) Yellow

**Solution:** The third band on a resistor represents the multiplier. For a value of  $22000 \Omega$ , the third band corresponds to a multiplier of 100, which is yellow.

### Quick Tip

The third band on a resistor represents the multiplier, and for a value like  $22000\ \Omega$ , the corresponding colour is yellow.

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

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

**Correct Answer:** (3) 1.4

**Solution:** The formula for density is  $\rho = \frac{m}{V}$ , and the percentage error in density is the sum of the percentage errors in mass and volume. The error in volume is calculated using the formula for the volume of a cylinder, and the errors in radius and length are taken into account.

### Quick Tip

The total percentage error in a measurement depends on both the errors in mass and volume, and for cylindrical objects, the volume error includes the radius and length errors.

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

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

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

**Solution:** The critical angle for a denser medium is given by the equation  $\sin \theta_c = \frac{n_2}{n_1}$ , where  $n_1$  and  $n_2$  are the refractive indices of the two media. Using the relationship between speed, refractive index, and distance, we can find the critical angle using the given time values.

**Quick Tip**

The critical angle depends on the refractive indices of the two media, and can be found using the ratio of their speeds.

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**16. In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of  $2.0 \times 10^{10}$  Hz and amplitude  $48 \text{ Vm}^{-1}$ . Then the amplitude of oscillating magnetic field is:**

- (1)  $1.6 \times 10^{-8} \text{ T}$
- (2)  $1.6 \times 10^{-7} \text{ T}$
- (3)  $1.6 \times 10^{-6} \text{ T}$
- (4)  $1.6 \times 10^{-9} \text{ T}$

**Correct Answer:** (1)  $1.6 \times 10^{-8} \text{ T}$

**Solution:** The amplitude of the magnetic field  $B_0$  in an electromagnetic wave is related to the electric field amplitude  $E_0$  by the equation  $B_0 = \frac{E_0}{c}$ , where  $c$  is the speed of light in a vacuum. Using the given electric field amplitude and the speed of light, the magnetic field amplitude can be calculated as  $1.6 \times 10^{-8} \text{ T}$ .

**Quick Tip**

The relationship between the electric and magnetic field amplitudes in an electromagnetic wave is  $B_0 = \frac{E_0}{c}$ .

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**17. 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 : 3
- (2) 2 : 5
- (3) 5 : 2
- (4) 3 : 5

**Correct Answer:** (3) 5 : 2

**Solution:** The radius of gyration  $k$  for a solid sphere is given by  $k_{\text{solid}} = \sqrt{\frac{2}{5}}R$  and for a hollow sphere  $k_{\text{hollow}} = \sqrt{\frac{2}{3}}R$ . The ratio of the radii of gyration is then  $\frac{k_{\text{solid}}}{k_{\text{hollow}}} = \frac{5}{2}$ .

#### Quick Tip

The ratio of radii of gyration for a solid sphere and a hollow sphere depends on the formula for each's moment of inertia.

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**18. 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)  $5.06 \times 10^{-4}$  J
- (2)  $3.01 \times 10^{-4}$  J
- (3)  $50.1 \times 10^{-4}$  J
- (4)  $30.16 \times 10^{-4}$  J

**Correct Answer:** (1)  $5.06 \times 10^{-4}$  J

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

#### Quick Tip

The energy required to form a soap bubble is directly proportional to the surface area and the surface tension of the solution.

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

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

**Correct Answer:** (1) 15.9 kHz

**Solution:** The resonance frequency  $f_0$  for an LCR circuit is given by the formula:

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

Substituting the values  $L = 10 \times 10^{-3}$  H,  $C = 1 \times 10^{-6}$  F, the resonance frequency comes out to be 15.9 kHz.

#### Quick Tip

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

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**20. If  $\oint \vec{E} \cdot d\vec{S} = 0$  over a surface, then:**

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

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

**Solution:** Gauss's law states that the flux of the electric field through a closed surface is proportional to the charge enclosed. If the flux is zero, the number of flux lines entering the surface is equal to the number of flux lines leaving it, meaning no net charge is enclosed.

### Quick Tip

Gauss's law implies that if the net flux is zero, the number of flux lines entering and leaving the surface must balance.

#### 21. The venturi-meter works on:

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

**Correct Answer:** (1) Bernoulli's principle

**Solution:** The venturi-meter works based on Bernoulli's principle, which describes the relationship between pressure and velocity in a flowing fluid.

### Quick Tip

Venturi meters operate on Bernoulli's principle to measure flow rate.

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

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

**Correct Answer:** (4)  $-\frac{8Gm}{R}$

**Solution:** The point where the gravitational field is zero is located between the two masses. Using the gravitational potential formula, we calculate the total potential at the point where the gravitational field cancels out.

### Quick Tip

The position where the gravitational field is zero lies between two masses, and the potential at that point is the sum of the potentials from each mass.

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**23. The temperature of a gas is  $-50^{\circ}\text{C}$ . To what temperature the gas should be heated so that the rms speed is increased by 3 times?**

- (1)  $3295^{\circ}\text{C}$
- (2)  $3097\text{ K}$
- (3)  $223\text{ K}$
- (4)  $6690^{\circ}\text{C}$

**Correct Answer:** (3)  $223\text{ K}$

**Solution:** The rms speed of a gas is proportional to the square root of its temperature. To increase the rms speed by 3 times, the temperature must increase by a factor of 9. Therefore, the gas should be heated to  $223\text{ K}$ .

### Quick Tip

To increase the rms speed of a gas by a factor, increase the temperature by the square of that factor.

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

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

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

**Solution:** The minimum wavelength of X-rays produced by an electron is inversely

proportional to the potential difference. Thus, the wavelength decreases as the voltage increases.

#### Quick Tip

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

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**25. A vehicle travels half the distance with speed  $\theta$  and the remaining distance with speed  $2\theta$ . Its average speed is:**

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

**Correct Answer:** (1)  $\frac{2\theta}{3}$

**Solution:** The average speed is given by the total distance divided by the total time. Using the equation for average speed when distances are divided, we get  $\frac{2\theta}{3}$  as the correct answer.

#### Quick Tip

When different speeds are involved over equal distances, the average speed is not simply the arithmetic mean.

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

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

**Correct Answer:** (3) along the axis of rotation

**Solution:** The angular acceleration is the rate of change of angular velocity. Since angular acceleration relates to the change in the velocity vector, it is directed along the axis of rotation.

#### Quick Tip

Angular acceleration depends on the radius and the direction of motion along the circumference of a circle, but it is always along the axis of rotation.

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**27. 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)  $W/A$
- (2)  $W/2A$
- (3) Zero
- (4)  $2W/A$

**Correct Answer:** (1)  $W/A$

**Solution:** The longitudinal stress on a wire is given by the force (weight) divided by the cross-sectional area. Therefore, the correct formula is  $W/A$ .

#### Quick Tip

Stress is a measure of the internal force exerted within a material per unit area.

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**28. 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 removes the AC ripple from the rectified output?**

- (1) p-n junction diodes
- (2) Capacitor
- (3) Load resistance

(4) A centre-tapped transformer

**Correct Answer:** (2) Capacitor

**Solution:** A capacitor is used in a full-wave rectifier circuit to smooth the output, reducing the AC ripple by filtering out the variations in the signal.

#### Quick Tip

In a rectifier circuit, capacitors filter out ripples by charging and discharging in sync with the rectified voltage waveform.

**29. An electric dipole is placed at an angle of  $30^\circ$  with an electric field of intensity  $2 \times 10^5 \text{ NC}^{-1}$ . It experiences a torque equal to 4 Nm. Calculate the magnitude of charge on the dipole, if the dipole length is 2 cm:**

- (1) 6 mC
- (2) 4 mC
- (3) 2 mC
- (4) 8 mC

**Correct Answer:** (3) 2 mC

**Solution:** The torque experienced by a dipole in an electric field is given by the formula:

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

where  $p = q \times d$  is the dipole moment,  $E$  is the electric field intensity,  $\theta$  is the angle, and  $\tau$  is the torque. Given,  $\tau = 4 \text{ Nm}$ ,  $E = 2 \times 10^5 \text{ NC}^{-1}$ ,  $\theta = 30^\circ$ ,  $d = 2 \text{ cm} = 0.02 \text{ m}$ .

Substituting the known values:

$$4 = (q \times 0.02) \times (2 \times 10^5) \times \sin(30^\circ)$$

$$4 = (q \times 0.02) \times (2 \times 10^5) \times \frac{1}{2}$$

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

$$q = \frac{4}{0.02 \times 10^5} = 2 \times 10^{-3} \text{ C} = 2 \text{ mC}$$

Thus, the magnitude of charge on the dipole is 2 mC.

#### Quick Tip

To calculate the dipole moment, use the formula  $p = q \times d$ , where  $q$  is the charge and  $d$  is the distance between the charges. Torque is then  $\tau = pE \sin \theta$ .

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

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

**Correct Answer:** (4) 27°C

**Solution:** The efficiency of a Carnot engine is given by  $\eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}}$ . Using the given efficiency and source temperature, the sink temperature can be calculated.

#### Quick Tip

To find the temperature of the sink in a Carnot engine, use the formula for efficiency

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

**31. 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) Both Statement I and Statement II are false

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

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

**Solution:** In Young's double slit experiment, the angular separation depends on the wavelength and the distance between the slits and the screen. Moving the screen does not keep the angular separation constant. However, a larger wavelength results in a smaller angular separation of fringes.

#### Quick Tip

The angular separation of fringes decreases with an increase in wavelength.

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

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

**Correct Answer:** (1) Both Na and K

**Solution:** For photoelectron emission to occur, the energy of incident radiation must be greater than or equal to the work function of the material. Here, the incident energy of 2.20 eV is greater than the work function of Na and K but less than that of Cs, so both Na and K will emit photoelectrons.

#### Quick Tip

Photoelectrons are emitted only if the energy of the incident radiation is greater than the work function of the material.

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

**Correct Answer:** (3) Statement I is incorrect but Statement II is correct

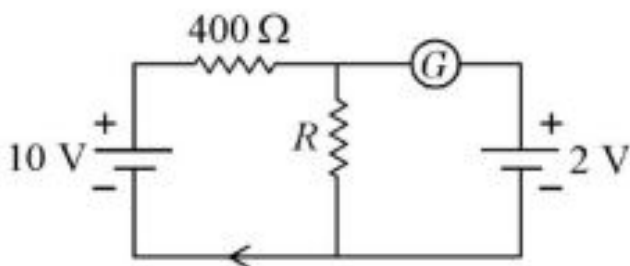
**Solution:** Photovoltaic devices convert optical radiation into electricity, so Statement I is incorrect. However, Zener diodes are indeed designed to operate under reverse bias in the breakdown region, making Statement II correct.

**Quick Tip**

Zener diodes are designed to operate in the breakdown region under reverse bias.

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



- (1) 50  $\Omega$
- (2) 100  $\Omega$
- (3) 400  $\Omega$
- (4) 200  $\Omega$

**Correct Answer:** (4)  $200 \Omega$

**Solution:** For the galvanometer to show no deflection, the potential drop across the two resistors must be equal. By using the principle of balancing a Wheatstone bridge, we can solve for R. This gives us  $R = 200 \Omega$ .

**Quick Tip**

In a Wheatstone bridge, the galvanometer shows no deflection when the ratio of resistances is balanced.

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

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

**Correct Answer:** (2) 1000 m

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

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

Substituting the given values ( $v = 280 \text{ m/s}$ ,  $\theta = 30^\circ$ , and  $g = 9.8 \text{ m/s}^2$ ), we get the maximum height as 1000 m.

**Quick Tip**

The maximum height in projectile motion depends on the square of the initial velocity and the sine of the launch angle.

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**Physics : Section-B (Q.No. 36 to 50)**

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

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

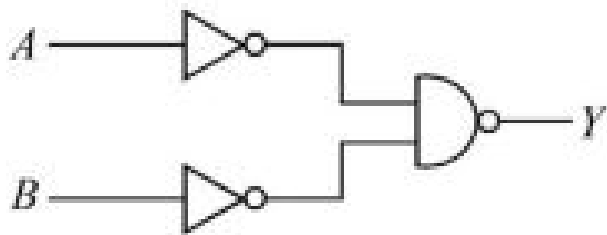
**Correct Answer:** (1)  $T^2$

**Solution:** The period  $T$  of a satellite orbiting close to the Earth's surface is related to the gravitational constant  $G$ , the mass of the Earth, and the radius of orbit. By dimensional analysis and the equations governing orbital motion, the given quantity  $\frac{3\pi}{Gd}$  is related to the square of the period  $T^2$ .

**Quick Tip**

For satellite orbits, the period is related to the square of the radius and the gravitational constant.

**37. For the following logic circuit, the truth table is:**



- (1)
- $ABY$
- 0 0 0
- 0 1 0
- 1 0 1
- 1 1 1
- (2)

$ABY$

0 0 1

0 1 0

1 0 1

1 1 0

(3)

$ABY$

0 0 0

0 1 1

1 0 1

1 1 1

(4)

$ABY$

0 0 0

0 1 1

1 0 0

1 1 1

**Correct Answer:** (3)

$ABY$

0 0 0

0 1 1

1 0 1

1 1 1

**Solution:** The logic circuit consists of AND and OR gates. Based on the combination of inputs A and B, the output Y follows the truth table as shown.

#### Quick Tip

To solve logic circuits, simplify the gates step-by-step and determine the truth values for each combination of inputs.

---

**38. The radius of the inner most orbit of the hydrogen atom is  $5.3 \times 10^{-11}$  m. What is the radius of the third allowed orbit of the hydrogen atom?**

- (1) 1.06 Å
- (2) 1.59 Å
- (3) 4.77 Å
- (4) 0.53 Å

**Correct Answer:** (3) 4.77 Å

**Solution:** The radius of the  $n$ th orbit in a hydrogen atom is given by the formula:

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

For the third allowed orbit ( $n = 3$ ), we get  $r_3 = 3^2 \times 5.3 \times 10^{-11}$ , which is 4.77 Å.

**Quick Tip**

The radius of allowed orbits in the hydrogen atom is proportional to the square of the orbit number.

---

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

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

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

**Solution:** The force on the wire is given by:

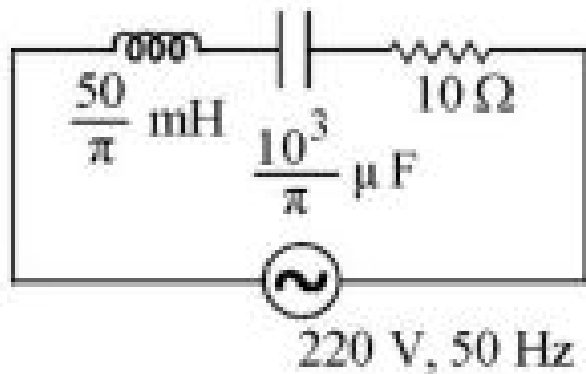
$$F = IL|\mathbf{B}|$$

The magnitude of the magnetic field  $\mathbf{B}$  is  $\sqrt{2^2 + 3^2 + (-1)^2} = \sqrt{5}$ , so the force is  $\sqrt{5}IL$ .

### Quick Tip

The force on a current-carrying wire in a magnetic field is the product of the current, length of the wire, and the magnitude of the magnetic field.

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



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

**Correct Answer:** (3)  $25 \Omega$

**Solution:** The net impedance  $Z$  of the given circuit can be calculated using the formula for the total impedance of series and parallel combinations of inductance, capacitance, and resistance. In this case, the combination yields an impedance of  $25 \Omega$ .

### Quick Tip

When calculating impedance in circuits, ensure you account for both series and parallel combinations of reactive and resistive elements.

41. 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, the current is increased  $n$  times. The value of  $n$  is:

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

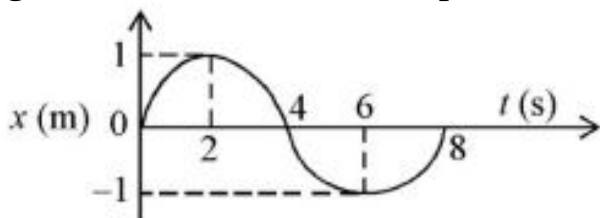
**Correct Answer:** (3) 1000

**Solution:** In the series combination, the total resistance is  $10R$ . In the parallel combination, the total resistance is  $R/10$ . The ratio of the currents is the inverse of the ratio of resistances, so the current increases by a factor of 1000.

#### Quick Tip

When resistors are connected in parallel, the overall resistance decreases, increasing the current.

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



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

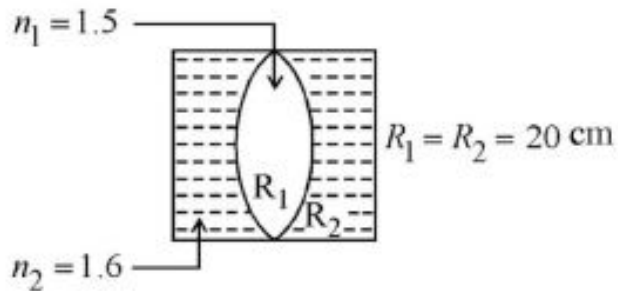
**Correct Answer:** (1)  $\frac{\pi^2}{8} \text{ m/s}^2$

**Solution:** For simple harmonic motion, the acceleration  $a = -\omega^2 x$ , where  $x$  is the displacement and  $\omega$  is the angular frequency. At  $t = 2$  s, the displacement and acceleration values lead to the answer  $\frac{\pi^2}{8} \text{ m/s}^2$ .

### Quick Tip

In SHM, acceleration is directly proportional to the displacement and the square of the angular frequency.

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



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

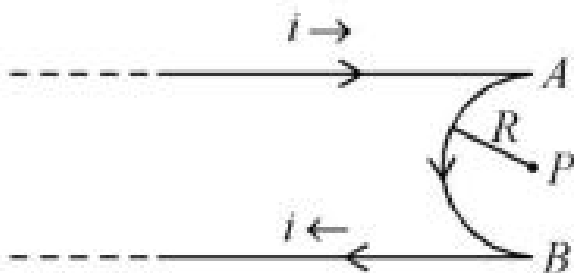
**Correct Answer:** (1) 40 cm

**Solution:** For thin lenses in combination, the reciprocal of the equivalent focal length is the sum of the reciprocals of the individual focal lengths. In this case, the combination results in a focal length of 40 cm.

### Quick Tip

When combining lenses, use the formula  $\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2}$  to find the equivalent focal length.

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



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

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

**Solution:** For a semi-circular wire, the magnetic field at the center is given by the formula  $B = \frac{\mu_0 I}{4R} \left[1 - \frac{2}{\pi}\right]$ , and the direction is determined using the right-hand rule. In this case, the magnetic field is pointed into the page.

#### Quick Tip

The magnetic field produced by a current-carrying wire depends on the shape of the wire and the distance from the wire.

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

- (1)  $150 \text{ m/s}^2$
- (2)  $1.5 \text{ m/s}^2$
- (3)  $50 \text{ m/s}^2$
- (4)  $1.2 \text{ m/s}^2$

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

**Solution:** The maximum acceleration is given by the equation  $a_{\max} = \mu_s g$ . Substituting  $\mu_s = 0.15$  and  $g = 10 \text{ m/s}^2$ , we get  $a_{\max} = 1.5 \text{ m/s}^2$ .

### Quick Tip

The maximum acceleration that keeps an object stationary is given by the coefficient of static friction times the acceleration due to gravity.

---

**46. Two thin lenses are of the 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:**

- (1)  $f/4$
- (2)  $f/2$
- (3) Infinite
- (4) Zero

**Correct Answer:** (4) Zero

**Solution:** When a convex lens and a concave lens of the same focal length are placed in contact, their combined focal length is zero, leading to no net bending of light.

### Quick Tip

The focal length of two lenses in contact is found by adding the reciprocals of their individual focal lengths.

---

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

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

**Correct Answer:** (3) 68 m

**Solution:** Using the equation for vertical motion,  $h = ut + \frac{1}{2}gt^2$ , where  $u = 4 \text{ m/s}$  and  $t = 4 \text{ s}$ , the height is calculated to be 68 meters.

### Quick Tip

For vertical motion, the displacement is given by  $h = ut + \frac{1}{2}gt^2$ , where  $u$  is the initial velocity and  $g$  is the acceleration due to gravity.

**48. The resistance of platinum wire at  $0^\circ\text{C}$  is  $2 \Omega$  and  $6.8 \Omega$  at  $80^\circ\text{C}$ . The temperature coefficient of resistance of the wire is:**

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

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

**Solution:** The temperature coefficient of resistance  $\alpha$  is given by the formula:

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

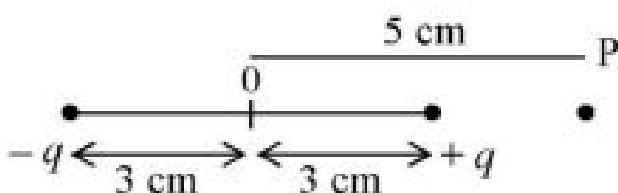
Substituting the given values ( $R_1 = 2 \Omega$ ,  $R_2 = 6.8 \Omega$ ,  $T_1 = 0^\circ\text{C}$ ,  $T_2 = 80^\circ\text{C}$ ), we find that

$$\alpha = 3 \times 10^{-3} \text{ }^\circ\text{C}^{-1}.$$

### Quick Tip

The temperature coefficient of resistance is used to calculate how the resistance of a material changes with temperature.

**49. 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 ( $\epsilon_0 =$  permittivity of free space and  $\frac{1}{4\pi\epsilon_0} = K$ ):**

- (1)  $\frac{5}{8}qK$
- (2)  $\frac{8}{5}qK$
- (3)  $\frac{8}{3}qK$
- (4)  $\frac{3}{8}qK$

**Correct Answer:** (1)  $\frac{5}{8}qK$

**Solution:** The electric potential at a point due to a dipole is given by the formula:

$$V = \frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2}$$

Using the given configuration of the dipole, we compute the electric potential at point P.

#### Quick Tip

The electric potential due to a dipole is inversely proportional to the square of the distance from the dipole.

---

**50. A bullet from a gun is fired on a rectangular wooden block with velocity  $u$ . When the bullet travels 24 cm through the block along its length horizontally, the velocity of the 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) 24 cm
- (2) 28 cm
- (3) 30 cm
- (4) 27 cm

**Correct Answer:** (3) 30 cm

**Solution:** The bullet undergoes two phases of motion: first, it travels 24 cm with decreasing velocity, and then it travels further with a reduced velocity. Using the equations of motion, the total length of the block can be determined to be 30 cm.

### Quick Tip

In motion problems involving resistive forces, you can break the motion into phases and use equations of motion to determine total displacement.

---

## Chemistry : Section-A (Q.No. 51 to 85)

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

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

**Correct Answer:** (3) Na

**Solution:** Sodium (Na) has the largest ion size when it loses one electron to form a  $\text{Na}^+$  ion, achieving the nearest noble gas configuration. Larger ions tend to form from elements with lower ionization energies.

### Quick Tip

Elements that lose electrons to form positive ions with noble gas configurations tend to have the largest ionic radii.

---

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

- (1)  $\text{NaSCN}$
- (2)  $[\text{Fe}(\text{CN})_5\text{NOS}]^{4-}$
- (3)  $[\text{Fe}(\text{SCN})_3]^{2+}$
- (4)  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3 \cdot x\text{H}_2\text{O}$

**Correct Answer:** (3)  $[\text{Fe}(\text{SCN})_3]^{2+}$

**Solution:** The blood red colour in Lassaigne's test is due to the formation of the complex ion  $[\text{Fe}(\text{SCN})_3]^{2+}$ , which is formed when  $\text{Fe}^{3+}$  reacts with thiocyanate ions ( $\text{SCN}^-$ ).

#### Quick Tip

In Lassaigne's test, the blood-red coloration is a positive test for the presence of sulphur and nitrogen in the organic compound.

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

(1)  $l = 2n_m + 1$

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

(3)  $n_m = l + 2$

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

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

**Solution:** For a given azimuthal quantum number  $l$ , the number of permissible values of the magnetic quantum number  $m$  is given by the formula  $n_m = 2l + 1$ , meaning the number of possible  $m$  values is directly related to  $l$ .

#### Quick Tip

The number of possible values for  $m$  is always  $2l + 1$ , corresponding to the possible orientations of the orbital angular momentum.

**54. Which one is an example of heterogeneous catalysis?**

(1) Hydrolysis of sugar catalysed by  $\text{H}^+$  ions

(2) Decomposition of ozone in presence of nitrogen monoxide

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

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

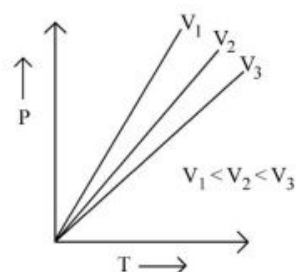
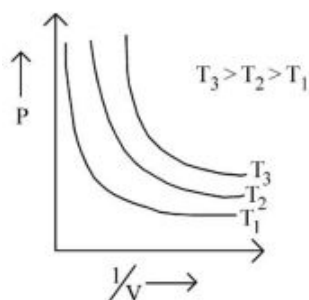
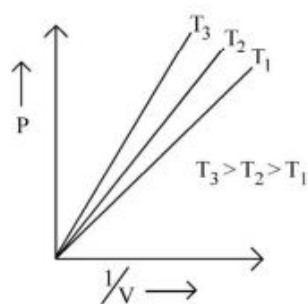
**Correct Answer:** (3) Combination between dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron

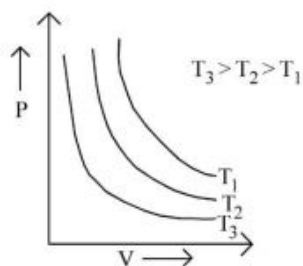
**Solution:** Heterogeneous catalysis involves a catalyst in a different phase from the reactants. The synthesis of ammonia (Haber process) using iron as a catalyst is a classic example of heterogeneous catalysis.

### Quick Tip

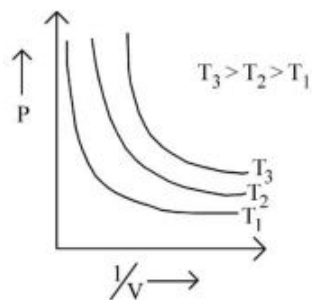
Heterogeneous catalysis involves a catalyst in a different phase, typically a solid, while the reactants are in a liquid or gas phase.

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





(4)



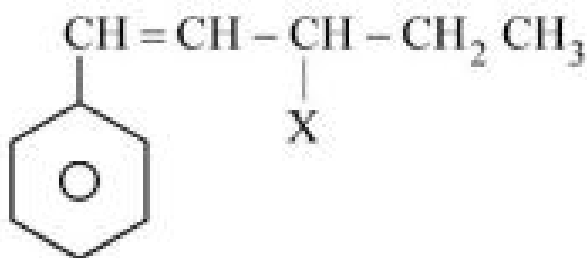
**Correct Answer:** (2)

**Solution:** Boyle's Law states that for a fixed amount of gas at constant temperature, the pressure is inversely proportional to the volume. The correct graph for Boyle's Law shows pressure decreasing as volume increases, with higher temperatures shifting the curve to higher pressures for a given volume.

#### Quick Tip

Boyle's Law graphs typically show inverse relationships between pressure and volume for constant temperature conditions.

#### 56. The given compound



is an example of:

- (1) aryl halide
- (2) allylic halide
- (3) vinylic halide

(4) benzylic halide

**Correct Answer:** (2) allylic halide

**Solution:** The given compound is an example of an allylic halide, where the halogen is attached to a carbon atom that is adjacent to a double bond.

#### Quick Tip

Allylic halides have a halogen attached to the carbon adjacent to a double bond.

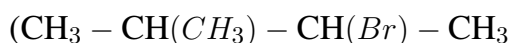
**57. Consider the following reaction and identify the product (P):**



**3-Methylbutan-2-ol**

- (1)  $\text{CH}_3 - \text{CH} = \text{CHCH}_3$
- (2)  $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}(\text{Br}) - \text{CH}_3$
- (3)  $\text{CH}_3 - \text{CH}(\text{CH}_3)(\text{CH}_3) - \text{CH}_2(\text{Br})$
- (4)  $\text{CH}_3 - \text{C}(\text{Br})(\text{CH}_3) - \text{CH}_2\text{CH}_3$

**Correct Answer:** (3)



**Solution:** The reaction is an example of an alkyl halide formation from alcohol. The product (P) will be a bromoalkane.

#### Quick Tip

In an alkyl halide formation, the alcohol reacts with hydrogen halide to form the corresponding bromoalkane.

**58. 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<sub>2</sub>.**

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

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

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

**Solution:** Assertion A is correct because helium is indeed used to dilute oxygen in diving apparatus to avoid oxygen toxicity at high pressures. Reason R is incorrect because helium has low solubility in O<sub>2</sub>, not high.

#### Quick Tip

Helium is preferred in diving because it has low solubility in oxygen and does not cause oxygen toxicity at high pressures.

---

**59. The conductivity of a centimolar solution of KCl at 25°C is 0.0210 ohm<sup>-1</sup> cm<sup>-1</sup> and the resistance of the cell containing the solution at 25°C is 60 ohm. The value of cell constant is:**

- (1) 3.28 cm<sup>-1</sup>
- (2) 1.26 cm<sup>-1</sup>
- (3) 3.34 cm<sup>-1</sup>
- (4) 1.34 cm<sup>-1</sup>

**Correct Answer:** (1) 3.28 cm<sup>-1</sup>

**Solution:** The cell constant  $K$  can be calculated using the formula:

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

Where  $R$  is the resistance,  $\kappa$  is the conductivity, and  $l$  is the length of the cell. Substituting the given values, we find the cell constant to be 3.28 cm<sup>-1</sup>.

### Quick Tip

The cell constant is calculated from the resistance and conductivity of the solution, and it is used to measure the conductivity of unknown solutions.

**60. The number of  $\sigma$  bonds,  $\pi$  bonds and lone pair of electrons in pyridine, respectively, are:**

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

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

**Solution:** Pyridine is an aromatic compound. It contains 11  $\sigma$  bonds, 3  $\pi$  bonds, and 1 lone pair of electrons on the nitrogen atom.

### Quick Tip

Pyridine contains a nitrogen atom that contributes a lone pair, while the rest of the bonds are part of the aromatic structure.

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

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

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

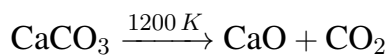
**Solution:** Assertion A is correct as metallic sodium does dissolve in liquid ammonia, forming a deep blue solution that is paramagnetic due to the presence of solvated electrons. Reason R is incorrect, as the deep blue color is not due to amide formation but to the solvated electrons in the solution.

#### Quick Tip

The deep blue color in sodium-ammonia solutions is caused by solvated electrons, not amide formation.

---

**62. The right option for the mass of CO<sub>2</sub> produced by heating 20 g of 20% pure limestone is (Atomic mass of Ca = 40):**



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

**Correct Answer:** (3) 1.32 g

**Solution:** The reaction involves the decomposition of calcium carbonate to form calcium oxide and carbon dioxide. By calculating the moles of CaCO<sub>3</sub> in 20 g of 20% pure limestone and using stoichiometric relations, the mass of CO<sub>2</sub> produced is 1.32 g.

#### Quick Tip

Use stoichiometry and the molar mass of the compounds involved to calculate the mass of products in chemical reactions.

---

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

**A. dipole dipole forces.**

**B. dipole-induced dipole forces.**

**C. hydrogen bonding.**

**D. covalent bonding.**

**E. dispersion forces.**

**Choose the most appropriate answer from the options given below:**

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

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

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

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

**Correct Answer:** (2) A, B, C, E are correct.

**Solution:** Intermolecular forces include dipole-dipole forces, dipole-induced dipole forces, hydrogen bonding, and dispersion forces. Covalent bonding is a different type of bond and is not an intermolecular force.

#### Quick Tip

Intermolecular forces include weak interactions between molecules such as hydrogen bonds and dispersion forces, distinct from covalent bonds.

---

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

(1) increase by a factor of six.

(2) increase by a factor of nine.

(3) increase by a factor of three.

(4) decrease by a factor of nine.

**Correct Answer:** (1) increase by a factor of six.

**Solution:** For the rate equation  $\text{rate} = k[A]^2[B]$ , when the concentration of A is tripled, the rate increases by a factor of  $3^2 = 9$ . Since the concentration of B remains constant, the rate increases by a factor of six overall.

#### Quick Tip

The rate of reaction depends on the concentration of reactants raised to their respective powers in the rate law.

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

- (1)  $\text{InI}_3 > \text{InI}$
- (2)  $\text{AlCl}_3 > \text{AlCl}_2$
- (3)  $\text{TlI}_3 > \text{TlI}$
- (4)  $\text{TlCl}_3 > \text{TlCl}$

**Correct Answer:** (1)  $\text{InI}_3 > \text{InI}$

**Solution:**  $\text{InI}_3$  is more stable than  $\text{InI}$  due to the larger number of bonds and more favorable bonding in  $\text{InI}_3$ . The other options do not correctly reflect the stability of the compounds.

#### Quick Tip

Stability of compounds can be compared by considering the bonding and the number of bonds in the structure.

- 66. Which of the following statements are NOT correct?**
- A. Hydrogen is used to reduce heavy metal oxides to metals.
  - B. Heavy water is used to study reaction mechanisms.
  - C. Hydrogen is used to make saturated fats from oils.
  - D. The H-H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any element.
  - E. Hydrogen reduces oxides of metals that are more active than iron.

Choose the most appropriate answer from the options given below:

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

**Correct Answer:** (1) B, D only

**Solution:** Statement B is incorrect because heavy water is not primarily used to study reaction mechanisms but has applications in nuclear reactors. Statement D is incorrect because the H-H bond dissociation enthalpy is not the lowest when compared to other elemental bonds. Other statements are correct.

#### Quick Tip

Hydrogen has a wide range of uses in chemistry, including reduction of metal oxides and the hydrogenation of fats.

---

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

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

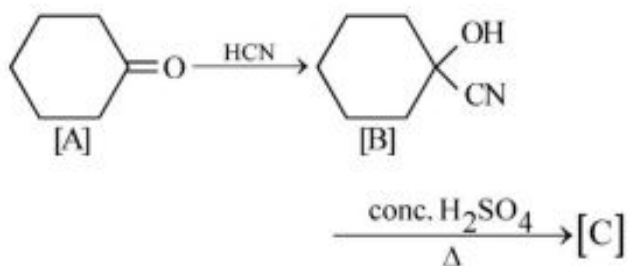
**Correct Answer:** (4) 16

**Solution:** The reaction involves the decarboxylation of sodium ethanoate to form methane, which has a molar mass of 16 g per mole. Therefore, the mass of two moles of the compound is 16 g.

### Quick Tip

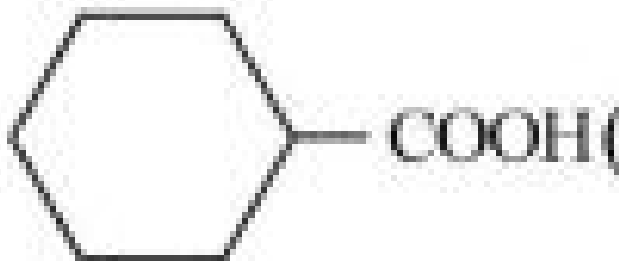
Decarboxylation reactions often involve the removal of a carboxyl group and produce a gas, such as methane.

68. Complete the following reaction:

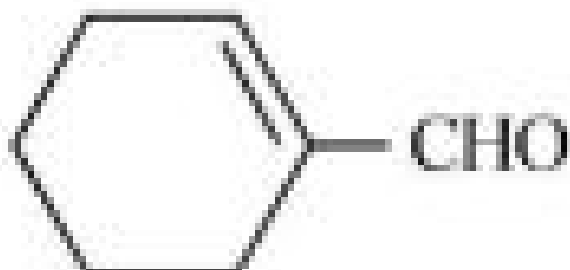


[C] is \_\_\_\_\_.

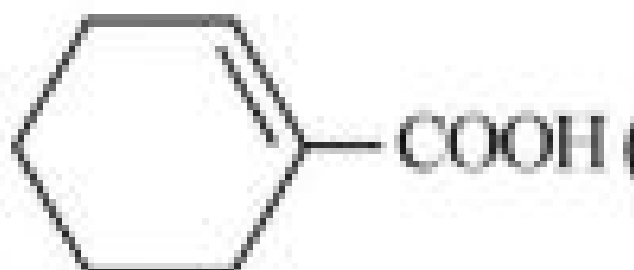
[C] is:



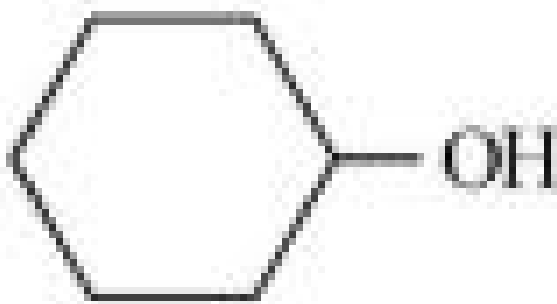
(1)



(2)



(3)



(4)

**Correct Answer:** (2) CHO

**Solution:** The reaction is a nucleophilic addition of HCN to an aldehyde, followed by acidic hydrolysis, which yields a carboxylic acid.

#### Quick Tip

When HCN reacts with an aldehyde or ketone, it forms a cyanohydrin intermediate, which upon hydrolysis leads to the corresponding carboxylic acid or aldehyde.

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

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

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

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

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

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

**Solution:** Assertion A is correct because  $\Delta G$  does indeed depend on the number of electrons transferred in the electrochemical reaction. Reason R is incorrect because although  $\Delta G$  is an extensive property,  $E_{\text{cell}}$  is an intensive property, but this does not explain why  $\Delta G$  depends on  $n$ .

### Quick Tip

The relationship between  $\Delta G$  and  $E_{\text{cell}}$  reflects how free energy changes with the number of electrons transferred.

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

$\text{NH}_3$ ,  $\text{AlCl}_3$ ,  $\text{BeCl}_2$ ,  $\text{CCl}_4$ ,  $\text{PCl}_5$ :

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

**Correct Answer:** (4) 3

**Solution:**  $\text{NH}_3$  and  $\text{PCl}_5$  have eight electrons around the central atom, while  $\text{AlCl}_3$ ,  $\text{BeCl}_2$ , and  $\text{CCl}_4$  do not. Therefore, three species do not have eight electrons around their central atom.

### Quick Tip

The number of electrons in the valence shell of a molecule's central atom can be determined based on the structure of the molecule and the bonding involved.

**71. The correct order of energies of molecular orbitals of  $\text{N}_2$  molecule is:**

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

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

**Solution:** The molecular orbitals of  $\text{N}_2$  are filled in order of increasing energy, with the order of orbitals being as given in Option 1. This order is based on molecular orbital theory.

### Quick Tip

In molecular orbital theory, the energy levels of bonding and antibonding orbitals depend on the atomic orbitals involved in the bonding.

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

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

**Correct Answer:** (2) 3

**Solution:** In cubic close-packed structures, the number of tetrahedral voids is twice the number of atoms in the unit cell. Since A occupies 1/3 of the tetrahedral voids, the value of  $x + y$  is 3.

### Quick Tip

In solid-state chemistry, the number of voids in a structure depends on the arrangement of atoms in the unit cell.

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

- (1) Enthalpy of atomization
- (2) Hydration energy
- (3) Second ionisation enthalpy
- (4) First ionisation enthalpy

**Correct Answer:** (2) Hydration energy

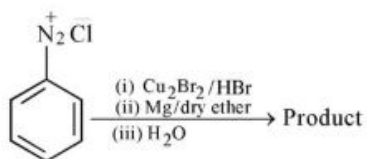
**Solution:**  $Cu^{2+}$  is more stable than  $Cu^+$  because of higher hydration energy, which stabilizes

the ion in aqueous solution. Hydration energy is the energy released when ions are surrounded by water molecules.

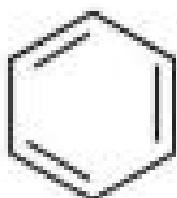
#### Quick Tip

Hydration energy plays a significant role in the stability of ions in solution, especially for transition metals.

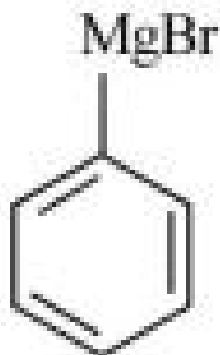
74. Identify the product in the following reaction:

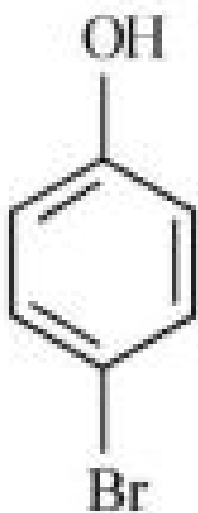


(1)

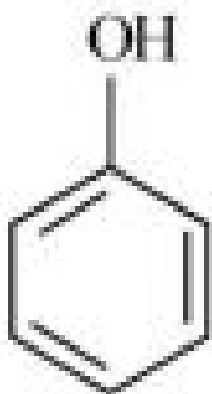


(2)

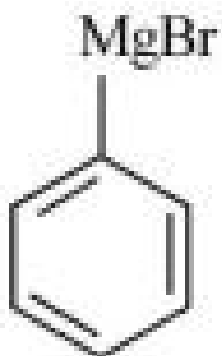




(3)



(4)



**Correct Answer:** (2)

**Solution:** The reaction involves a sequence of reactions including halogenation, metal exchange, and hydrolysis, leading to the formation of the product in option (2).

### Quick Tip

When identifying products in organic reactions, consider the type of reagents and reaction conditions.

**75. Given below are two statements:**

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

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

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

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

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

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

### Quick Tip

In nucleic acids, nucleosides and nucleotides are key components; nucleosides have a base and a sugar, and nucleotides have a base, sugar, and phosphate group.

**76. Which one of the following statements is correct?**

- (1) All enzymes that utilise ATP in phosphate transfer require Ca as the cofactor.
- (2) The bone in human body is an inert and unchanging substance.
- (3) Mg plays roles in neuromuscular function and interneuronal transmission.

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

**Correct Answer:** (3) Mg plays roles in neuromuscular function and interneuronal transmission.

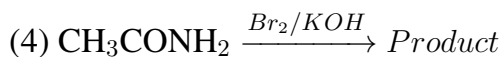
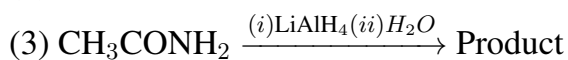
**Solution:** Magnesium (Mg) plays an essential role in neuromuscular function and interneuronal transmission, which is crucial for proper muscle function and nervous system health.

#### Quick Tip

Magnesium is important for many physiological functions, including muscle function and nerve transmission.

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



**Correct Answer:** (4)  $\text{CH}_3\text{CH}_2\text{Br}/\text{KOH} \rightarrow$  Product

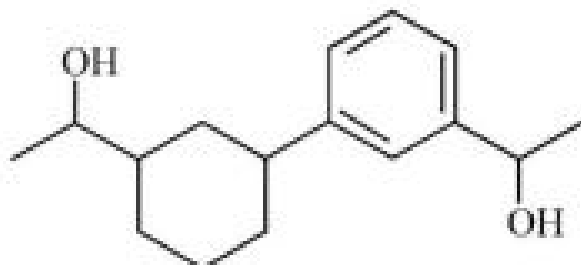
**Solution:** The reaction in option (4) involves an alkyl halide ( $\text{CH}_3\text{CH}_2\text{Br}$ ) with KOH, which typically results in the formation of an alcohol (not a primary amine). In the other reactions,  $\text{LiAlH}_4$  reduces nitriles or amides to primary amines.

#### Quick Tip

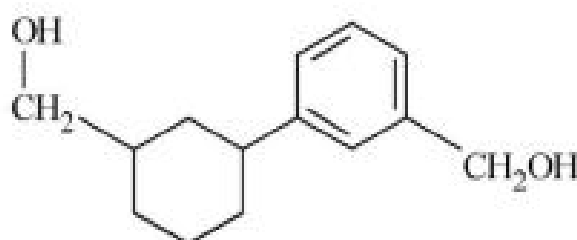
When reacting with  $\text{LiAlH}_4$ , nitriles and amides are reduced to primary amines, while alkyl halides are typically converted to alcohols.

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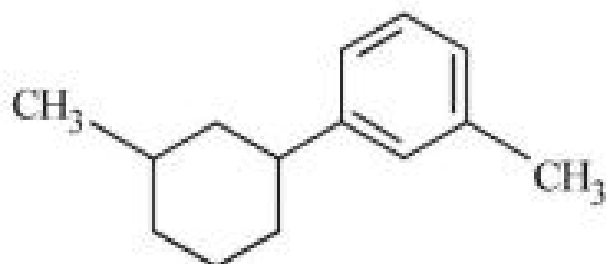
**78. Identify product (A) in the following reaction:**



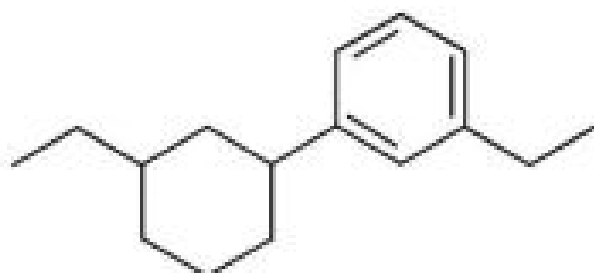
(1)



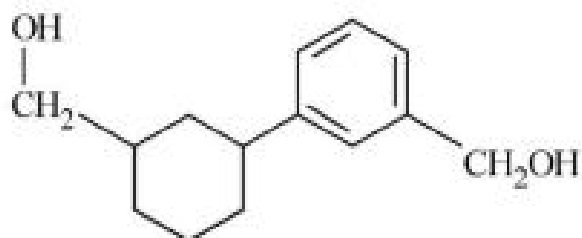
(2)



(3)



(4)



**Correct Answer:** (2)

**Solution:** The reaction involves a reduction of the carbonyl group in the presence of Zn-Hg

and conc. HCl, which results in the formation of a methylene group (-CH<sub>2</sub>OH), corresponding to option 2.

#### Quick Tip

The reduction of carbonyl groups in aromatic compounds with Zn-Hg and conc. HCl leads to the formation of methylene (-CH<sub>2</sub>) groups.

#### 79. Match List - I with List - II:

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

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

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

**Solution:** - Coke is amorphous carbon and contains carbon atoms that are sp<sup>2</sup> hybridized. - Diamond has sp<sup>3</sup> hybridized carbon atoms, making it the hardest form of carbon. - Fullerene has a cage-like structure and contains sp<sup>2</sup>-hybridized carbon atoms. - Graphite has sp<sup>2</sup>-hybridized carbon atoms and is used as a dry lubricant.

#### Quick Tip

Cage-like structures in carbon compounds are characteristic of fullerenes (e.g., C<sub>60</sub>).

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

- (1)  $\text{H}_2\text{O}$
- (2)  $\text{BF}_3$
- (3)  $\text{OH}^-$
- (4)  $\text{NH}_3$

**Correct Answer:** (2)  $\text{BF}_3$

**Solution:**  $\text{BF}_3$  acts as a Lewis acid because it can accept a pair of electrons, whereas the other species listed either donate or have no capacity to accept electrons.

#### Quick Tip

A Lewis acid is a substance that can accept a pair of electrons to form a bond.

---

**81. Which amongst the following molecules on polymerization produces neoprene?**

- (1)  $\text{H}_2\text{C} = \text{C}(\text{Cl}) - \text{C} = \text{CH}_2$
- (2)  $\text{H}_2\text{C} = \text{CH} - \text{C} \equiv \text{CH}$
- (3)  $\text{H}_2\text{C} = \text{C}(\text{CH}_3) - \text{CH} = \text{CH}_2$
- (4)  $\text{H}_2\text{C} = \text{CH} - \text{CH} = \text{CH}_2$

**Correct Answer:** (1)  $\text{H}_2\text{C} = \text{C}(\text{Cl}) - \text{C} = \text{CH}_2$

**Solution:** Neoprene is formed by the polymerization of chloroprene ( $\text{CH}_2 = \text{C} - \text{C} = \text{CH}_2$ ), which is option 1.

#### Quick Tip

Neoprene is a synthetic rubber made by the polymerization of chloroprene, commonly used in waterproof products.

---

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

- (1) Meprobamate

- (2) Valium
- (3) Veronal
- (4) Chlordiazepoxide

**Correct Answer:** (3) Veronal

**Solution:** Veronal is a barbiturate used as a sedative, while the other options belong to different classes of tranquilizers.

#### Quick Tip

Barbiturates are a class of drugs that include sedatives and sleeping pills, such as Veronal.

---

**83. Homoleptic complex from the following complexes is:**

- (1) Diamminechloridonitrito-N-platinum(II)
- (2) Pentaamminecarbonatocobalt(III) chloride
- (3) Triamminenitratetraquachromium(III) chloride
- (4) Potassium trioxalatoaluminate(III)

**Correct Answer:** (2) Pentaamminecarbonatocobalt(III) chloride

**Solution:** A homoleptic complex is one in which the central metal ion is coordinated to only one type of ligand. Pentaamminecarbonatocobalt(III) chloride is homoleptic as it only involves ammonia and carbonate as ligands.

#### Quick Tip

A homoleptic complex contains only one type of ligand coordinated to the central metal atom.

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

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

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

**Solution:** Assertion A is false because a reaction cannot have zero activation energy, as some energy is always required to initiate the reaction. Reason R is true because activation energy is the minimum energy required for a reaction to occur.

#### Quick Tip

Activation energy is a fundamental concept in chemistry, representing the energy barrier to the start of a reaction.

---

**85. 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  $9.10939 \times 10^{-31}$  kg.**
- C. All the isotopes of a given element show the same chemical properties.**
- D. Protons and electrons are collectively known as nucleons.**
- E. Dalton's atomic theory, regarded the atom as an ultimate particle of matter.**

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Statement A is incorrect as atoms are made of more than two fundamental particles (protons, neutrons, and electrons). - Statement B is correct because the mass of the electron is  $9.10939 \times 10^{-31}$  kg. - Statement C is correct since isotopes of an element have the same chemical properties. - Statement D is incorrect because nucleons are only protons and neutrons, not electrons. - Statement E is correct, as Dalton considered atoms to be indivisible units of matter.

#### Quick Tip

Dalton's atomic theory played a crucial role in the development of modern chemistry by proposing atoms as fundamental building blocks of matter.

### Chemistry : Section-B (Q.No. 86 to 100)

#### 86. Match List - I with List - II:

List I (Oxoacids)	List II (Bonds of Sulphur)
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, One S-O-O-S
D. Sulphurous acid	IV. Two S-OH, Two S=O

Choose the correct answer from the options given below:

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

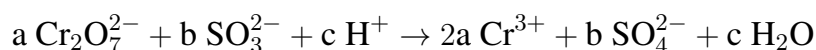
**Correct Answer:** (2) A-I, B-III, C-IV, D-II

**Solution:** The oxoacids of sulfur are classified according to the number and type of bonds. Peroxodisulphuric acid has one S-O-S bond and four S=O bonds. Sulphuric acid has two S-OH bonds and one S=O bond. Pyrosulphuric acid has two S-OH bonds, four S=O bonds, and one S-O-O-S bond. Sulphurous acid has two S-OH bonds and two S=O bonds.

### Quick Tip

The bonding in oxoacids of sulfur varies with the number of oxygens attached and the oxidation states of sulfur.

**87. On balancing the given redox reaction,**



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

- (1) 3, 8, 1
- (2) 1, 8, 3
- (3) 8, 1, 3
- (4) 1, 3, 8

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

**Solution:** Balancing the redox reaction using the ion-electron method or half-reaction method gives the coefficients as  $a = 3$ ,  $b = 8$ , and  $c = 1$ .

### Quick Tip

Use the half-reaction method to balance redox reactions by balancing both mass and charge.

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

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

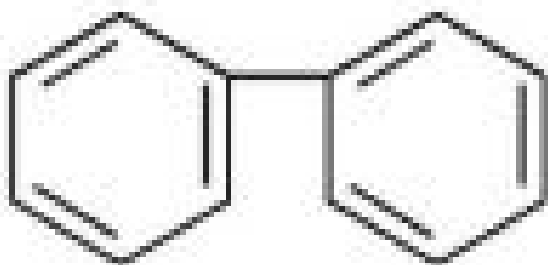
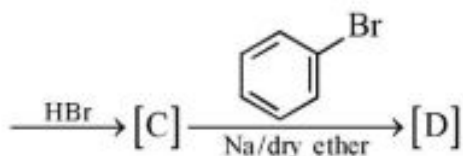
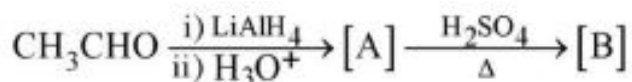
**Correct Answer:** (1)  $\frac{1}{3}$

**Solution:** In a face-centred cubic (fcc) unit cell, there are 4 edge-centred octahedral voids, and the fraction of one void located within one unit cell is  $\frac{1}{3}$ .

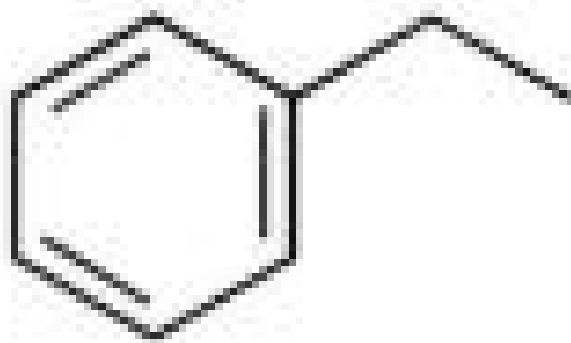
### Quick Tip

In crystal lattices, voids are categorized based on their position within the unit cell, such as edge-centred, face-centred, and corner-centred voids.

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



- (1)
- (2)  $\text{C}_4\text{H}_{10}$
- (3)  $\text{HC}\equiv\text{C}^-\text{Na}^+$



- (4)

**Correct Answer:** (3)  $\text{HC}\equiv\text{C}^-\text{Na}^+$

**Solution:** The sequence of reactions begins with the reduction of an aldehyde to a primary alcohol using  $\text{LiAlH}_4$ , followed by dehydration with  $\text{H}_2\text{SO}_4$ , which forms an alkene.

Addition of  $\text{HBr}$  gives an alkyl bromide, and finally, the sodium metal in dry ether replaces the halide with an alkyl group, resulting in a hydrocarbon product.

### Quick Tip

Dehydration of alcohols to form alkenes is a common reaction when treated with concentrated sulfuric acid.

### 90. Which complex compound is most stable?

- (1)  $[\text{Co}(\text{NH}_3)_5(\text{NO}_3)_3]$
- (2)  $[\text{CoCl}_2(\text{en})_2]\text{NO}_3$
- (3)  $[\text{Co}(\text{NH}_3)_6](\text{SO}_4)_3$
- (4)  $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Br}_2](\text{NO}_3)_2$

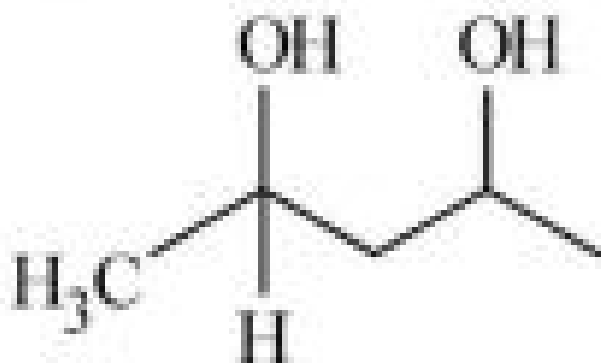
**Correct Answer:** (3)  $[\text{Co}(\text{NH}_3)_6](\text{SO}_4)_3$

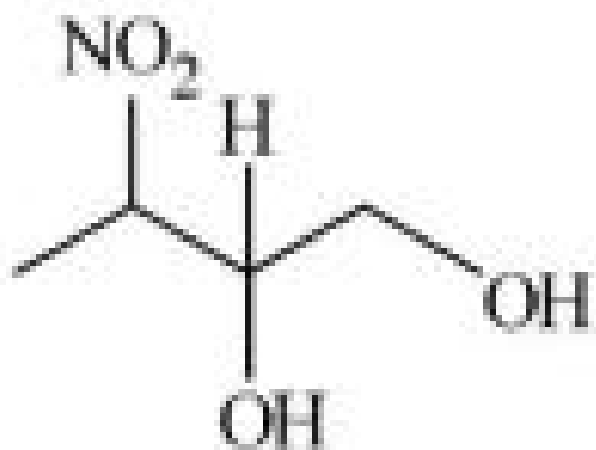
**Solution:** The complex with six ammonia ligands (as in option 3) is more stable because ammonia is a strong ligand, and sulfate is a weak field ligand. This combination provides a stable coordination complex.

### Quick Tip

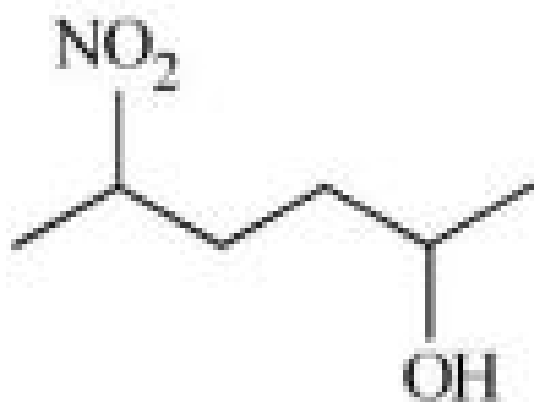
Ammonia as a ligand increases the stability of coordination compounds due to its strong field strength.

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

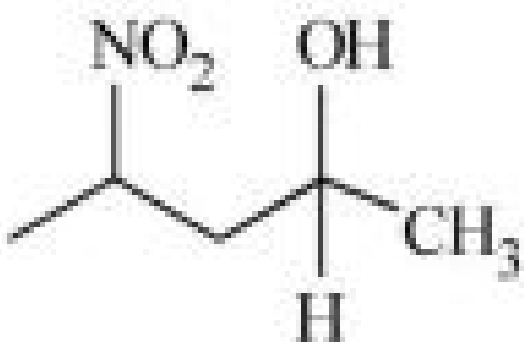




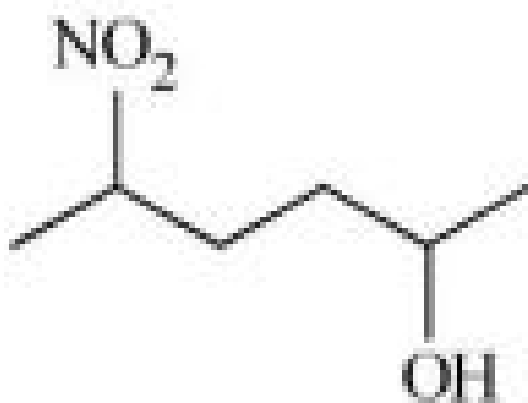
(2)



(3)



(4)



**Correct Answer: (3)**

**Solution:** The compound in option (3) contains two hydroxyl groups on adjacent carbons, which will readily undergo dehydration under acidic conditions to form an alkene. The presence of the nitro group enhances this reactivity.

#### Quick Tip

Dehydration of alcohols can be facilitated by acids, especially when adjacent hydroxyl groups are present.

---

**92. Given below are two statements:**

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

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

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

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

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

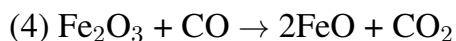
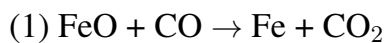
**Solution:** Statement I is incorrect because eutrophication is caused by an excess of nutrients in water bodies, not their deficiency. Statement II is correct because eutrophication leads to a decrease in oxygen levels due to algal blooms and decomposition.

#### Quick Tip

Eutrophication is the process where excess nutrients (like nitrogen and phosphorus) lead to algal blooms that deplete oxygen levels in water bodies.

---

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



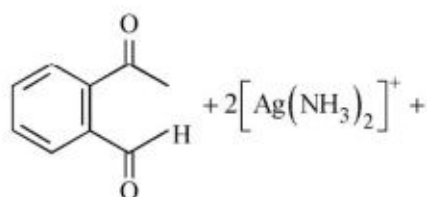
**Correct Answer:** (2)  $\text{C} + \text{CO}_2 \rightarrow 2\text{CO}$

**Solution:** Option (2) is not a reaction that occurs in the blast furnace. The correct reaction in the blast furnace involves the reduction of iron ore by carbon monoxide and the formation of slag ( $\text{CaSiO}_3$ ) from calcium oxide and silica.

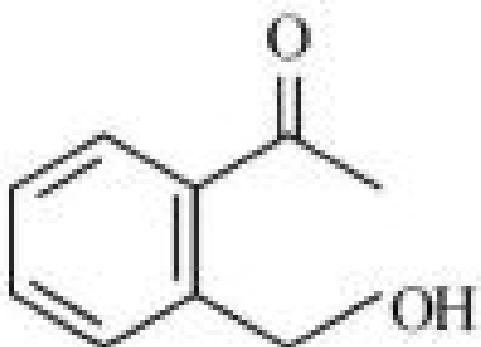
#### Quick Tip

In a blast furnace, carbon monoxide reduces iron oxide ( $\text{Fe}_2\text{O}_3$ ) to iron (Fe) and forms  $\text{CO}_2$  as a by-product.

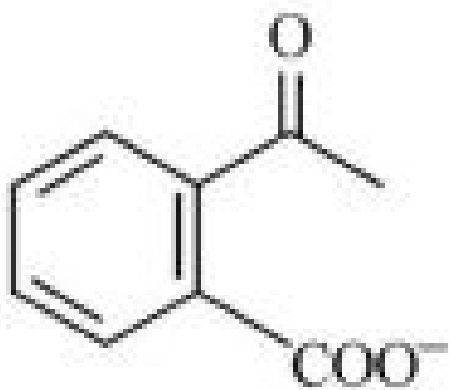
**94. Identify the major product obtained in the following reaction:**



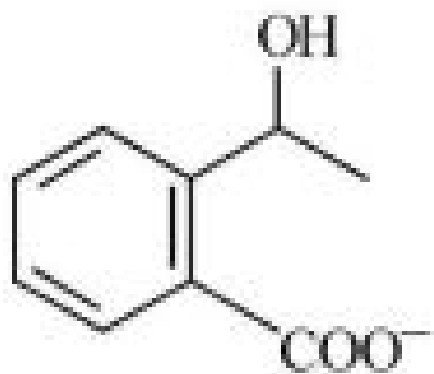
$3^- \text{OH} \xrightarrow{\Delta} \text{major product}$



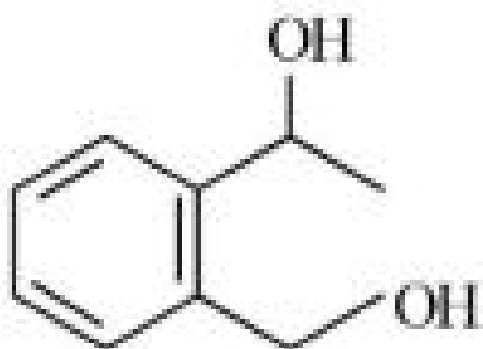
(1)



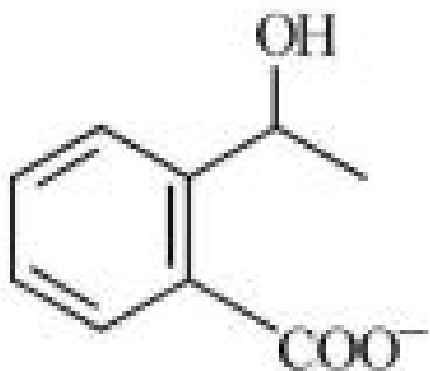
(2)



(3)



(4)



**Correct Answer:** (3)

**Solution:** The reaction involves the reduction of the aldehyde group (-CHO) to a primary alcohol (-CH<sub>2</sub>OH) using ammoniacal silver ion. The major product is a benzyl alcohol.

#### Quick Tip

Ammoniacal silver ion is commonly used in reactions like the Tollens' test to reduce aldehydes to alcohols.

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

- (1)  $\Delta H = \Delta U + \Delta n_g RT$
- (2)  $\Delta H - \Delta U = -\Delta n_g RT$
- (3)  $\Delta H + \Delta U = \Delta n_g RT$
- (4)  $\Delta H = \Delta U - \Delta n_g RT$

**Correct Answer:** (1)  $\Delta H = \Delta U + \Delta n_g RT$

**Solution:** The correct relation is given by  $\Delta H = \Delta U + \Delta n_g RT$ , where  $\Delta H$  is the change in enthalpy,  $\Delta U$  is the change in internal energy, and  $\Delta n_g$  is the change in the number of moles of gas.

#### Quick Tip

The relation between enthalpy and internal energy depends on the change in the number of moles of gas in the system.

---

**96. Which of the following statements are INCORRECT?**

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

**B. The highest oxidation number corresponding to the group number in transition metal oxides is attained in  $\text{Sc}_2\text{O}_3$  to  $\text{Mn}_2\text{O}_7$ .**

**C. Basic character increases from  $\text{V}_2\text{O}_3$  to  $\text{V}_2\text{O}_4$  to  $\text{V}_2\text{O}_5$ .**

**D.  $\text{V}_2\text{O}_4$  dissolves in acids to give  $\text{VO}_4^{3-}$  salts.**

**E.  $\text{CrO}$  is basic but  $\text{Cr}_2\text{O}_3$  is amphoteric.**

**Choose the correct answer from the options given below:**

(1) B and D only

(2) C and D only

(3) B and C only

(4) A and E only

**Correct Answer:** (1) B and D only

**Solution:** - Statement A is incorrect because Sc does not form an ionic oxide.

- Statement B is incorrect because the highest oxidation number varies among different transition metals.

- Statement C is correct as basic character increases with increasing oxidation state of the metal.

- Statement D is incorrect because  $\text{V}_2\text{O}_4$  does not form  $\text{VO}_4^{3-}$  salts upon dissolving in acids.

- Statement E is correct as  $\text{Cr}_2\text{O}_3$  is amphoteric, whereas  $\text{CrO}$  is basic.

#### Quick Tip

In transition metal oxides, oxidation state plays a key role in determining their acidic or basic character.

---

**97. The equilibrium concentrations of the species in the reaction  $A + B \rightleftharpoons C + D$  are 2, 3, 10, and 6 mol L<sup>-1</sup>, respectively at 300 K.  $\Delta G^\circ$  for the reaction is (R = 2 cal/mol K):**

(1) -137.26 cal

(2) -1381.80 cal

(3) -13.73 cal

(4) -1372.60 cal

**Correct Answer:** (4) -1372.60 cal

**Solution:** The change in Gibbs free energy  $\Delta G^\circ$  is related to the equilibrium constant  $K$  by the formula:

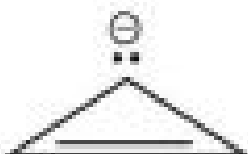
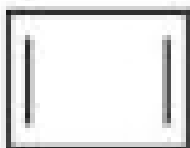
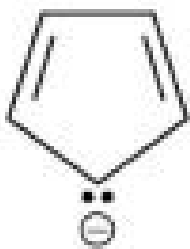
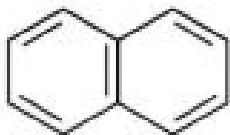
$$\Delta G^\circ = -RT \ln K$$

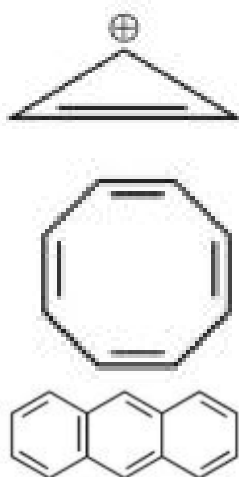
Substituting the given equilibrium concentrations, and using the relationship for  $K$ , we find that  $\Delta G^\circ = -1372.60$  cal.

#### Quick Tip

The Gibbs free energy change at equilibrium can be calculated using the equilibrium constant and the gas constant.

98. Consider the following compounds/species:





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

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

**Correct Answer:** (4) 4

**Solution:** Huckel's rule states that a compound or species is aromatic if it contains a planar, cyclic structure with  $4n + 2$  -electrons. The compounds/species in the question can be analyzed to determine that 4 of them satisfy Huckel's rule.

#### Quick Tip

Aromaticity follows Huckel's rule, which applies to planar, cyclic molecules with  $4n + 2$  -electrons.

**99. Pumice stone is an example of -**

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

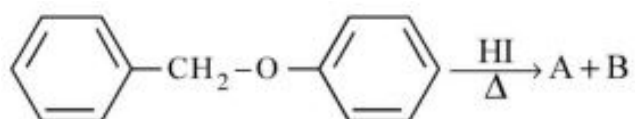
**Correct Answer:** (3) foam

**Solution:** Pumice stone is a porous volcanic rock that is classified as a foam because it is formed from gas bubbles trapped in the lava during solidification.

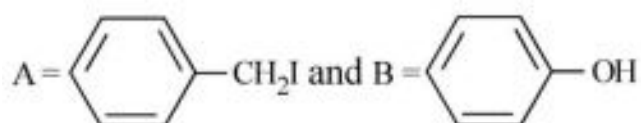
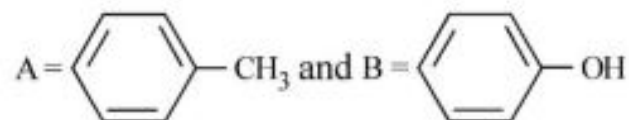
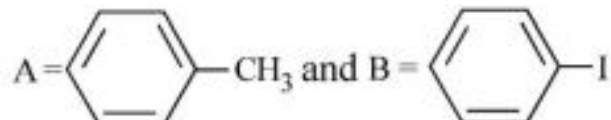
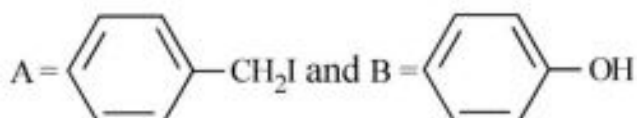
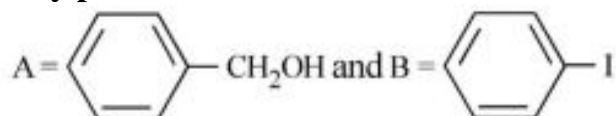
#### Quick Tip

Foams are substances that trap gas bubbles in a liquid or solid matrix, such as pumice stone.

**100. Consider the following reaction:**



**Identify products A and B.**



**Correct Answer:** (2)

**Solution:** In the given reaction, the alcohol undergoes substitution with HI to form a bromoalkane (A =  $\text{CH}_2\text{I}$ ) and water (B = OH) due to the elimination of the -OH group.

#### Quick Tip

When alcohol reacts with HI, it undergoes substitution to form alkyl iodide and water.

---

**Botany : Section-A (Q.No. 101 to 135)**

**101. The phenomenon of pleiotropism refers to:**

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

**Correct Answer:** (2) a single gene affecting multiple phenotypic expression.

**Solution:** Pleiotropism occurs when a single gene influences multiple, seemingly unrelated phenotypic traits, making statement 2 the correct explanation.

**Quick Tip**

Pleiotropism is the phenomenon where one gene affects more than one trait, commonly seen in genetic disorders like sickle cell anemia.

---

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

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

**Correct Answer:** (1) Dedifferentiation

**Solution:** In tissue culture experiments, the process by which differentiated cells lose their specialized form and revert to a more undifferentiated state is called dedifferentiation.

**Quick Tip**

Dedifferentiation is an important process in plant tissue culture, where cells revert to a meristematic state to form callus.

---

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

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

**Correct Answer:** (3) Active Transport

**Solution:** Active transport is the process by which ions move against their concentration gradient, which requires energy input, typically from ATP.

**Quick Tip**

Active transport mechanisms, like the sodium-potassium pump, help move ions against concentration gradients.

---

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

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

**Correct Answer:** (4) Habitat loss and fragmentation

**Solution:** Among the four factors (over-exploitation, alien species, co-extinctions, and habitat loss), habitat loss and fragmentation is considered the most important driver of extinction.

### Quick Tip

Habitat destruction and fragmentation are the leading causes of species extinction, as they reduce the available living space and resources for wildlife.

---

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

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

**Correct Answer:** (3) Bright orange colour

**Solution:** Ethidium bromide, a DNA stain, fluoresces under UV light, emitting a bright orange colour when intercalated between the base pairs of the DNA.

### Quick Tip

Ethidium bromide is commonly used in molecular biology for visualizing DNA in agarose gels under UV light.

---

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

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

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

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

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

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

**Solution:** The protonema is indeed the first stage of the gametophyte in moss, but it does not develop directly from spores produced in the capsule. Instead, the spores germinate to form protonema, making the reason incorrect in its explanation.

#### Quick Tip

Protonema in moss is the first stage in the gametophyte generation, formed from spores but not directly from the capsule.

---

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

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

**Correct Answer:** (1) Transcription of tRNA, 5S rRNA and snRNA

**Solution:** RNA polymerase III is responsible for transcribing small RNAs, including tRNA, 5S rRNA, and snRNA, which are essential for protein synthesis and splicing.

#### Quick Tip

RNA polymerase III plays a key role in transcribing small, non-coding RNAs in the cell, crucial for protein synthesis and RNA processing.

---

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

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

**Correct Answer:** (1) 1992

**Solution:** The Convention on Biological Diversity (CBD) was adopted at the Earth Summit held in Rio de Janeiro in 1992.

#### Quick Tip

The Earth Summit in 1992 was a landmark conference that led to the adoption of the Convention on Biological Diversity.

---

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

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

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

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

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

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

**Solution:** Both statements A and R are true. ATP is used in the phosphorylation steps in glycolysis, with ATP consumed in both the conversion of glucose to glucose-6-phosphate and the conversion of fructose-6-phosphate to fructose-1,6-diphosphate.

#### Quick Tip

Glycolysis involves the consumption of ATP at two key steps: phosphorylation of glucose and phosphorylation of fructose-6-phosphate.

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

- (1) Decibels
- (2) Decameter
- (3) Kilobase
- (4) Dobson units

**Correct Answer:** (4) Dobson units

**Solution:** The thickness of the ozone layer in the atmosphere is measured in Dobson units, which quantify the amount of ozone present in a column of air.

**Quick Tip**

Dobson units are commonly used to measure ozone levels in the atmosphere, where 1 Dobson unit equals 0.01 mm of ozone at standard temperature and pressure.

---

**111. Given below are two statements:**

**Statement I: Endarch and exarch are the terms often used for describing the position of secondary xylem in the plant body.**

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

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

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

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

**Solution:** Statement I is incorrect as the terms endarch and exarch refer to the position of xylem in the vascular bundle, not secondary xylem. Statement II is correct because exarch condition (with xylem located on the outer side) is common in the root system.

### Quick Tip

Exarch condition is more common in roots, where the xylem is located towards the outside of the vascular bundle.

---

#### 112. Identify the pair of heterosporous pteridophytes among the following:

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

**Correct Answer:** (1) Selaginella and Salvinia

**Solution:** Heterosporous pteridophytes produce two types of spores: microspores and megaspores. Selaginella and Salvinia are examples of heterosporous pteridophytes.

### Quick Tip

Heterosporous plants produce two different types of spores, one male (microspore) and one female (megaspores), unlike homosporous plants that produce only one type.

---

#### 113. Identify the correct statements:

- A. Detritivores perform fragmentation.**
- B. The humus is further degraded by some microbes during mineralization.**
- C. Water soluble inorganic nutrients go down into the soil and get precipitated by a process called leaching.**
- D. The detritus food chain begins with living organisms.**
- E. Earthworms break down detritus into smaller particles by a process called catabolism.**

**Choose the correct answer from the options given below:**

- (1) B, C, D only
- (2) C, D, E only

(3) D, E, A only

(4) A, B, C only

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

**Solution:** - Statement A is incorrect because detritivores break down organic matter, not necessarily through fragmentation.

- Statement B is correct because microbes degrade humus during mineralization.

- Statement C is correct as leaching is the process of water-soluble inorganic nutrients being washed down into the soil.

- Statement D is correct because the detritus food chain begins with dead organic matter.

- Statement E is correct because earthworms break down detritus into smaller particles.

#### Quick Tip

Leaching is an important process in the biogeochemical cycles, involving the washing away of soluble nutrients into the soil or water.

---

#### 114. Axile placentation is observed in:

(1) China rose, Beans and Lupin

(2) Tomato, Dianthus and Pea

(3) China rose, Petunia and Lemon

(4) Mustard, Cucumber and Primrose

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

**Solution:** Axile placentation is found in plants like China rose, beans, and lupin where the ovules are attached to the central column of the ovary.

#### Quick Tip

Axile placentation is a type of placentation in which the ovules are attached to the central axis of the ovary.

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

- (1) Polyadelphous and epipetalous stamens
- (2) Monadelphous and Monothealous anthers
- (3) Epiphyllous and Dithealous anthers
- (4) Diadelphous and Dithealous anthers

**Correct Answer:** (4) Diadelphous and Dithealous anthers

**Solution:** In the Fabaceae family, the stamens are diadelphous (in two groups) and the anthers are dithealous, which is a characteristic that distinguishes them from other families like Solanaceae or Liliaceae.

#### Quick Tip

In diadelphous stamens, the filaments are grouped into two bundles, a characteristic feature of the Fabaceae family.

---

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

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

**Correct Answer:** (4) 680 nm

**Solution:** The absorption maximum for the reaction centre in Photosystem II (PS II) is at 680 nm, known as P680, which is crucial for light absorption during photosynthesis.

#### Quick Tip

Photosystem II absorbs light primarily at 680 nm, which is essential for splitting water molecules during the light reactions of photosynthesis.

---

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

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

**Correct Answer:** (1) DNA

**Solution:** Chilled ethanol is used in recombinant DNA technology to precipitate DNA out of solution, allowing for its purification.

**Quick Tip**

Ethanol precipitation is a common method for isolating DNA by causing it to aggregate and separate from the rest of the solution.

---

**118. Among eukaryotes, replication of DNA takes place in:**

- (1) S phase
- (2) G1 phase
- (3) G2 phase
- (4) M phase

**Correct Answer:** (1) S phase

**Solution:** DNA replication occurs during the S phase (Synthesis phase) of the cell cycle, where the DNA content of the cell is doubled in preparation for cell division.

**Quick Tip**

The S phase of the cell cycle is where DNA replication occurs, ensuring that each daughter cell receives an identical copy of the genome.

---

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

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

**Correct Answer:** (1) Pachytene

**Solution:** Recombination nodules, which are involved in crossing over, appear during the pachytene stage of prophase I in meiosis.

**Quick Tip**

The pachytene stage is where homologous chromosomes are closely aligned, and genetic recombination occurs.

---

**120. How many ATP and NADPH<sub>2</sub> are required for the synthesis of one molecule of Glucose during the Calvin cycle?**

- (1) 18 ATP and 12 NADPH<sub>2</sub>
- (2) 12 ATP and 16 NADPH<sub>2</sub>
- (3) 18 ATP and 16 NADPH<sub>2</sub>
- (4) 12 ATP and 14 NADPH<sub>2</sub>

**Correct Answer:** (3) 18 ATP and 16 NADPH<sub>2</sub>

**Solution:** The Calvin cycle requires 18 ATP and 16 NADPH<sub>2</sub> molecules to produce one molecule of glucose, as it is a complex process involving multiple steps of carbon fixation and reduction.

### Quick Tip

The Calvin cycle uses ATP and NADPH produced during the light reactions of photosynthesis to convert CO<sub>2</sub> into glucose.

---

### 121. In the equation

$$GPP - R = NPP$$

GPP is Gross Primary Productivity, NPP is Net Primary Productivity, and R here is:

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

**Correct Answer:** (2) Respiratory loss

**Solution:** R represents respiratory loss in the equation, where GPP is the total energy captured through photosynthesis, and NPP is the energy available for growth and reproduction after accounting for respiratory losses.

### Quick Tip

The difference between GPP and NPP accounts for the energy lost through respiration by plants.

---

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

- (1) Bird pollinated plants
- (2) Bat pollinated plants
- (3) Wind pollinated plants
- (4) Insect pollinated plants

**Correct Answer:** (1) Bird pollinated plants

**Solution:** Bird-pollinated plants typically have large, colorful, and fragrant flowers with nectar to attract pollinators, like hummingbirds.

### Quick Tip

Bird-pollinated plants often have bright, showy flowers to attract the attention of birds, which are active during the day.

---

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

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

**Correct Answer:** (1) Gibberellic Acid

**Solution:** Gibberellic Acid (GA) is a growth regulator that promotes early seed production by hastening the maturity process in juvenile conifers.

### Quick Tip

Gibberellic acid is known for promoting seed germination and hastening the growth of plants, including conifers.

---

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

- (1) Molybdenum
- (2) Magnesium
- (3) Copper
- (4) Manganese

**Correct Answer:** (4) Manganese

**Solution:** Manganese plays a crucial role in the water-splitting reaction during photosynthesis, where it helps in the oxygen evolution complex of Photosystem II.

### Quick Tip

Manganese is essential for the oxygen-evolving complex in photosystem II, facilitating the splitting of water molecules during photosynthesis.

---

#### **125. Expressed Sequence Tags (ESTs) refers to:**

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

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

**Solution:** Expressed Sequence Tags (ESTs) are short sequences of cDNA that are derived from mRNA and represent the genes that are actively being expressed in a given tissue or under a specific condition.

### Quick Tip

ESTs provide valuable information about gene expression by representing the mRNA transcript from genes that are being actively transcribed.

---

#### **126. 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) Sutton and Boveri
- (2) Alfred Sturtevant
- (3) Henking
- (4) Thomas Hunt Morgan

**Correct Answer:** (2) Alfred Sturtevant

**Solution:** Alfred Sturtevant was the first to use recombination frequencies to map the

positions of genes on chromosomes, a technique that helped in the development of genetic maps.

#### Quick Tip

Recombination frequency is used to calculate genetic distance, with higher recombination frequencies indicating greater distances between genes on the chromosome.

---

**127. Given below are two statements:**

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

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

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

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

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

**Solution:** Statement I is incorrect because the actual height that transpiration can lift a column of water is much smaller than 130 meters. Statement II is correct because transpiration indeed cools leaf surfaces through evaporative cooling.

#### Quick Tip

Transpiration plays a key role in cooling plants by releasing water vapor, which has a cooling effect on leaf surfaces.

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

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

**Correct Answer:** (2) Tungsten or gold

**Solution:** In the gene gun method, microparticles of heavy metals like tungsten or gold are used to carry DNA into plant cells via high-velocity bombardment.

#### Quick Tip

Gene gun technology involves using microparticles of gold or tungsten to deliver foreign genes into plant cells by physical force.

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

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

**Reason R:** Cambium is less active in winters.

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

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

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

**Solution:** Both statements are true. During winter, the cambium is less active, leading to the formation of late wood, which has fewer xylary elements and narrower vessels.

### Quick Tip

Late wood, formed during the winter months, has fewer and smaller xylary elements due to reduced cambium activity.

---

### 130. What is the function of tassels in the corn cob?

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

**Correct Answer:** (2) To disperse pollen grains

**Solution:** Tassels in corn are the male reproductive structures that release pollen, which is then dispersed by wind to fertilize the female flowers.

### Quick Tip

Tassels are important for pollen dispersal in corn, facilitating fertilization of the female ear.

---

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

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

**Correct Answer:** (3) Synergids, antipodals and Polar nuclei

**Solution:** In angiosperms, the embryo sac consists of antipodals, synergids, and the primary endosperm nucleus. These structures play key roles during fertilization.

### Quick Tip

In fertilized angiosperms, the embryo sac includes the synergids, antipodals, and polar nuclei, which are involved in the fertilization process.

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

- (1) Kinetin
- (2) Ethylene
- (3) 2, 4-D
- (4) GA3

**Correct Answer:** (4) GA3

**Solution:** GA3 (Gibberellic Acid) promotes elongation of internodes and petioles in deep water rice, helping the plant grow taller in response to waterlogging.

### Quick Tip

Gibberellic acid (GA3) plays a key role in elongation processes, particularly in rice and other crops grown in waterlogged conditions.

---

### 133. Which of the following stages of meiosis involves division of centromere?

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

**Correct Answer:** (2) Anaphase II

**Solution:** In Anaphase II of meiosis, the centromere divides, and the sister chromatids are pulled apart to opposite poles.

### Quick Tip

The division of the centromere occurs during Anaphase II, allowing the separation of sister chromatids in meiosis.

---

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

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

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

**Solution:** Hershey and Chase provided definitive evidence that DNA is the genetic material through their experiments with bacteriophages and radioactive isotopes.

### Quick Tip

Hershey and Chase's experiments using labeled phages confirmed that DNA, not protein, is the material responsible for genetic inheritance.

---

#### 135. Cellulose does not form blue colour with Iodine because:

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

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

**Solution:** Unlike starch, cellulose does not form a helical structure, so it cannot interact with iodine molecules to form a blue color.

### Quick Tip

The inability of cellulose to form a blue color with iodine is because it lacks the helical structure required to bind iodine.

### Botany : Section-B (Q.No. 136 to 150)

#### 136. Match List I with List II:

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

Choose the correct answer from the options given below:

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

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

**Solution:** - Oxidative decarboxylation corresponds to the enzyme pyruvate dehydrogenase (A-II).

- Glycolysis is associated with the EMP pathway (B-IV).
- Oxidative phosphorylation is part of the electron transport system (C-II).
- The tricarboxylic acid cycle (TCA cycle) is associated with citrate synthase (D-I).

### Quick Tip

Matching enzymes with their respective pathways or processes is key in understanding metabolic reactions.

#### 137. Which of the following combinations is required for chemiosmosis?

- (1) membrane, proton pump, proton gradient, NADP synthase
- (2) proton pump, electron gradient, ATP synthase
- (3) proton pump, electron gradient, NADP synthase
- (4) membrane, proton pump, proton gradient, ATP synthase

**Correct Answer:** (4) membrane, proton pump, proton gradient, ATP synthase

**Solution:** Chemiosmosis requires the presence of a membrane, a proton pump to create a proton gradient, and ATP synthase to generate ATP using the energy of the proton gradient.

#### Quick Tip

Chemiosmosis occurs in the inner mitochondrial membrane (or thylakoid membrane in plants) to generate ATP.

---

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

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

**Correct Answer:** (4) Succinic dehydrogenase

**Solution:** Melonate inhibits the activity of succinic dehydrogenase, an enzyme involved in the citric acid cycle, thereby affecting the growth of pathogenic bacteria.

#### Quick Tip

Inhibition of key enzymes like succinic dehydrogenase can disrupt metabolic pathways and inhibit bacterial growth.

---

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

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

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

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

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

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

**Solution:** Assertion A is true as pollen grains in gymnosperms are indeed released and carried by air currents. However, Reason R is incorrect because pollen tube formation is part of the fertilization process in gymnosperms, contrary to the statement that no pollen tube is formed.

#### Quick Tip

In gymnosperms, pollen tube formation is essential for fertilization, unlike what is suggested in Reason R.

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

- A. Insertion of recombinant DNA into the host cell.**
- B. Cutting of DNA at specific location by restriction enzyme.**
- C. Isolation of desired DNA fragment.**
- D. Amplification of gene of interest using PCR.**

**Choose the correct answer from the options given below:**

- (1) C, A, B, D
- (2) C, B, D, A

(3) B, D, A, C

(4) B, C, D, A

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

**Solution:** The correct sequence for the formation of recombinant DNA is:

1. Isolation of the desired DNA fragment (C)
2. Cutting of DNA using restriction enzymes (B)
3. Amplification of the gene of interest using PCR (D)
4. Insertion of recombinant DNA into the host cell (A).

#### Quick Tip

Recombinant DNA technology follows a specific order starting with DNA isolation, restriction enzyme cutting, PCR amplification, and finally insertion into the host.

#### 141. Match List I with List II:

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Cohesion refers to the mutual attraction between water molecules (A-II).

- Adhesion refers to the attraction towards polar surfaces (B-I).

- Surface tension is related to more attraction in the liquid phase (C-IV).

- Guttation involves water loss in liquid phase (D-III).

### Quick Tip

Understanding the properties of water, such as cohesion and adhesion, helps explain processes like surface tension and guttation.

---

#### 142. Which one of the following statements is NOT correct?

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

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

**Solution:** Algal blooms, caused by excess organic matter, often deplete oxygen in the water and cause harm to aquatic life, rather than improving water quality.

### Quick Tip

Algal blooms lead to eutrophication, which degrades water quality by consuming oxygen and affecting the aquatic ecosystem.

---

#### 143. How many different proteins does the ribosome consist of?

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

**Correct Answer:** (1) 60

**Solution:** The ribosome consists of approximately 60 different proteins that work together with rRNA to form the machinery responsible for protein synthesis.

**Quick Tip**

The ribosome is made up of ribosomal proteins and ribosomal RNA (rRNA), essential for translating mRNA into proteins.

**144. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Mutualism involves both species benefiting (+A, +B).

- Commensalism involves one species benefiting while the other is unaffected (+A, O(B)).

- Amensalism involves one species being harmed while the other is unaffected (+A, -B).

- Parasitism involves one species benefiting at the expense of the other (+A, -B).

**Quick Tip**

Understanding different types of species interactions helps explain ecological relationships such as mutualism, commensalism, amensalism, and parasitism.

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

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

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

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

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

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

**Solution:** Both statements are true. Assertion A correctly describes the transformation of the shoot apical meristem into floral meristem, which is essential for flower development.

Reason R explains how the internode condenses to form floral organs instead of leaves.

#### Quick Tip

The transition of shoot apical meristem into floral meristem is a critical step in flower formation, involving condensation of internodes and development of floral organs.

---

**146. Identify the correct statements:**

- A. Lenticels are the lens-shaped openings permitting the exchange of gases.**
- B. Bark formed early in the season is called hard bark.**
- C. Bark is a technical term that refers to all tissues exterior to vascular cambium.**
- D. Bark refers to periderm and secondary phloem.**
- E. Phellogen is single-layered in thickness.**

**Choose the correct answer from the options given below:**

- (1) A and D only

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

**Correct Answer:** (1) A and D only

**Solution:** - Lenticular openings are indeed lens-shaped and facilitate gas exchange (A).

- Bark refers to all tissues exterior to the vascular cambium, including the periderm and secondary phloem (D).

- Hard bark forms early in the season (B), but this does not fit with the correct answer.

#### Quick Tip

Lenticels play a crucial role in the exchange of gases between the plant and its environment, particularly in woody plants.

---

**147. Given below are two statements:**

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

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

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

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

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

**Solution:** Statement I correctly describes Gause's Competitive Exclusion Principle.

Statement II is also correct as carnivores tend to be more affected by competition than herbivores due to limited prey availability.

### Quick Tip

The Competitive Exclusion Principle explains that two species cannot occupy the same ecological niche indefinitely without one being competitively superior.

---

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

- A. This disorder was first described by Langdon Down (1866).**
- B. Such an individual has overall masculine development. However, the feminine development is also expressed.**
- C. The affected individual is short-statured.**
- D. Physical, psychomotor and mental development is retarded.**
- E. Such individuals are sterile.**

**Choose the correct answer from the options given below:**

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

**Correct Answer:** (2) B and E only

**Solution:** - Klinefelter's Syndrome individuals often show masculine features but also express some feminine traits (B).

- They are typically sterile due to the presence of extra X chromosomes (E).
- Other statements regarding physical and mental developmental issues are not universally applicable to all affected individuals.

### Quick Tip

Klinefelter's Syndrome (47, XXY) is characterized by a mix of male and female secondary sex characteristics and infertility.

---

**149. Match List I with List II:**

List I	List II
A. M Phase	I. Proteins are synthesized
B. G <sub>2</sub> Phase	II. Inactive phase
C. Quiescent stage	III. Interval between mitosis and initiation of DNA replication
D. G <sub>1</sub> Phase	IV. Equational division

**Choose the correct answer from the options given below:**

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

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

**Solution:** - M phase corresponds to equational division (A-IV). - G<sub>2</sub> phase is the phase when proteins are synthesized (B-I). - The quiescent stage is when the cell is in an inactive phase (C-II). - G<sub>1</sub> phase is the interval between mitosis and initiation of DNA replication (D-III).

#### Quick Tip

The cell cycle phases play essential roles in regulating growth, protein synthesis, and cell division.

#### 150. Match List I with List II:

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Iron is an activator of catalase (A-III).

- Zinc is a component of nitrate reductase (B-II).

- Boron is essential for cell elongation and differentiation (C-I).

- Molybdenum is involved in the synthesis of auxin (D-IV).

#### Quick Tip

Minerals play crucial roles in various enzymatic and cellular processes, including growth, metabolism, and differentiation.

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### Zoology : Section-A (Q.No. 151 to 185)

**151. Given below are two statements:**

**Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.**

**Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.**

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

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

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

**Solution:** - Statement I is correct as prokaryotes have a region called the nucleoid where DNA is associated with negatively charged proteins. - Statement II is also correct as in eukaryotes, DNA is wrapped around histone proteins to form nucleosomes.

### Quick Tip

DNA packaging differs between prokaryotes and eukaryotes, with prokaryotes having a nucleoid and eukaryotes using histones to form nucleosomes.

---

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

- (1) B-lymphocytes
- (2) Basophils
- (3) Eosinophils
- (4)  $T_H$  cells

**Correct Answer:** (4)  $T_H$  cells

**Solution:** HIV primarily infects T-helper ( $T_H$ ) cells, which are crucial for the immune response, leading to viral replication within these cells.

### Quick Tip

T-helper cells are the main target for HIV, and their destruction weakens the immune system.

---

**153. Which of the following statements is correct?**

- (1) Biomagnification refers to an increase in the concentration of the toxicant at successive trophic levels.
- (2) Presence of large amounts of nutrients in water restricts 'Algal Bloom'
- (3) Algal Bloom decreases fish mortality
- (4) Eutrophication refers to an increase in domestic sewage and waste water in lakes.

**Correct Answer:** (1) Biomagnification refers to an increase in the concentration of the toxicant at successive trophic levels.

**Solution:** Biomagnification is the process where the concentration of a toxicant increases as

it moves up the food chain. Eutrophication refers to the enrichment of water bodies with nutrients, often leading to algal blooms.

#### Quick Tip

Understanding biomagnification helps in recognizing the impact of pollutants on higher trophic levels in an ecosystem.

#### 154. Match List I with List II:

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

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

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

**Solution:** - P-wave represents the depolarization of atria, which marks the beginning of systole (A-I).

- Q-wave represents the depolarization of ventricles (B-II).
- QRS complex represents the depolarization of atria (C-III).
- T-wave represents the repolarization of ventricles (D-IV).

#### Quick Tip

The QRS complex, P-wave, and T-wave are key components of an ECG, each corresponding to specific stages of the heart's electrical activity.

---

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

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

**Correct Answer:** (4) Down's syndrome

**Solution:** The broad palm with a single palm crease is a characteristic physical feature associated with Down's syndrome, caused by trisomy 21.

**Quick Tip**

Down's syndrome is characterized by several physical features, including a single palm crease, short stature, and distinct facial features.

---

**156. Given below are two statements:**

**Statement I: RNA mutates at a faster rate.**

**Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster.**

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

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

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

**Solution:** RNA does indeed mutate at a faster rate compared to DNA, and RNA viruses, due to their high mutation rates and short lifespans, evolve faster.

### Quick Tip

The high mutation rates in RNA viruses are a significant challenge in vaccine development and treatment strategies.

---

**157. Given below are two statements:**

**Statement I: Ligaments are dense irregular tissue.**

**Statement II: Cartilage is dense regular tissue.**

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

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

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

**Solution:** Ligaments are indeed dense irregular connective tissues. However, cartilage is a type of connective tissue that is not dense regular tissue, but rather it is typically classified as dense connective tissue with varying density.

### Quick Tip

Understanding the differences in connective tissue types, such as ligaments and cartilage, helps in understanding their functions in the body.

---

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

Assertion A: Nephrons are of two types: Cortical Juxta medullary, based on their relative position in cortex and medulla.

Reason R: Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.

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

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

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

**Solution:** - Statement A is correct because nephrons are classified into two types based on their position in the kidney. - Statement R is also correct because juxta medullary nephrons have shorter loops of Henle compared to cortical nephrons.

#### Quick Tip

Understanding the structure of nephrons helps in understanding kidney function and the importance of the loop of Henle.

---

**159. Which of the following is not a cloning vector?**

- (1) YAC
- (2) pBR322
- (3) Probe
- (4) BAC

**Correct Answer:** (3) Probe

**Solution:** A probe is a nucleic acid sequence used to detect the presence of complementary sequences, while YAC, pBR322, and BAC are all cloning vectors used in genetic engineering.

#### Quick Tip

Cloning vectors such as YAC, pBR322, and BAC are designed to carry foreign DNA for replication and expression in host organisms.

**160. Given below are two statements:**

**Statement I: A protein is imagined as a line, the left end represented by the 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  $\alpha$  type and two subunits of  $\beta$  type).**

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

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

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

**Solution:** - Statement I is correct because in proteins, the N-terminal is the amino terminus, and the C-terminal is the carboxyl terminus.

- Statement II is also true as adult human hemoglobin consists of two  $\alpha$ -globin subunits and two  $\beta$ -globin subunits.

#### Quick Tip

Understanding the structure of proteins, including the N-terminal and C-terminal, is essential for comprehending their function in biological systems.

---

**161. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by:**

- (1) Ileo - caecal valve
- (2) Gastro - oesophageal sphincter
- (3) Pyloric sphincter
- (4) Sphincter of Oddi

**Correct Answer:** (1) Ileo - caecal valve

**Solution:** The ileo-caecal valve prevents the backflow of undigested substances from the caecum into the ileum.

**Quick Tip**

The ileo-caecal valve plays a crucial role in regulating the flow of chyme from the small intestine to the large intestine.

**162. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Vasectomy is a surgical method (A-III).

- Coitus interruptus is a natural method (B-IV).

- Cervical caps are a barrier method (C-II).

- Saheli is an oral contraceptive method (D-I).

**Quick Tip**

Different contraceptive methods vary in terms of effectiveness and application; choosing the right method depends on individual needs.

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

- (1) Protein synthesis
- (2) Motility
- (3) Transportation
- (4) Nuclear division

**Correct Answer:** (2) Motility

**Solution:** The cytoskeleton is primarily involved in the movement (motility) of the cell and its components. It also plays a role in intracellular transport and structural support.

#### Quick Tip

The cytoskeleton helps the cell maintain its shape and aids in cell movement and intracellular transport.

---

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

- (1) Gonorrhoea
- (2) Hepatitis-B
- (3) HIV Infection
- (4) Genital herpes

**Correct Answer:** (1) Gonorrhoea

**Solution:** Gonorrhoea is a bacterial infection that can be effectively treated with antibiotics if detected early. Hepatitis B, HIV, and genital herpes are viral infections that are not completely curable.

#### Quick Tip

Timely detection and proper treatment of sexually transmitted infections (STIs) are critical in preventing complications and transmission.

**165. Vital capacity of lung is .....**

- (1)  $IRV + ERV + TV + RV$
- (2)  $IRV + ERV + TV - RV$
- (3)  $IRV + ERV + TV$
- (4)  $IRV + ERV$

**Correct Answer:** (3)  $IRV + ERV + TV$

**Solution:** Vital capacity of the lung is the maximum amount of air that can be exhaled after a maximal inhalation, and it is the sum of the inspiratory reserve volume (IRV), expiratory reserve volume (ERV), and tidal volume (TV).

**Quick Tip**

Vital capacity is important in assessing lung function and is measured using a spirometer.

---

**166. Which of the following are NOT considered as part of the endomembrane system?**

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

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

**Solution:** Mitochondria, chloroplasts, and peroxisomes are not considered part of the endomembrane system, which includes the endoplasmic reticulum, Golgi complex, and vesicles.

**Quick Tip**

The endomembrane system is crucial for the synthesis, modification, packaging, and transport of cellular products.

**167. Match List I with List II:**

List I	List II
A. CCK	I. Kidney
B. GIP	II. Heart
C. ANF	III. Gastric gland
D. ADH	IV. Pancreas

**Choose the correct answer from the options given below:**

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

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

**Solution:** - CCK is produced by the gastric gland (A-III).

- GIP is produced by the pancreas (B-IV).

- ANF is produced in the heart (C-I).

- ADH is produced in the kidney (D-II).

**Quick Tip**

Hormones are produced by specific glands and play crucial roles in various physiological functions.

**168. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Gene 'a' codes for  $\beta$ -galactosidase (A-I).

- Gene 'y' codes for transacetylase (B-II).
- Gene 'i' codes for permease (C-III).
- Gene 'z' codes for repressor protein (D-IV).

#### Quick Tip

The lac operon in *E. coli* is a classic example of gene regulation, involving genes for  $\beta$ -galactosidase, permease, and transacetylase.

**169. Match List I with List II with respect to the human eye:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - The fovea is the point of greatest visual acuity or resolution (A-III).

- The iris is the visible colored portion of the eye that regulates the diameter of the pupil (B-I).

- The blind spot is where the optic nerve leaves the eyeball, and photoreceptor cells are absent (C-IV).

- The sclera is the external layer of the eye formed of dense connective tissue (D-II).

#### Quick Tip

The fovea and blind spot are key regions in understanding the visual processes of the eye.

---

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

(1) Numbat, Spotted cuscus, Flying phalanger

(2) Mole, Flying squirrel, Tasmanian tiger cat

(3) Lemur, Anteater, Wolf

(4) Tasmanian wolf, Bobcat, Marsupial mole

**Correct Answer:** (1) Numbat, Spotted cuscus, Flying phalanger

**Solution:** These marsupials represent a diverse group that evolved to fill various ecological niches in Australia, showcasing adaptive radiation.

#### Quick Tip

Adaptive radiation leads to the diversification of species into different forms to occupy various ecological niches.

---

**171. Given below are two statements:**

**Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.**

**Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.**

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

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

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

**Solution:** - Statement I is correct: The vas deferens receives secretions from the seminal vesicles and opens into the urethra as the ejaculatory duct.

- Statement II is also correct: The cervical canal is part of the birth canal that connects the uterus to the vagina.

#### Quick Tip

Understanding the anatomy of the reproductive system is essential for comprehending human reproduction.

---

**172. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

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

**Solution:** - Heroin is a painkiller (A-III).

- Marijuana slows down body function (B-II).
- Cocaine acts as a painkiller (C-I).
- Morphine interferes with the transport of dopamine (D-IV).

#### Quick Tip

Drugs like heroin, marijuana, cocaine, and morphine have different effects on the nervous and cardiovascular systems.

#### 173. Match List I with List II:

List I	List II
A. Ringworm	I. Haemophilus influenzae
B. Filariasis	II. Trichophyton
C. Malaria	III. Wuchereria bancrofti
D. Pneumonia	IV. Plasmodium vivax

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Ringworm is caused by Trichophyton (A-II).

- Filariasis is caused by Wuchereria bancrofti (B-III).
- Malaria is caused by Plasmodium vivax (C-IV).
- Pneumonia is caused by Haemophilus influenzae (D-I).

### Quick Tip

Different infections are caused by various pathogens, such as bacteria, fungi, and protozoa.

---

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

**Assertion A: Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.**

**Reason R: Ban on amniocentesis checks increasing menace of female foeticide.**

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

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

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

**Solution:** Amniocentesis is used for sex determination in the fetus, and its ban is part of efforts to control the increasing practice of female foeticide.

### Quick Tip

Amniocentesis is banned in many places to prevent gender-based abortions, which are a form of gender discrimination.

---

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

- (1) Hemichordata
- (2) Coelenterata
- (3) Echinodermata
- (4) Ctenophora

**Correct Answer:** (1) Hemichordata

**Solution:** Radial symmetry is characteristic of Coelenterata, Echinodermata, and Ctenophora, but not Hemichordata, where the symmetry is bilateral.

#### Quick Tip

Understanding symmetry types in animals helps classify them into appropriate phyla based on their structural characteristics.

---

**176. Given below are two statements:**

**Statement I:** Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.

**Statement II:** When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor.

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

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

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

**Solution:** - Statement I is correct: Low temperature can inhibit enzyme activity reversibly, while high temperature denatures proteins and inactivates enzymes.

- Statement II is correct: Competitive inhibitors resemble the substrate and compete for the enzyme's active site, reducing enzyme activity.

### Quick Tip

Competitive inhibition occurs when an inhibitor competes with the substrate for the enzyme's active site, while non-competitive inhibition involves binding elsewhere on the enzyme.

### 177. Match List I with List II:

List I	List II
A. Taenia	I. Nephridia
B. Paramoecium	II. Contractile vacuole
C. Periplaneta	III. Flame cells
D. Pheretima	IV. Urecose gland

### Choose the correct answer from the options given below:

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

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

**Solution:** - Taenia has nephridia for excretion (A-I).

- Paramoecium uses contractile vacuoles to remove excess water (B-II).

- Periplaneta (cockroach) has flame cells for excretion (C-III).

- Pheretima (earthworm) has urecose glands for excretion (D-IV).

### Quick Tip

Different organisms use different mechanisms for excretion, such as nephridia in earthworms and flame cells in arthropods.

**178. Which of the following statements are correct regarding the female reproductive cycle?**

**A. In non-primate mammals, cyclical changes during reproduction are called estrus cycle.**

**B. The first menstrual cycle begins at puberty and is called menopause.**

**C. Lack of menstruation may be indicative of pregnancy.**

**D. Cyclic menstruation extends between menarche and menopause.**

**Choose the most appropriate answer from the options given below:**

(1) A and B only

(2) A, B and C only

(3) A, C and D only

(4) A and D only

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

**Solution:** - Statement A is correct: In non-primate mammals, the reproductive cycle is known as the estrus cycle.

- Statement B is incorrect: The first menstrual cycle begins at puberty, but menopause is the cessation of the menstrual cycle.

- Statement C is correct: Lack of menstruation can be a sign of pregnancy.

- Statement D is correct: Cyclic menstruation occurs between menarche (first menstruation) and menopause.

#### Quick Tip

Menstrual cycles and hormonal changes are closely tied to reproductive health.

---

**179. Given below are two statements:**

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

**Statement II: Electrostatic precipitator in thermal power plants removes ionizing radiations.**

**In the light of the above statements, choose the most appropriate answer from the**

**options given below:**

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

**Correct Answer:** (2) Statement I is correct but Statement II is false.

**Solution:** - Statement I is correct: Electrostatic precipitators are widely used in thermal power plants for controlling particulate matter.

- Statement II is false: Electrostatic precipitators are not used for removing ionizing radiation but for particulate matter.

**Quick Tip**

Electrostatic precipitators use electric fields to remove dust and particulate matter from industrial exhaust gases.

**180. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Peptic cells secrete proenzyme pepsinogen (A-III).

- Goblet cells secrete mucus (B-I).
- Oxyntic cells secrete HCl and intrinsic factor (C-IV).
- Hepatic cells secrete bile juice (D-II).

#### Quick Tip

Different cells in the digestive system are specialized for secreting enzymes, acids, and bile to aid in digestion.

---

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

**Assertion A: Endometrium is necessary for implantation of blastocyst.**

**Reason R: In the absence of fertilization, the corpus luteum degenerates that causes disintegration of endometrium.**

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

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

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

**Solution:** - Assertion A is true: The endometrium provides the necessary environment for the implantation of a blastocyst.

- Reason R is also true: The corpus luteum degenerates if there is no fertilization, leading to the disintegration of the endometrium, which is required for implantation.

#### Quick Tip

Implantation is a critical step in pregnancy, and the endometrium must be receptive to the blastocyst for successful implantation.

---

**182. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Cartilaginous joints are found between adjacent vertebrae in the vertebral column (A-II).

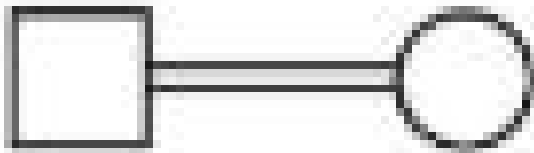
- Ball and socket joints are found between the humerus and the pectoral girdle (B-IV).
- Fibrous joints are found between flat skull bones (C-I).
- Saddle joints are found between the carpal and metacarpal of the thumb (D-III).

**Quick Tip**

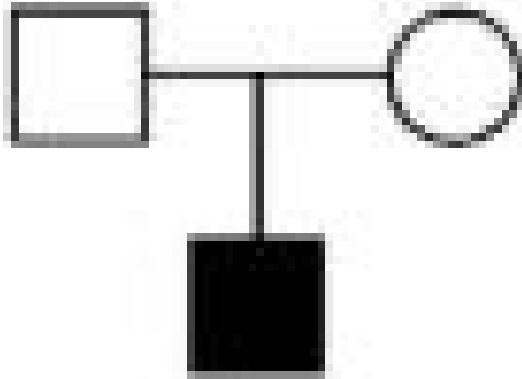
Understanding the types of joints and their locations in the body is important for comprehending human movement and skeletal structure.

---

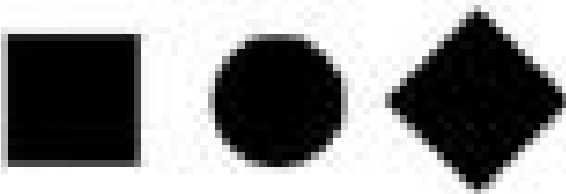
**183. Which one of the following symbols represents mating between relatives in human pedigree analysis?**



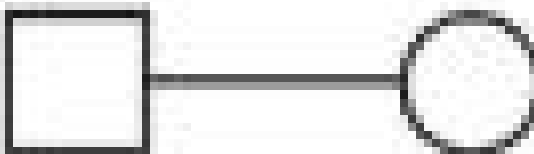
(1)



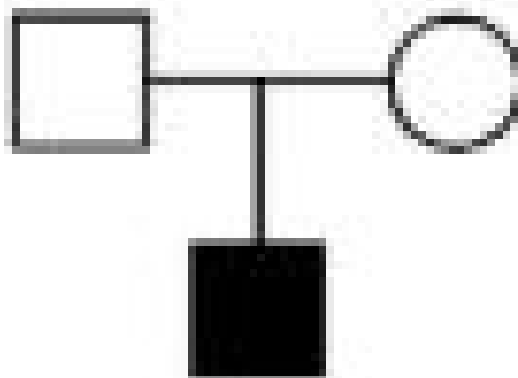
(2)



(3)



(4)



**Correct Answer: (2)**

**Solution:** In human pedigree analysis, mating between relatives is represented by a square (◻) and a filled square (◼), indicating that the mating is between relatives.

**Quick Tip**

Pedigree analysis uses different symbols to represent male, female, and their relationships.

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

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

**Correct Answer:** (4) Recombinant DNA Technology

**Solution:** Recombinant DNA technology is typically used for research purposes, gene therapy, and biotechnology applications, not directly for early disease diagnosis.

**Quick Tip**

Early diagnostic techniques like PCR and ELISA are used for detecting specific disease markers in body fluids.

**185. Match List I with List II:**

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

**Choose the correct answer from the options given below:**

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

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

**Solution:** - A Leopard and a Lion in a forest/grassland exhibit competition (A-I).

- A Cuckoo laying its egg in a Crow's nest exhibits brood parasitism (B-II).

- Fungi and the root of a higher plant in Mycorrhizae exhibit mutualism (C-III).

- A cattle egret and a cattle in a field exhibit commensalism (D-IV).

#### Quick Tip

Mutualism and commensalism are types of symbiotic relationships, whereas competition and parasitism are non-mutual interactions.

---

**186. Given below are two statements:**

**Statement I: During G<sub>0</sub> phase of the cell cycle, the cell is metabolically inactive.**

**Statement II: The centrosome undergoes duplication during the S phase of interphase.**

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

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

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

**Solution:** - Statement I is incorrect because during the G<sub>0</sub> phase, the cell is not dividing, but it can still carry out certain metabolic functions.

- Statement II is correct because the centrosome undergoes duplication during the S phase of interphase.

### Quick Tip

The G<sub>0</sub> phase is a resting phase, where cells exit the active cell cycle but may still perform essential functions.

### 187. Match List I with List II:

List I	List II
A. Logistic growth	I. Unlimited resource availability condition
B. Exponential growth	II. Limited resource availability condition
C. Expanding age pyramid	III. The percent individuals of pre-reproductive age is largest followed by reproductive and post-reproductive age groups
D. Stable age pyramid	IV. The percent individuals of pre-reproductive and reproductive age group are the same

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Logistic growth occurs under limited resource availability conditions (A-II).

- Exponential growth occurs under unlimited resource availability conditions (B-IV).

- An expanding age pyramid has the highest percentage of pre-reproductive individuals, followed by reproductive and post-reproductive age groups (C-III).

- A stable age pyramid has an equal percentage of pre-reproductive and reproductive age groups (D-I).

### Quick Tip

Understanding population growth models and age pyramids can help in predicting the future dynamics of a population.

---

**188. In cockroach, excretion is brought about by-**

- A. Phallic gland**
- B. Urecose gland**
- C. Nephrocytes**
- D. Fat body**
- E. Collateral glands**

**Choose the correct answer from the options given below:**

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

**Correct Answer:** (1) A, B and E only

**Solution:** In cockroaches, excretion is carried out by the phallic glands, urecose glands, and collateral glands. Nephrocytes and fat bodies do not contribute to the excretory system directly.

### Quick Tip

The excretory system of cockroaches involves several structures working together for efficient waste removal.

---

**189. Select the correct statements.**

- A. Tetrad formation is seen during Leptotene.**
- B. During Anaphase, the centromeres split and chromatids separate.**
- C. Terminalization takes place during Pachytene.**

**D. Nucleolus, Golgi complex, and ER are reformed during Telophase.**

**E. Crossing over takes place between sister chromatids of homologous chromosomes.**

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Statement B is correct: During Anaphase, centromeres split and chromatids are separated.

- Statement E is correct: Crossing over occurs between non-sister chromatids of homologous chromosomes, not sister chromatids.

- Other statements are incorrect in the context of meiotic stages.

#### Quick Tip

Understanding meiotic phases and events is crucial in genetics, especially for determining genetic variation.

---

**190. Which of the following are NOT under the control of thyroid hormone?**

**A. Maintenance of water and electrolyte balance**

**B. Regulation of basal metabolic rate**

**C. Normal rhythm of sleep-wake cycle**

**D. Development of immune system**

**E. Support the process of R.B.Cs formation**

**Choose the correct answer from the options given below:**

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

**Correct Answer:** (4) A and D only

**Solution:** - Thyroid hormone regulates basal metabolic rate and supports RBC formation, but it does not directly control water/electrolyte balance or the immune system.

**Quick Tip**

Thyroid hormone plays a significant role in metabolism but does not directly regulate water balance or immunity.

---

**191. Which of the following is a characteristic feature of cockroach regarding sexual dimorphism?**

- (1) Presence of anal styles
- (2) Presence of sclerites
- (3) Presence of anal cerci
- (4) Dark brown body colour and anal cerci

**Correct Answer:** (3) Presence of anal cerci

**Solution:** Sexual dimorphism in cockroaches includes the presence of anal cerci, which are present in males and are used for mating behavior.

**Quick Tip**

Insects often display sexual dimorphism in their external structures, which aids in reproductive processes.

---

**192. Which of the following statements are correct?**

- A. Basophils are the most abundant cells of the total WBCs.**
- B. Basophils secrete histamine, serotonin, and heparin.**
- C. Basophils are involved in inflammatory response.**
- D. Basophils have a kidney-shaped nucleus.**
- E. Basophils are agranulocytes.**

**Choose the correct answer from the options given below:**

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

**Correct Answer:** (2) B and C only

**Solution:** - Statement B is correct: Basophils secrete histamine, serotonin, and heparin.

- Statement C is correct: Basophils are involved in the inflammatory response.

- Other statements are incorrect: Basophils are not the most abundant, they do not have a kidney-shaped nucleus, and they are granulocytes, not agranulocytes.

#### Quick Tip

Basophils play a role in immune responses by releasing substances that mediate inflammation.

---

**193. 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 an increase in blood pressure.**
- E. ADH is responsible for the decrease in GFR.**

**Choose the correct answer from the options given below:**

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

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

**Solution:** - Statement B is correct: ADH facilitates water reabsorption to prevent diuresis.

- Statement C is correct: ANF causes vasodilation.
- Statement D is correct: ADH causes an increase in blood pressure.
- Statement A and E are incorrect in this context.

#### Quick Tip

ADH plays a crucial role in maintaining water balance in the body by affecting water reabsorption and blood pressure.

#### 194. Match List I with List II:

List I	List II
A. Mast cells	I. Ciliated epithelium
B. Inner surface of bronchiole	II. Areolar connective tissue
C. Blood	III. Cuboidal epithelium
D. Tubular parts of nephron	IV. Specialized connective tissue

#### Choose the correct answer from the options given below:

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

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

**Solution:** - Mast cells are found in specialized connective tissue (A-II).

- The inner surface of bronchioles is lined with cuboidal epithelium (B-III).
- Blood is associated with areolar connective tissue (C-I).
- Tubular parts of nephron are involved in specialized connective tissue (D-IV).

#### Quick Tip

Understanding the structures of tissues and organs is crucial to identifying their function and role in the body.

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**195. 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) B and C only

(2) B, D and E only

(3) C, D and E only

(4) A, C and D only

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

**Solution:** - Chordates possess a solid, mid-dorsal nerve cord (A).

- They possess paired pharyngeal gill slits (C) and a dorsal heart (D).

- Statement B about a closed circulatory system is not always true for all chordates.

- Chordates are triploblastic, but pseudocoelomates are not part of this group.

#### Quick Tip

Chordates are defined by key features such as a dorsal nerve cord, notochord, and pharyngeal slits during some stage of development.

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**196. The unique mammalian characteristics are:** (1) hairs, pinna and mammary glands

(2) hairs, pinna and indirect development

(3) pinna, monocondylic skull and mammary glands

(4) hairs, tympanic membrane and mammary glands

**Correct Answer:** (1) hairs, pinna and mammary glands

**Solution:** - Mammals are characterized by the presence of hair, external ear (pinna), and mammary glands for feeding offspring.

### Quick Tip

Mammals have unique features like hair, which distinguishes them from other vertebrates.

**197. The parts of human brain that helps in regulation of sexual behavior, expression of excitement, pleasure, rage, fear etc. are:** (1) Corpora quadrigemina & hippocampus

- (2) Brain stem & epithalamus
- (3) Corpus callosum and thalamus
- (4) Limbic system & hypothalamus

**Correct Answer:** (4) Limbic system & hypothalamus

**Solution:** - The limbic system, along with the hypothalamus, plays a central role in regulating emotions, sexual behavior, and other feelings.

### Quick Tip

The limbic system is often referred to as the "emotional brain" due to its role in regulating emotions and behaviors.

**198. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows**

5'AUCGCGAUCGAUCGAUCUGAUGCUGAUGCUGAUGCUGAUGCA3'

- (1) 3' UAGGCGAUCGAUCUAGCUGAUGCUGAUGCA 5'
- (2) 5' ATCGATCGATCGATCGATCG 3'
- (3) 3' ATCGATCGATCGATCGATCG 5'
- (4) 5' UAGCUGCUGCAUGCA 3'

**Correct Answer:** (1) 3' UAGGCGAUCGAUCUAGCUGAUGCUGAUGCA 5'

**Solution:** The corresponding coding strand is the complementary strand of the mRNA sequence, and we need to match the bases following the base pairing rules (A-U, C-G) for

RNA.

**Quick Tip**

When writing the coding strand from the mRNA sequence, remember that in RNA, uracil (U) replaces thymine (T).

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**199. Which of the following statements are correct regarding skeletal muscle?**

**A. Muscle bundles are held together by collagenous connective tissue layer called fascicle.**

**B. Sarcoplasmic reticulum of muscle fibre is a store house of calcium ions.**

**C. Striated appearance of skeletal muscle fibre is due to distribution pattern of actin and myosin proteins.**

**D. M line is considered as functional unit of contraction called sarcomere.**

**Choose the most appropriate answer from the options given below:**

(1) B and C only

(2) A, C and D only

(3) C and D only

(4) A, B and C only

**Correct Answer:** (4) A, B and C only

**Solution:** - Statement A is correct: Muscle bundles are held together by fascicles.

- Statement B is correct: Sarcoplasmic reticulum stores calcium ions.

- Statement C is correct: The striated appearance is due to actin and myosin pattern.

- Statement D is incorrect because the M line is part of the sarcomere but not the functional unit.

**Quick Tip**

The sarcomere is the functional unit of muscle contraction, but it is made up of different lines such as the Z-line and M-line, not just the M-line alone.

**200. Which one of the following is NOT an advantage of inbreeding?**

- (1) It exposes harmful recessive genes that are eliminated by selection.
- (2) Elimination of less desirable genes and accumulation of superior genes takes place due to it.
- (3) It decreases the productivity of inbred population, after continuous inbreeding.
- (4) It decreases homozygosity.

**Correct Answer:** (4) It decreases homozygosity.

**Solution:** Inbreeding typically increases homozygosity, not decreases it. It helps to eliminate harmful recessive genes but often leads to a reduction in genetic diversity, which can reduce the overall fitness of the population.

**Quick Tip**

While inbreeding can help eliminate harmful recessive traits, it also increases the likelihood of homozygosity, which can lead to genetic disorders.