

NEET (UG) 2026 Re-Exam

Question Paper with Answers and Solutions

Questions	180	Maximum marks	720
Language	English	Marking	+4 correct, -1 wrong, 0 blank
Physics	Questions 1 to 45		
Chemistry	Questions 46 to 90		
Biology	Questions 91 to 180		

INSTRUCTIONS

1. This booklet carries all 180 questions of the official NEET (UG) 2026 Re-Exam paper, set by the National Testing Agency (NTA), in NTA's order and numbering.
2. Each question is followed by its answer and a worked solution written by BrainIt. Cover the solution with a sheet of paper to attempt a question first.
3. Each question has four options, numbered (1) to (4). Where NTA accepted more than one option, the answer lists all of them.
4. For exam practice, attempt the whole paper in one sitting, timed as in the exam, then mark it: +4 for a correct answer, -1 for a wrong one, 0 for a question left blank.
5. This paper is also online, with every solution, at brainit.pro/neet/question-papers/neet-2026-re-exam/

Name			
Date attempted		Time taken	
Correct		Score	/ 720



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PHYSICS

1. A particle of mass M moves along a horizontal x axis from $x = 0$ to $x = L$. The coefficient of kinetic friction varies as a function of x as $\mu_k(x) = \mu_0 - \alpha x$, where μ_0, α are constants of appropriate dimensions, so that $\mu_k(L) = 0$. The total work done by the frictional force during the motion is $n\mu_0 MgL$, where g is the acceleration due to gravity. The value of n is:

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

Answer (4)

Sol. The condition $\mu_k(L) = 0$ fixes $\alpha = \mu_0/L$, so $\mu_k(x) = \mu_0(1 - \frac{x}{L})$ falls linearly from μ_0 to zero. Because the force varies with position, the work must be integrated: $|W| = \int_0^L \mu_k(x) Mg dx = \mu_0 Mg [L - \frac{L}{2}] = \frac{1}{2} \mu_0 MgL$. Comparing with $n\mu_0 MgL$ gives $n = 1/2$, which is simply the average of the initial and final friction coefficients since the variation is linear. NCERT Class 11, Work, Energy and Power (work done by a variable force).

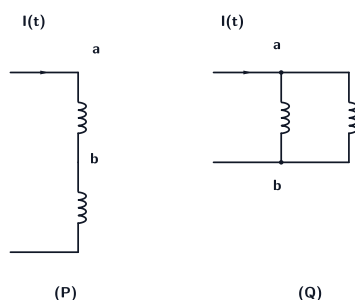
2. The mean free path of molecules in an ideal gas A is half that of another ideal gas B . The diameter of the spherical molecules of gas A is twice the diameter of the molecules of B . If number densities of the gases A and B are n_A and n_B , respectively, the correct option is:

- (1) $n_A = n_B$ (2) $n_A = 2n_B$
(3) $n_A = \frac{1}{4}n_B$ (4) $n_A = \frac{1}{2}n_B$

Answer (4)

Sol. Mean free path is $\lambda = \frac{1}{\sqrt{2}\pi d^2 n}$, so $\lambda \propto \frac{1}{d^2 n}$. Taking the ratio, $\frac{\lambda_A}{\lambda_B} = \frac{d_B^2 n_B}{d_A^2 n_A}$. Substituting $\lambda_A/\lambda_B = \frac{1}{2}$ and $d_A = 2d_B$ gives $\frac{1}{2} = \frac{n_B}{4n_A}$, hence $n_A = \frac{1}{2}n_B$. NCERT Class 11, Kinetic Theory (mean free path).

3. Two identical inductors are connected in two different configurations P and Q , where a time varying current $I(t)$ is flowing, as shown in the figure. The induced emf between points a and b for configuration P is E_P and that for configuration Q is E_Q . The ratio E_P/E_Q is: [Neglect the effect of mutual inductance.]



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

Answer (4)

Sol. In configuration P the two inductors are in series and the segment between a and b spans just ONE of them, carrying the full current, so $E_P = L \frac{dI}{dt}$. In configuration Q the points a and b straddle the parallel pair, whose equivalent inductance is $\frac{L}{2}$, so $E_Q = \frac{L}{2} \frac{dI}{dt}$. The ratio is therefore 2. NCERT Class 12, Electromagnetic Induction (self-inductance).

Why the other options are wrong:

- (1) takes E_P across the series pair as $2L$ and inverts the ratio
- (2) inverts the correct answer by swapping which configuration sits in the numerator
- (3) assumes identical inductors must produce identical electromotive forces (emfs) regardless of how a and b are placed

4. For sound waves, if the number of nodes for the 5th harmonic of an open-ended pipe is n and that for the 9th harmonic of the same pipe with one of its ends closed is m , the ratio $\frac{n}{m}$ is

- (1) $\frac{5}{9}$ (2) $\frac{9}{5}$ (3) 1 (4) $\frac{3}{5}$

Answer (3)

Sol. An open-open pipe has antinodes at both ends, and its p -th harmonic contains exactly p nodes, so the 5th harmonic gives $n = 5$. A closed pipe supports only odd harmonics, with a node at the closed end and an antinode at the open end; its q -th harmonic (q odd) contains $\frac{q+1}{2}$ nodes, so the 9th harmonic gives $m = \frac{10}{2} = 5$. The ratio is therefore 1. NCERT Class 11, Waves (standing waves in air columns).

5. Consider a long solenoid of length l and radius r . If n is the number of turns per unit length and μ_0 is the permeability of free space, the inductance of the solenoid is :

- (1) $\mu_0 \pi n^2 r^2 l$ (2) $\mu_0 n^2 r^2 l$
(3) $(\mu_0/2\pi) n^2 r^2 l$ (4) $2\mu_0 \pi n^2 r^2 l$

Answer (1)

Sol. For a long solenoid $L = \mu_0 n^2 A l$, where n is turns per unit length and A the cross-sectional area. Substituting $A = \pi r^2$ gives $L = \mu_0 \pi n^2 r^2 l$. NCERT Class 12, Electromagnetic Induction (self-inductance).

6. Consider a particle moving along a straight line, whose position as a function of time is given by $s(t) = \alpha t^2 - \beta t + \gamma$, where $\alpha = 1 \text{ ms}^{-2}$, $\beta = 6 \text{ ms}^{-1}$ and $\gamma = 5 \text{ m}$. The average speed of the particle, in ms^{-1} from $t = 0$ to $t = 6 \text{ s}$ is:

(1) 12 (2) 6 (3) 3 (4) 0

Answer (3)

Sol. Average speed uses total PATH LENGTH, not displacement, so the turning point must be located first. Here $v = \frac{ds}{dt} = 2t - 6$, which vanishes at $t = 3 \text{ s}$. Positions are $s(0) = 5 \text{ m}$, $s(3) = -4 \text{ m}$, $s(6) = 5 \text{ m}$, giving 9 m travelled in each leg and 18 m in total. Hence average speed $= 18/6 = 3 \text{ ms}^{-1}$.
NCERT Class 11, Motion in a Straight Line.

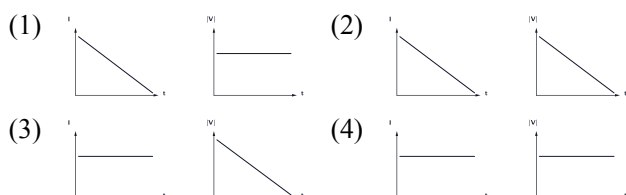
7. Consider the following nuclear reaction $^{238}\text{U} \rightarrow ^{234}\text{Th} + ^4\text{He}$. Take masses of ^{238}U , ^{234}Th and ^4He as 238.050 u, 234.043 u and 4.003 u, respectively. The Q value for the reaction, in keV, is: [Given: $1 \text{ u} = 931.5 \text{ MeV } c^{-2}$]

(1) 3726 (2) 3730 (3) 3736 (4) 3740

Answer (1)

Sol. The Q value is the mass defect converted to energy:
 $\Delta m = 238.050 - (234.043 + 4.003) = 0.004 \text{ u}$.
Multiplying by the conversion factor, $Q = 0.004 \times 931.5 = 3.726 \text{ MeV} = 3726 \text{ keV}$. The positive value confirms the decay is spontaneous. NCERT Class 12, Nuclei (mass-energy and nuclear reactions).

8. A beam of light falls on a metal surface such that photo-electrons are generated. If power of the light source starts to decrease linearly with time t , then variation of the photocurrent I and magnitude of the stopping potential $|V|$ with time is best represented by:



Answer (1)

Sol. Photocurrent is set by the NUMBER of photons striking the surface per second, so it is proportional to the source power and falls linearly with t . Stopping potential, by contrast, depends only on the maximum kinetic energy of the emitted electrons, $eV_0 = h\nu - \phi_0$, which is fixed by the FREQUENCY and the work function - neither of which changes here. So $|V|$ stays flat while I decays. NCERT Class 12, Dual Nature of Radiation and Matter.

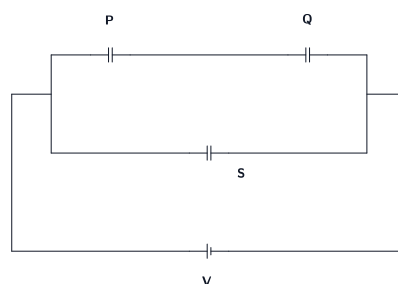
Why the other options are wrong:

- (2) treats stopping potential as intensity-dependent,

the single most common photoelectric misconception

- (3) swaps the roles entirely, tying current to frequency and stopping potential to intensity
- (4) assumes neither quantity responds to the source, ignoring that current tracks photon flux

9. Three identical capacitors, P , Q and S , each of the capacitance C , are connected to a battery of voltage V , as shown in the figure. If the energy stored in the capacitor P and total energy stored in the system are U_P and U_T , respectively, then the ratio $\frac{U_P}{U_T}$ is:



(1) 2/3 (2) 1/3 (3) 1/2 (4) 1/6

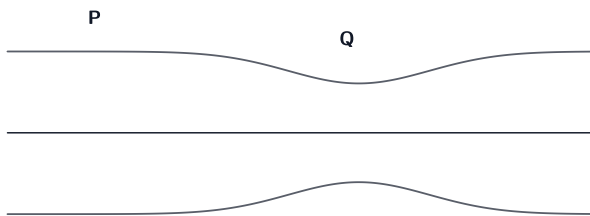
Answer (4)

Sol. P and Q form a series branch of equivalent capacitance $C/2$, and that branch sits in parallel with S across the battery, so $C_{eq} = \frac{C}{2} + C = \frac{3C}{2}$ and $U_T = \frac{1}{2} \left(\frac{3C}{2} \right) V^2 = \frac{3}{4} CV^2$. Identical capacitors in series split the voltage equally, so P holds $V/2$ and $U_P = \frac{1}{2} C \left(\frac{V}{2} \right)^2 = \frac{CV^2}{8}$. The ratio is $\frac{CV^2/8}{3CV^2/4} = \frac{1}{6}$.
NCERT Class 12, Electrostatic Potential and Capacitance.

Why the other options are wrong:

- (1) treats all three capacitors as being in parallel, so each stores an equal third and P plus Q gives 2/3
- (2) assumes the three capacitors share the energy equally, ignoring that P sees only half the battery voltage
- (3) computes the ratio of U_P to the energy of the series branch alone, forgetting to include S in the total

10. Water flows in a streamline motion through a horizontal pipe of circular cross-section as shown in the figure. The pressure difference of water between P and Q is 15 Nm^{-2} . The area of cross-section at P and Q are 40 cm^2 and 20 cm^2 , respectively. The rate of flow of water through the pipe, in cm^3s^{-1} , is: [Take density of water = 1000 kg m^{-3}]



- (1) 100 (2) 200 (3) 300 (4) 400

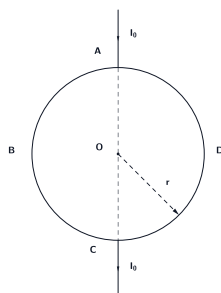
Answer (4)

Sol. Continuity gives $A_P v_P = A_Q v_Q$, so halving the area doubles the speed: $v_Q = 2v_P$. For a horizontal pipe Bernoulli's equation reduces to $\Delta P = \frac{1}{2}\rho(v_Q^2 - v_P^2) = \frac{3}{2}\rho v_P^2$. Substituting $15 = 1500 v_P^2$ gives $v_P = 0.1 \text{ ms}^{-1} = 10 \text{ cm s}^{-1}$, and the volume flow rate is $A_P v_P = 40 \times 10 = 400 \text{ cm}^3\text{s}^{-1}$. NCERT Class 11, Mechanical Properties of Fluids.

Why the other options are wrong:

- (1) uses the narrow area A_Q with the wide-section speed v_P , mismatching the pair
- (2) drops the factor 3 from $v_Q^2 - v_P^2$, effectively using $\Delta P = \frac{1}{2}\rho v_Q^2$ alone
- (3) mixes SI and centimetre-gram-second (CGS) units partway through, most often by leaving ρ in kg m^{-3} alongside areas in cm^2

11. A current I_0 flows through a metallic circular loop of radius r as shown in the figure. Resistance of the segment ABC is half that of ADC . Magnitude of magnetic field at the centre O of the loop is :



- (1) $\frac{\mu_0 I_0}{12r}$ (2) $\frac{\mu_0 I_0}{4r}$
 (3) $\frac{\mu_0 I_0}{2r}$ (4) $\frac{\mu_0 I_0}{2\pi r}$

Answer (1)

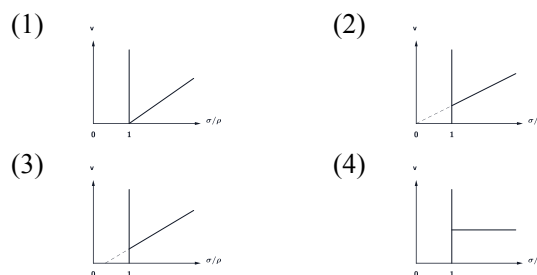
Sol. The current entering at A divides between the two arcs in INVERSE proportion to their resistances, so with $R_{ABC} = \frac{1}{2}R_{ADC}$ the currents are $\frac{2}{3}I_0$ and $\frac{1}{3}I_0$.

Each arc is a semicircle (A at the top, C at the bottom), contributing $\frac{\mu_0 I}{4r}$ but in OPPOSITE directions at O . The net field is $\frac{\mu_0}{4r} \left(\frac{2}{3}I_0 - \frac{1}{3}I_0 \right) = \frac{\mu_0 I_0}{12r}$. NCERT Class 12, Moving Charges and Magnetism (Biot-Savart law).

Why the other options are wrong:

- (2) sends the whole current I_0 round one semicircle and ignores the opposing contribution from the other arc
- (3) uses the full-loop result $\frac{\mu_0 I}{2r}$ without splitting the current or accounting for cancellation
- (4) applies the formula for a long straight wire, $\frac{\mu_0 I}{2\pi r}$, instead of an arc

12. In the measurement of viscosity of liquids using terminal velocity experiment, spherical balls of same radius but having different densities are used. The variation of the terminal velocity (v) with the ratio of density of spherical ball (σ) to density of the liquid (ρ), is best represented by:



Answer (1)

Sol. Stokes' law gives $v = \frac{2r^2 g}{9\eta} (\sigma - \rho)$, which can be rewritten as $v = \frac{2r^2 g \rho}{9\eta} \left(\frac{\sigma}{\rho} - 1 \right)$. With r fixed this is a STRAIGHT LINE in σ/ρ whose intercept on the horizontal axis is exactly at $\sigma/\rho = 1$. Below that value the ball is lighter than the liquid and does not sink at all, so the downward terminal velocity stays zero. NCERT Class 11, Mechanical Properties of Fluids (Stokes' law).

Why the other options are wrong:

- (2) takes $v \propto \sigma$ and lets the line pass through the origin, ignoring the buoyant term $-\rho$
- (3) places the zero-velocity crossing at some arbitrary density ratio rather than at the neutral-buoyancy point $\sigma = \rho$
- (4) treats terminal velocity as a fixed property of the ball once it sinks, missing its linear dependence on excess density

13. Two planets P_1 and P_2 with equal mass have radii R_1 and R_2 , respectively, where $R_2 = \frac{R_1}{2}$. The escape speeds of P_1 and P_2 are v_1 and v_2 , respectively. Then $\frac{v_2}{v_1}$ is:

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

Answer (3)

Sol. Escape speed is $v_e = \sqrt{\frac{2GM}{R}}$. With the masses equal, $v_e \propto R^{-1/2}$, so $\frac{v_2}{v_1} = \sqrt{\frac{R_1}{R_2}} = \sqrt{2}$. The denser, smaller planet is harder to escape from, which is the physical sense check. NCERT Class 11, Gravitation (escape speed).

14. In a solar system, the time-period of revolution of a planet tracing a circular orbit of radius R is proportional to:

- (1) $R^{1/2}$ (2) $R^{3/2}$ (3) R^2 (4) R^3

Answer (2)

Sol. Kepler's third law states $T^2 \propto R^3$ for orbits about a common central mass, so $T \propto R^{3/2}$. It also follows directly from equating gravitational and centripetal force: $\frac{GMm}{R^2} = m\omega^2 R$ with $\omega = 2\pi/T$. NCERT Class 11, Gravitation (Kepler's laws).

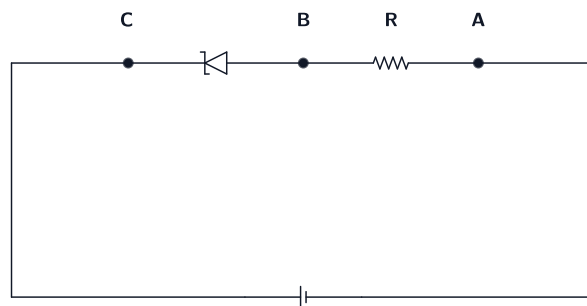
15. Two infinitely long parallel conducting wires A and B carry currents I and $2I$, respectively, in the same direction. The wire A has uniform mass per unit length λ and lies on an insulated floor. The wire B is kept fixed at a height h above the floor. The minimum magnitude of h so that the wire A does not rise from the floor is: [g is the acceleration due to gravity and μ_0 is the permeability of free space.]

- (1) $\frac{\mu_0 I^2}{2\pi\lambda g}$ (2) $\frac{\mu_0 I^2}{\pi\lambda g}$
(3) $\frac{2\mu_0 I^2}{\pi\lambda g}$ (4) $\frac{4\mu_0 I^2}{\pi\lambda g}$

Answer (2)

Sol. Parallel currents in the SAME direction attract, so wire B pulls wire A upwards with force per unit length $\frac{\mu_0(I)(2I)}{2\pi h} = \frac{\mu_0 I^2}{\pi h}$. Wire A stays on the floor as long as this does not exceed its weight per unit length λg , so $\frac{\mu_0 I^2}{\pi h} \leq \lambda g$ and $h_{\min} = \frac{\mu_0 I^2}{\pi\lambda g}$. NCERT Class 12, Moving Charges and Magnetism (force between two parallel currents).

16. An ideal Zener diode with breakdown voltage of -3 V is reverse biased with a negative input voltage $V_i = -5\text{ V}$. The magnitude of voltage difference between point B and A is:



- (1) 3 V (2) 2 V (3) 1 V (4) 0 V

Answer (2)

Sol. Once an ideal Zener diode is driven past its breakdown voltage it CLAMPS the voltage across itself at 3 V and behaves like a constant-voltage source. The remaining $5 - 3 = 2\text{ V}$ of the supply must therefore appear across the series resistor, which is the element between B and A . NCERT Class 12, Semiconductor Electronics (Zener diode as a voltage regulator).

Why the other options are wrong:

- (1) reports the voltage across the ZENER rather than across the resistor between B and A
- (3) subtracts twice, or assumes the diode drops an extra 1 V forward-bias contribution
- (4) assumes the reverse-biased diode blocks all current, so no drop appears across the resistor - but breakdown means current does flow

17. In an adiabatic expansion, the temperature of one mole of an ideal monatomic gas ($\gamma = 5/3$) decreases from 60 K to 50 K. The work done by the gas in the process is: (Take the universal gas constant as $R = 8.3\text{ J mol}^{-1}\text{K}^{-1}$)

- (1) 41.5 J (2) 83 J (3) 124.5 J (4) 166 J

Answer (3)

Sol. In an adiabatic process $Q = 0$, so the work done by the gas comes entirely out of its internal energy: $W = -\Delta U = nC_V(T_1 - T_2)$. For a monatomic gas $C_V = \frac{3}{2}R$, giving $W = 1 \times \frac{3}{2}(8.3)(10) = 124.5\text{ J}$. The same follows from $W = \frac{nR(T_1 - T_2)}{\gamma - 1}$ with $\gamma = 5/3$. NCERT Class 11, Thermodynamics.

18. A ray of light with wavelength λ is incident on three different photoelectric cells namely 1, 2 and 3. The threshold wavelength of these photoelectric cells are λ_1 , λ_2 , and λ_3 , respectively and the magnitude of stopping potentials of these cells are V_1 , V_2 and V_3 , respectively. The relation between λ and threshold wavelengths are $\lambda_1 < \lambda$, $\lambda_2 > \lambda$ and $\lambda_3 \gg \lambda$. The correct option is:

- (1) $V_1 = 0$, $V_2 < V_3$ (2) $V_1 = 0$, $V_2 > V_3$
 (3) $V_1 > V_2$, $V_3 = 0$ (4) $V_1 < V_2$, $V_3 = 0$

Answer (1)

Sol. Emission occurs only when the incident wavelength is SHORTER than the threshold wavelength. Cell 1 has $\lambda_1 < \lambda$, so the photons are too weak and $V_1 = 0$. For the other two, $eV_0 = hc \left(\frac{1}{\lambda} - \frac{1}{\lambda_{th}} \right)$; a LARGER threshold wavelength means a smaller work function and hence a larger stopping potential. Since $\lambda_3 \gg \lambda_2$, the term $1/\lambda_3$ is nearly zero and $V_3 > V_2$. NCERT Class 12, Dual Nature of Radiation and Matter (Einstein's photoelectric equation).

19. A photon and an electron, each of 20 eV energy, move in free space. The ratio of linear momentum of electron p_e to that of photon p_{ph} , $\frac{p_e}{p_{ph}}$ is: [Take speed of light = $3 \times 10^8 \text{ ms}^{-1}$, charge of electron = $-1.6 \times 10^{-19} \text{ C}$ and mass of electron = $9 \times 10^{-31} \text{ kg}$]

- (1) $\frac{2}{450}$ (2) $\frac{1}{250}$
 (3) 225 (4) 275

Answer (3)

Sol. A photon's momentum is $p = \frac{E}{c} = \frac{20 \times 1.6 \times 10^{-19}}{3 \times 10^8} \approx 1.07 \times 10^{-26} \text{ kg m s}^{-1}$. A non-relativistic electron of the same kinetic energy has $p = \sqrt{2mE} = \sqrt{2(9 \times 10^{-31})(3.2 \times 10^{-18})} = 2.4 \times 10^{-24} \text{ kg m s}^{-1}$. The ratio is therefore about 225 - a massive particle carries far more momentum than a photon of the same energy, because $p \propto \sqrt{E}$ for matter but $p \propto E$ for light. NCERT Class 12, Dual Nature of Radiation and Matter.

20. Which of the following measurements require 'index correction'?

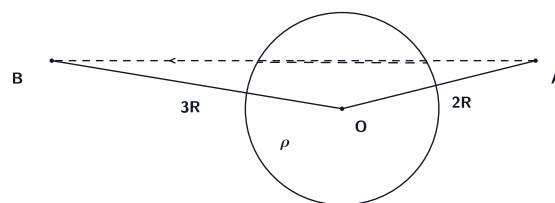
- (1) Measurement of resistance of a wire using meter bridge
 (2) Measurement of gravitational acceleration using simple pendulum
 (3) Measurement of focal length of lenses using optical bench
 (4) Measurement of speed of sound using resonance tube

Answer (3)

Sol. On an optical bench the positions read on the scale are those of the UPRIGHTS, not of the optical centres of

the lens, mirror or object pin. The fixed offset between an upright's index mark and the actual optical element is removed by the index (or bench) correction, applied to every measured object and image distance before computing the focal length. NCERT Class 12 practical work, Ray Optics and Optical Instruments.

21. A unit positive point charge is taken slowly through an infinitesimally thin tube that is inside a charged dielectric sphere of radius R , having uniform positive charge density ρ , as shown in the figure. The initial and final positions of the charge are marked by A and B at distance $2R$ and $3R$ respectively, from the centre of the sphere. In this process, the magnitude of the total work done on the point charge is $\frac{\rho R^2}{n\epsilon_0}$. The value of n is : (ϵ_0 is the permittivity of vacuum)



- (1) 2 (2) 6 (3) 9 (4) 18

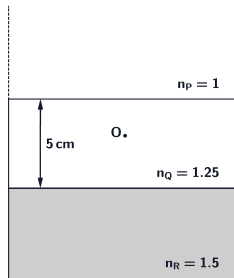
Answer (4)

Sol. Work done in moving a charge slowly is path-independent and depends only on the endpoint potentials, so the detour through the tube is a red herring. Both A and B lie OUTSIDE the sphere, where $V(r) = \frac{Q}{4\pi\epsilon_0 r}$ with $Q = \frac{4}{3}\pi R^3 \rho$. Then $|W| = |V_B - V_A| = \frac{Q}{4\pi\epsilon_0 R} \left| \frac{1}{3} - \frac{1}{2} \right| = \frac{\rho R^2}{18\epsilon_0}$, giving $n = 18$. NCERT Class 12, Electrostatic Potential and Capacitance.

Why the other options are wrong:

- (1) uses only the $\frac{1}{2}$ from position A and drops the $\frac{4}{3}\pi R^3$ volume factor
- (2) computes $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ but forgets the $\frac{1}{3}$ carried by the sphere's total charge
- (3) integrates the internal field along the tube as if the endpoints were inside the sphere

22. Consider three media P , Q and R with refractive indices 1, 1.25, and 1.5 respectively. The medium Q having a thickness of 5 cm is placed between extended media P and R as shown in the figure. An object O is placed at the centre of medium Q . If viewed from medium P near the normal direction, the apparent depth of O is h_1 . For similar observation from medium R , the apparent depth is h_2 . The value of $|h_1 - h_2|$, in cm, is:



- (1) 0 (2) 1 (3) 2 (4) 3

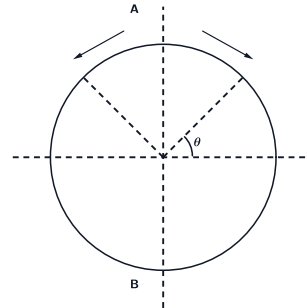
Answer (2)

Sol. For near-normal viewing across a plane boundary, apparent depth = real depth $\times \frac{n_{\text{observer}}}{n_{\text{object}}}$, and the object sits 2.5 cm from each face. Viewed from P : $h_1 = 2.5 \times \frac{1}{1.25} = 2$ cm. Viewed from R : $h_2 = 2.5 \times \frac{1.5}{1.25} = 3$ cm. Hence $|h_1 - h_2| = 1$ cm. Looking in from the DENSER side makes the object appear farther away, which is the sense check here. NCERT Class 12, Ray Optics and Optical Instruments (refraction at plane surfaces).

Why the other options are wrong:

- (1) assumes the symmetric placement of the object makes the two apparent depths equal, ignoring the different observer media
- (3) uses the full 5 cm thickness instead of the 2.5 cm from the object to each face
- (4) computes h_2 alone and reports it as the difference

23. A frictionless circular wire of unit radius is fixed on the horizontal plane. Two-point particles of unit mass start moving simultaneously from point A ($\theta = \frac{\pi}{2}$) with identical uniform angular speeds in opposite directions, and meet again at point B ($\theta = -\frac{\pi}{2}$). During this time, which of the following figures schematically represent the magnitude of the total linear momentum P of the system, as a function of θ ?



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

Answer (3)

Sol. By symmetry the two particles sit at mirror-image angles about the vertical, so their tangential velocities have equal and opposite horizontal components while their vertical components add. Writing the particles at θ and $\pi - \theta$, the resultant works out to $P = 2m\omega r |\cos \theta|$, which is zero at the start ($\theta = \pi/2$), peaks when the particles are diametrically opposite the meeting point ($\theta = 0$), and returns to zero as they collide at B . That single smooth hump is option (3). NCERT Class 11, System of Particles and Rotational Motion (motion of the centre of mass).

Why the other options are wrong:

- (1) assumes momentum is conserved as a constant because the SPEEDS are constant, forgetting that momentum is a vector whose direction keeps changing
- (2) inverts the phase - takes $P \propto |\sin \theta|$, i.e. maximum where the particles start rather than where they are farthest apart
- (4) assumes P falls off linearly with angle instead of following the cosine of the half-separation

24. The temperature of a metallic sphere of radius R is increased by a small amount ΔT . If the linear coefficient of thermal expansion of the metal is α , the approximate increase in the volume of the sphere is:

- (1) $2\pi R^3 \alpha \Delta T$ (2) $3\pi R^3 \alpha \Delta T$
 (3) $4\pi R^3 \alpha \Delta T$ (4) $6\pi R^3 \alpha \Delta T$

Answer (3)

Sol. For small expansions the coefficient of volume expansion is $\gamma = 3\alpha$. Hence $\Delta V = V\gamma\Delta T = \frac{4}{3}\pi R^3 \times 3\alpha \times \Delta T = 4\pi R^3 \alpha \Delta T$. Equivalently, differentiating $V = \frac{4}{3}\pi R^3$ gives $\Delta V = 4\pi R^2 \Delta R$ with $\Delta R = R\alpha\Delta T$. NCERT Class 11, Thermal Properties of Matter.

25. A cylindrical cork of uniform density floats in a liquid of density ρ_1 . If the cork is depressed slightly and released, it oscillates harmonically with time period T . If the same cork floats in another liquid of density ρ_2 , then the similar oscillation has time period $2T$. The value of ρ_2/ρ_1 is:

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

Answer (4)

Sol. Depressing the cork by x creates an extra buoyant force $A\rho g x$ directed back towards equilibrium, so the effective spring constant is $k = A\rho g$ and $T = 2\pi\sqrt{\frac{m}{A\rho g}}$. With m and A unchanged, $T \propto \rho^{-1/2}$. Doubling the period therefore requires the density to fall by a factor of four: $\frac{\rho_2}{\rho_1} = \frac{1}{4}$. NCERT Class 11, Oscillations (simple harmonic motion (SHM) examples).

26. One main scale division of a Vernier calliper is equal to 1 mm and the number of divisions on the Vernier scale is 10. When both the jaws touch each other, the Vernier scale shifts to the left of zero of the main scale in such a way that 4th Vernier division coincides with a division of the main scale. If this Vernier calliper measures the length of the wire to be 1 cm, the actual length of the wire is :

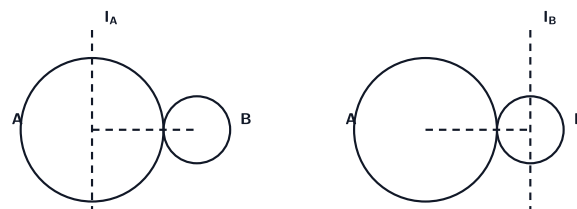
- (1) 0.60 cm (2) 0.96 cm (3) 1.00 cm (4) 1.06 cm

Answer (4)

Sol. NTA dropped this question because no printed option matched the correct answer; option (4) is corrected here to 1.06 cm. Working: least count = $\frac{1\text{MSD}}{N} = \frac{1\text{mm}}{10} = 0.1\text{ mm}$. The Vernier zero lies to the left of the main-scale zero, so the zero error is negative. With the 4th Vernier division coinciding, zero error = $-(N - n) \times LC = -(10 - 4)(0.1) = -0.6\text{ mm}$. Therefore true length = observed reading - zero error = $10.0 - (-0.6) = 10.6\text{ mm} = 1.06\text{ cm}$

. NCERT Class 11, Units and Measurements (least count and instrumental error).

27. A solid sphere A of radius R and mass M is attached at a point to a smaller solid sphere B of radius $r < R$ and mass $m < M$. Assume that the line joining their centres lies along the horizontal. The moment of inertia of the system calculated about a vertical axis passing through the centre of A is I_A and that calculated about a vertical axis passing through the centre of B is I_B . The difference $I_A - I_B$ is:



- (1) $(M - m)(R + r)^2$ (2) $(m - M)(R + r)^2$
 (3) $(m - M)(R - r)^2$ (4) 0

Answer (2)

Sol. The spheres touch, so their centres are separated by $d = R + r$. About the axis through A : $I_A = \frac{2}{5}MR^2 + \frac{2}{5}mr^2 + md^2$; about the axis through B : $I_B = \frac{2}{5}MR^2 + \frac{2}{5}mr^2 + Md^2$. The two spin terms are common to both and cancel, leaving $I_A - I_B = (m - M)(R + r)^2$, a negative quantity as expected since the heavier sphere sits off-axis in the second case. NCERT Class 11, System of Particles and Rotational Motion (parallel axis theorem).

Why the other options are wrong:

- (1) gets the separation right but flips the sign - attaches the parallel-axis term to the wrong body in each case
- (3) uses $R - r$ as the centre separation, as if the small sphere were embedded in the large one rather than attached externally
- (4) assumes the moment of inertia is independent of the choice of axis, ignoring the parallel axis theorem altogether

28. Consider a spring-mass simple harmonic oscillator in one dimension. The mass of the particle is m kg and the spring constant is $k \text{ Nm}^{-1}$. At a given instant, the extension of the spring is x -meter and the speed of the particle is $v \text{ ms}^{-1}$. On the x - v plane, if the graph of v as a function of x is a circle, then the correct option is:

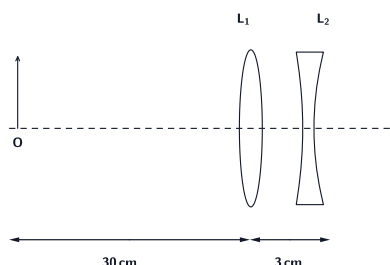
- (1) $k = \frac{1}{m}$ (2) $k = m$
 (3) $k = m^2$ (4) $k = \sqrt{m}$

Answer (2)

Sol. Conservation of energy gives $\frac{1}{2}mv^2 + \frac{1}{2}kx^2 = E$, which rearranges to $\frac{v^2}{2E/m} + \frac{x^2}{2E/k} = 1$ - an ellipse in

the $x-v$ plane. An ellipse becomes a CIRCLE only when the two semi-axes are equal, i.e. $\frac{2E}{m} = \frac{2E}{k}$, which requires $k = m$ numerically. NCERT Class 11, Oscillations (energy in simple harmonic motion).

29. The lens combination as shown in the figure, consists of two lenses, L_1 and L_2 , of the focal lengths $+10$ cm and -10 cm, respectively. The position of the image formed is:



- (1) 20 cm to the left of the concave lens
- (2) 60 cm to the left of the concave lens
- (3) 30 cm to the right of the concave lens
- (4) 60 cm to the right of the concave lens

Answer (2)

Sol. For the convex lens, $u = -30$ cm and $f = +10$ cm give $\frac{1}{v} = \frac{1}{10} - \frac{1}{30} = \frac{1}{15}$, so its image lies 15 cm to its right. The lenses are 3 cm apart, so that image sits 12 cm BEYOND the concave lens and acts as a VIRTUAL OBJECT with $u = +12$ cm. Then $\frac{1}{v} = -\frac{1}{10} + \frac{1}{12} = -\frac{1}{60}$, giving $v = -60$ cm: 60 cm to the left of the concave lens. NCERT Class 12, Ray Optics and Optical Instruments (combination of thin lenses).

Why the other options are wrong:

- (1) uses the thin-lens-in-contact formula $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$, which fails for a 3 cm separation
- (3) keeps the sign of v positive, missing that a negative v places a virtual image on the incoming side
- (4) gets the magnitude right but assigns the image to the wrong side of the concave lens

30. An ac voltage $V = 220 \sin(2 \times 10^3 t)$ Volt is applied to a series LCR circuit. Then the current amplitude in this circuit is: (Given : $L = 10$ mH, $C = 25 \mu\text{F}$, $R = 100 \Omega$)

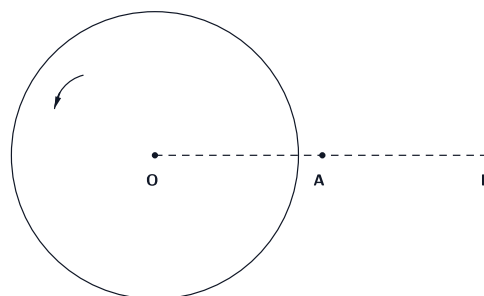
- (1) 2.2 A (2) 5.5 A (3) 11.0 A (4) 22.0 A

Answer (1)

Sol. With $\omega = 2 \times 10^3 \text{ rad s}^{-1}$, the reactances are $X_L = \omega L = 20 \Omega$ and $X_C = \frac{1}{\omega C} = 20 \Omega$. Since $X_L = X_C$ the circuit is at RESONANCE, the reactances cancel and the impedance reduces to $Z = R = 100 \Omega$. The current amplitude is then $I_0 = \frac{V_0}{Z} = \frac{220}{100} = 2.2 \text{ A}$.

NCERT Class 12, Alternating Current (LCR series circuit and resonance).

31. A thin horizontal disc is rotating about a vertical axis passing through its fixed centre O . Its angular momentum is L_A and L_B computed about points A and B , respectively, with $OB = 2 \times OA$. The value of $\frac{L_A}{L_B}$ is:



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

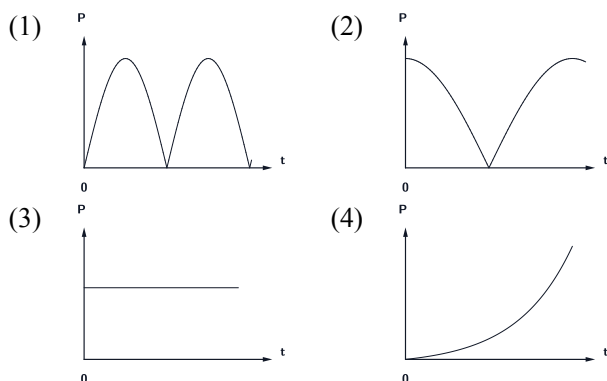
Answer (3)

Sol. The angular momentum of a rigid body about any point splits as $\vec{L} = \vec{L}_{cm} + \vec{r} \times M\vec{v}_{cm}$. Here the centre is FIXED, so $\vec{v}_{cm} = 0$ and the orbital term vanishes for every reference point. Only the spin term $I_{cm}\omega$ survives, which is the same whether you compute about A or B , so the ratio is 1 regardless of the distances. NCERT Class 11, System of Particles and Rotational Motion (angular momentum of a rotating rigid body).

Why the other options are wrong:

- (1) assumes $L \propto 1/r^2$, importing an inverse-square intuition that does not apply
- (2) assumes L scales inversely with the distance to the reference point
- (4) assumes L grows in proportion to the distance, as it would for a single particle moving in a straight line

32. A conducting loop of finite resistance lies on the $x - y$ plane. There is a constant magnetic field in the z direction. The area of the loop varies with time t , as $A = A_0(1 + \sin t)$ in appropriate units. The figure that correctly indicates the qualitative behaviour of the power P dissipated in the loop as a function of time is:



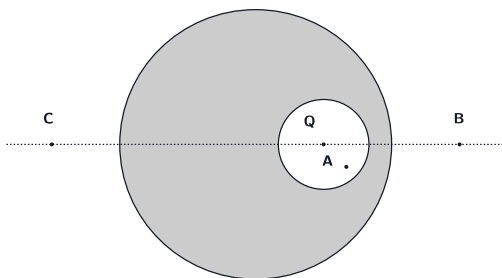
Answer (2)

Sol. Faraday's law gives $\varepsilon = -\frac{d\Phi}{dt} = -BA_0 \cos t$, so the dissipated power is $P = \frac{\varepsilon^2}{R} = \frac{B^2 A_0^2}{R} \cos^2 t$. Because $\cos^2 t$ is MAXIMUM at $t = 0$ and touches zero at $t = \pi/2$, the correct graph starts at a peak and dips to zero, unlike a $\sin^2 t$ curve which would start at zero. P is never negative because the electromotive force (emf) is squared. NCERT Class 12, Electromagnetic Induction (Faraday's law).

Why the other options are wrong:

- (1) differentiates $\sin t$ to $\cos t$ rather than $\sin t$, producing a $\sin^2 t$ curve that starts at zero
- (3) assumes the constant field means a constant emf, forgetting that it is the CHANGING area that drives induction
- (4) confuses the growing area with growing power, ignoring that the flux change is periodic and bounded

33. A point charge Q is placed inside a cavity within a solid isolated conducting sphere. Consider points A , B and C as shown in the figure, where the magnitudes of the electric fields are E_A , E_B , E_C , respectively. The points B and C are at the same distance from the center of the solid sphere. The correct option is :



- (1) $E_A = 0$, $E_B = E_C$ (2) $E_A \neq 0$, $E_B = E_C$
 (3) $E_A = 0$, $E_B > E_C$ (4) $E_A \neq 0$, $E_B < E_C$

Answer (2)

Sol. Point A lies in the empty cavity, not in the conducting material, so the field of Q is fully present there and $E_A \neq 0$. The induced $-Q$ on the cavity wall and $+Q$ on the outer surface arrange themselves so that the outer surface charge is UNIFORM regardless of where the cavity sits, so outside the sphere the field is exactly that of a point charge Q at the centre. Since B and C are equidistant from that centre, $E_B = E_C$. NCERT Class 12, Electric Charges and Fields (electrostatics of conductors).

Why the other options are wrong:

- (1) confuses the cavity with the conducting material
- the field vanishes inside the METAL, not inside the hollow
- (3) combines the cavity error with the idea that the off-centre cavity biases the external field towards B
- (4) correctly sees $E_A \neq 0$ but wrongly assumes the external field is skewed away from the cavity side

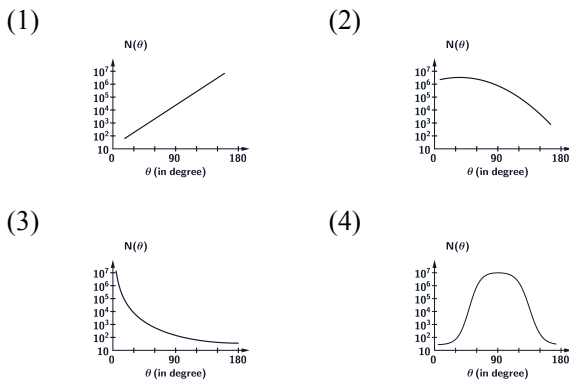
34. Consider a fixed uniformly charged insulating sphere with radius R and total charge $+Q$. A point charge $-q$ ($q \ll Q$) with mass m is released from rest at a distance of $3R$ from the centre of the charged sphere. When the point charge reaches the surface of the sphere, its speed is: (ε_0 is the permittivity of vacuum, neglect gravitational forces).

- (1) $\sqrt{\frac{3Qq}{4\pi\varepsilon_0 mR}}$
 (2) $\sqrt{\frac{2Qq}{3\pi\varepsilon_0 mR}}$
 (3) $\sqrt{\frac{Qq}{3\pi\varepsilon_0 mR}}$
 (4) $\sqrt{\frac{Qq}{4\pi\varepsilon_0 mR}}$

Answer (3)

Sol. Outside the sphere the potential energy of the attracting pair is $U(r) = -\frac{Qq}{4\pi\varepsilon_0 r}$. Energy conservation from $r = 3R$ (at rest) to $r = R$ gives $\frac{1}{2}mv^2 = \frac{Qq}{4\pi\varepsilon_0 R} \left(1 - \frac{1}{3}\right) = \frac{Qq}{6\pi\varepsilon_0 R}$. Solving, $v = \sqrt{\frac{Qq}{3\pi\varepsilon_0 mR}}$. NCERT Class 12, Electrostatic Potential and Capacitance.

35. In Geiger-Marsden experiment, the number of scattered α -particles $N(\theta)$ is plotted as a function of scattering angle θ . Which of the following options represents the correct plot?



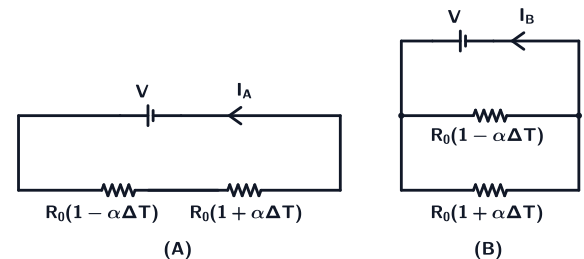
Answer (3)

Sol. Rutherford's scattering formula gives $N(\theta) \propto \frac{1}{\sin^4(\theta/2)}$, so the count is enormous for small deflections and drops by several orders of magnitude as θ increases - which is exactly why the plots are drawn on a logarithmic vertical axis. The experimental finding was that the overwhelming majority of α -particles pass almost undeviated, with only a tiny fraction turned through large angles by the nucleus. NCERT Class 12, Atoms (alpha-particle scattering).

Why the other options are wrong:

- (1) reverses the physics, implying most particles suffer large deflections and the atom is uniformly dense
- (2) captures the falling trend but far too weakly - it misses that the drop spans many orders of magnitude
- (4) invents a preferred scattering angle, as if the nucleus deflected particles by a characteristic amount

36. Consider two circuits, (A) and (B), each having two resistors. One of them has a positive temperature coefficient of resistance, $+\alpha$, while the other one has a negative temperature coefficient, $-\alpha$, as shown in the figure. The current through these circuits are denoted by I_A and I_B . At initial temperature, the resistance of the two resistors is R_0 . As the temperature is increased, the correct option that describes the variation of current in these circuits is:



- (1) I_A remains constant while I_B increases
- (2) I_A decreases while I_B increases
- (3) I_A increases while I_B decreases
- (4) Both I_A and I_B remain constant

Answer (1)

Sol. In circuit (A) the resistors are in SERIES, so $R_A = R_0(1 - \alpha\Delta T) + R_0(1 + \alpha\Delta T) = 2R_0$ - the two temperature terms cancel exactly and I_A is unchanged. In circuit (B) they are in PARALLEL, giving $R_B = \frac{R_0(1 - \alpha^2\Delta T^2)}{2}$, which decreases as ΔT grows because of the $-\alpha^2\Delta T^2$ term, so I_B increases. NCERT Class 12, Current Electricity (temperature dependence of resistivity).

Why the other options are wrong:

- (2) assumes the series combination must heat up and resist more, missing the exact cancellation between $+\alpha$ and $-\alpha$
- (3) swaps the two circuits, applying the parallel result to (A) and the series result to (B)
- (4) spots the cancellation in series and wrongly assumes the same cancellation holds for reciprocals in parallel

37. Consider that σ_s , k_B , b represents Stefan-Boltzmann constant, Boltzmann constant and Wien's displacement law constant, respectively. The dimension of $\sigma_s k_B^{-1} b$ is

- (1) $[L^{-1}T^{-1}K^{-2}]$
- (2) $[L^{-1}K^{-2}]$
- (3) $[L^{-1}T^{-1}K^{-3}]$
- (4) $[L^{-1}T^{-1}K^{-4}]$

Answer (1)

Sol. Take each constant from its defining equation.

Stefan's law $E = \sigma_s T^4$ makes σ_s a power per unit area per K^4 , so $[\sigma_s] = [MT^{-3}K^{-4}]$. Boltzmann's constant is an energy per kelvin, $[k_B] =$

$[ML^2T^{-2}K^{-1}]$, and Wien's constant is a wavelength times a temperature, $[b] = [LK]$. Multiplying, $[MT^{-3}K^{-4}][M^{-1}L^{-2}T^2K][LK] = [L^{-1}T^{-1}K^{-2}]$. NCERT Class 11, Units and Measurements; the constants themselves come from Thermal Properties of Matter.

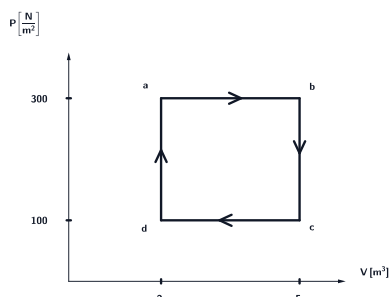
38. An electromagnetic wave travelling in a lossless dielectric medium having a dielectric constant, $\epsilon_r = 9$, has the electric field, $E_x = E_0 \sin(kz - 2\pi \times 10^6 t)$ Vm⁻¹ where E_0 is the amplitude and k is the wave vector. Among the following options, the incorrect choice is

- (1) The speed of the electromagnetic wave inside the medium is 10^8 ms⁻¹
- (2) The wavelength of the electromagnetic wave inside the medium is 300 m
- (3) The magnetic field is given by the relation $B_y = \frac{E_0}{v} \sin(kz - 2\pi \times 10^6 t)$ where v is the speed of the electromagnetic wave inside the medium
- (4) The direction of propagation of the electromagnetic wave is along $+z$

Answer (2) or (3) (NTA accepted more than one option)

Sol. NTA accepted both option (2) and option (3) as answers. The refractive index is $n = \sqrt{\epsilon_r} = 3$, so $v = \frac{c}{n} = 10^8$ m s⁻¹, making option (1) correct. From $\omega = 2\pi \times 10^6$, the frequency is 10^6 Hz, hence $\lambda = \frac{v}{f} = 100$ m, not 300 m; therefore option (2) is incorrect. Option (3) is also incorrect as printed: the magnetic field should be $B_y = \frac{E_0}{v} \sin(kz - \omega t)$, whereas the option uses B_0/v . Option (4) is correct because $kz - \omega t$ represents propagation along $+z$. NCERT Class 12, Electromagnetic Waves.

39. One mole of an ideal monatomic gas undergoes a cyclic process as shown in the figure. The total heat supplied to the gas is:



- (1) 400 J (2) 500 J (3) 600 J (4) 800 J

Answer (3)

Sol. Over a complete cycle the gas returns to its initial state, so $\Delta U = 0$ and the first law reduces to $Q = W$. The cycle is a rectangle on the $P-V$ diagram between $P = 100$ and 300 N m⁻² and $V = 2$ and 5 m³, traversed clockwise, so the work done by the

gas is the enclosed area $= (300 - 100)(5 - 2) = 600$ J. Hence 600 J of heat is supplied. NCERT Class 11, Thermodynamics (cyclic process).

Why the other options are wrong:

- (1) miscounts one side of the rectangle, typically taking $\Delta V = 2$ m³
- (2) computes only the net heat of the two isobaric legs and omits the isochoric contributions to the balance
- (4) adds the areas under the two isobaric legs instead of taking their difference, double-counting the return path

40. Consider that an electron is revolving in an excited state of Hydrogen atom with velocity $\sqrt{25.6} \times 10^5$ ms⁻¹. The radius of the orbit is $x \times 10^{-9}$ m. The value of x is: [Take the mass of electron to be 9×10^{-31} kg, charge of electron $= -1.6 \times 10^{-19}$ C and $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ Nm²C⁻²]

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

Answer (4)

Sol. In a Bohr orbit the Coulomb attraction supplies the centripetal force: $\frac{ke^2}{r^2} = \frac{mv^2}{r}$, which rearranges to $r = \frac{ke^2}{mv^2}$. Substituting $v^2 = 25.6 \times 10^{10} = 2.56 \times 10^{11}$, the numerator is $9 \times 10^9 \times (1.6 \times 10^{-19})^2 = 2.304 \times 10^{-28}$ and the denominator is $9 \times 10^{-31} \times 2.56 \times 10^{11} = 2.304 \times 10^{-19}$. Their ratio is 1×10^{-9} m, so $x = 1$. NCERT Class 12, Atoms (Bohr model).

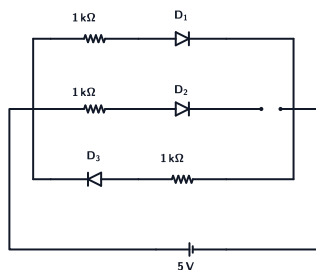
41. A car travels on a circular racetrack of radius 50 m, which is banked at an angle θ . If the car travels at a speed 10 ms⁻¹, then the wear and tear on its tyres is minimum. Taking the acceleration due to gravity to be 10 ms⁻², the value of θ is:

- (1) $\tan^{-1}(\frac{1}{5})$ (2) $\tan^{-1}(\frac{2}{5})$
- (3) $\tan^{-1}(\sqrt{3}/2)$ (4) $\tan^{-1}(2\sqrt{3})$

Answer (1)

Sol. Minimum wear and tear is the exam's way of saying no sideways friction is needed, i.e. the car is at the optimum (design) speed of the banked track. Then the horizontal component of the normal reaction alone supplies the centripetal force, giving $\tan \theta = \frac{v^2}{rg} = \frac{10^2}{50 \times 10} = \frac{1}{5}$, so $\theta = \tan^{-1}(1/5)$. NCERT Class 11, Laws of Motion (motion on a banked road).

42. Three identical p-n junction diodes D_1 , D_2 , and D_3 are connected across a battery as shown in the figure. If the width of the depletion regions of D_1 , D_2 and D_3 are W_1 , W_2 and W_3 , respectively, then the correct option is:



- (1) $W_1 > W_2 > W_3$ (2) $W_3 = W_1 > W_2$
 (3) $W_3 > W_2 > W_1$ (4) $W_2 > W_1 = W_3$

Answer (3)

Sol. Depletion width is set by the net potential barrier at the junction. Forward bias lowers the barrier and NARROWS the depletion layer; reverse bias raises it and WIDENS the layer; an unbiased junction sits at its equilibrium width in between. In this circuit D_1 is forward biased (narrowest), D_2 's branch carries no bias so it keeps its equilibrium width, and D_3 is reverse biased (widest), giving $W_3 > W_2 > W_1$. NCERT Class 12, Semiconductor Electronics (p-n junction).

Why the other options are wrong:

- (1) reverses the bias effect, assuming forward bias widens and reverse bias narrows the depletion region
- (2) assumes forward and reverse bias shift the width by equal and opposite amounts so that W_1 and W_3 coincide
- (4) treats the unbiased diode as the extreme case rather than the intermediate one

43. The following table presents the part of the electromagnetic spectrum and their corresponding major applications. The correct option is:

List I	List II
P) Microwave	I) For purifying the water
Q) UV rays	II) For warming the food
R) Gamma rays	III) For AM and FM communication systems
S) Radio wave	IV) For treating the Cancer cells

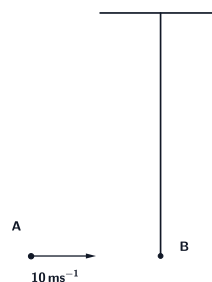
- (1) P-I, Q-II, R-III, S-IV (2) P-I, Q-IV, R-II, S-III
 (3) P-II, Q-I, R-IV, S-III (4) P-II, Q-IV, R-III, S-I

Answer (3)

Sol. Microwaves are absorbed by water molecules in food and heat it, so P-II. Ultraviolet radiation is germicidal

and is used in water sterilisation, so Q-I. Gamma rays carry enough energy to destroy malignant tissue and are used in radiotherapy, so R-IV. Radio waves are the carriers in amplitude modulated (AM) and frequency modulated (FM) broadcasting, so S-III. NCERT Class 12, Electromagnetic Waves (electromagnetic spectrum).

44. Bob B of mass m at rest is hanging vertically from the ceiling via a massless string of length 10 m, as shown in the figure. Point mass A of mass m travelling horizontally with speed 10 ms^{-1} hits bob B elastically. The bob B rises h meter after the collision. Taking the acceleration due to gravity $g = 10 \text{ ms}^{-2}$ and neglecting the size of the bob, the value of h is:



- (1) 8 (2) 7 (3) 5 (4) 2.5

Answer (3)

Sol. In a head-on ELASTIC collision between equal masses the velocities are simply exchanged, so A stops dead and B leaves the collision at the full 10 ms^{-1} . Energy conservation on the swing then gives $h = \frac{v^2}{2g} = \frac{100}{20} = 5 \text{ m}$. The bob rises only 5 m, less than the 10 m string length, so it stays below the horizontal through the point of suspension and the string never goes slack. NCERT Class 11, Work, Energy and Power (collisions).

Why the other options are wrong:

- Option (1) (8 m) and option (2) (7 m) are higher than 5 m. Even if B took all the kinetic energy of A , it could rise only $\frac{v^2}{2g} = 5 \text{ m}$. A greater height needs energy the collision never supplied.
- Option (4) (2.5 m) gives B only half the kinetic energy of A , as if the energy were shared equally between the two masses. That halves the height. In an elastic collision of equal masses, all of it passes to B .

45. An ideal gas is made of polyatomic molecules. Each of the molecules has three translational, three rotational and f number of vibrational modes. If the ratio of heat capacities C_P/C_V of the gas is $8/7$, then the value of f is:

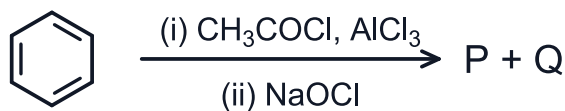
- (1) 4 (2) 3 (3) 2 (4) 1

Answer (1)

Sol. Equipartition assigns $\frac{1}{2}k_B T$ to each translational and rotational mode but a full $k_B T$ to each vibrational mode, so $C_V = \frac{R}{2}(3 + 3 + 2f) = (3 + f)R$ and $C_P = C_V + R = (4 + f)R$. Setting $\frac{4+f}{3+f} = \frac{8}{7}$ gives $28 + 7f = 24 + 8f$, so $f = 4$. NCERT Class 11, Kinetic Theory (law of equipartition of energy).

CHEMISTRY

46. For the following reaction sequence, choose the correct option.



- (1) If **P** is the sodium salt of a carboxylic acid, **Q** is a primary alcohol
- (2) **P** and **Q** are aromatic compounds
- (3) If **P** gives a carboxylic acid on acidification, **Q** gives a poisonous gas on exposure to air and light
- (4) Both **P** and **Q** are carbonyl compounds

Answer (3)

Sol. Friedel-Crafts acylation converts benzene to acetophenone, and sodium hypochlorite then carries out the haloform reaction on the methyl ketone, giving sodium benzoate (**P**) and chloroform (**Q**). Acidifying sodium benzoate liberates benzoic acid, and chloroform slowly oxidises in air and light to phosgene, COCl_2 , which is highly poisonous - the reason chloroform is stored in dark bottles with a little ethanol. NCERT Class 12, Aldehydes, Ketones and Carboxylic Acids (haloform reaction); chloroform's oxidation is in Haloalkanes and Haloarenes.

Why the other options are wrong:

- (1) identifies **P** correctly but calls chloroform a primary alcohol, confusing the haloform product with a reduction product
- (2) chloroform contains no ring and is not aromatic, so both products cannot be aromatic
- (4) neither the carboxylate salt nor chloroform retains a $\text{C}=\text{O}$ available as a carbonyl compound in the sense intended

47. Given below are two statements. (Given : $\text{oxH}_2 = \text{HOOC} - \text{COOH}$)

Statement I: $[\text{Fe}(\text{ox})_3]^{3-}$ is chiral.

Statement II: $\text{trans-}[\text{Cr}(\text{H}_2\text{O})_2(\text{ox})_2]^-$ is chiral.

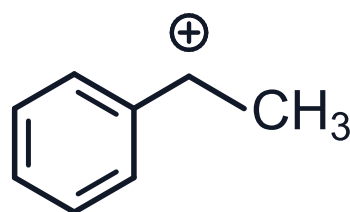
In light of the above statements, choose the most appropriate answer from the options given below:

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

Answer (3)

Sol. A tris-chelate of type $[\text{M}(\text{AA})_3]$ has no plane or centre of symmetry and exists as the non-superimposable delta and lambda propeller forms, so $[\text{Fe}(\text{ox})_3]^{3-}$ is indeed chiral. For the bis-chelate $[\text{Cr}(\text{H}_2\text{O})_2(\text{ox})_2]^-$, only the CIS isomer is chiral; the TRANS isomer, with the two aqua ligands on opposite sides, possesses a plane of symmetry and is therefore achiral. Statement-II names the wrong isomer. NCERT Class 12, Coordination Compounds (isomerism).

48. The following carbocation is stabilized by the interaction of the empty p orbital with



- (1) filled σ and filled π orbitals
- (2) empty σ and empty π^* orbitals
- (3) empty σ^* and filled π orbitals
- (4) empty σ^* and empty π^* orbitals

Answer (1)

Sol. Stabilising an electron-deficient centre means DONATING electron density into its empty p orbital, so the interacting orbitals must be filled. Two filled sets are available here: the filled π orbitals of the benzene ring, which deliver resonance stabilisation to this benzylic cation, and the filled σ C-H orbitals of the adjacent methyl group, which supply hyperconjugation. Empty orbitals such as σ^* or π^* have nothing to give. NCERT Class 11, Organic Chemistry: Some Basic Principles and Techniques (resonance and hyperconjugation).

Why the other options are wrong:

- (2) pairs the empty p orbital with other EMPTY orbitals, which cannot transfer any electron density
- (3) gets the π contribution right but calls the hyperconjugating orbital σ^* ; it is the filled σ C-H orbital that donates
- (4) selects two antibonding, empty orbitals - the exact opposite of what a cation needs

49. In potash alum, the ratio of K^+ and SO_4^{2-} ions is

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

Answer (1)

Sol. Potash alum is the double salt

$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$, most compactly written as $KAl(SO_4)_2 \cdot 12H_2O$. Each formula unit supplies one K^+ balanced against two sulphate ions (together with one Al^{3+}), so the ratio is 1 : 2. NCERT Class 11, The p-Block Elements (compounds of aluminium).

50. The correct statement about peptides and proteins is

- (1) Tertiary structure of proteins has two or more polypeptide subunits
- (2) Only the proteins having a quaternary structure are biologically active
- (3) In β -pleated sheet structures, peptide chains are held together by intermolecular hydrogen bonds
- (4) In α -helices, the polypeptide chain is twisted into a left-handed screw (helix) through intramolecular hydrogen bonds

Answer (3)

Sol. In a β -pleated sheet the polypeptide chains lie stretched side by side, and the hydrogen bonds run BETWEEN neighbouring chains - intermolecular. This is the key structural contrast with the α -helix, where the hydrogen bonds are intramolecular, formed within a single coiled chain. NCERT Class 12, Biomolecules (secondary structure of proteins).

51. The numbers 17.0145 and 21.0235 were rounded to three figures after the decimal point. The resulting numbers, respectively, are

- (1) 17.014 and 21.023 (2) 17.015 and 21.023
- (3) 17.014 and 21.024 (4) 17.015 and 21.024

Answer (3)

Sol. Both numbers end in an exact 5 with nothing after it, which is the tie case, so the round-half-to-EVEN convention applies rather than always rounding up. In 17.0145 the digit to be retained is 4, already even, so it stays: 17.014. In 21.0235 the retained digit is 3, which is odd, so it is raised to the even value 4: 21.024. NCERT Class 11, Some Basic Concepts of Chemistry (significant figures).

52. The correct order of solubility of the given salts in water at 298 K is (Given K_{sp} at 298 K: $AgBr = 5.0 \times 10^{-13}$; $Zn(OH)_2 = 1.0 \times 10^{-15}$; $Hg_2Cl_2 = 1.3 \times 10^{-18}$)

- (1) $Hg_2Cl_2 > Zn(OH)_2 > AgBr$ (2) $AgBr > Zn(OH)_2 > Hg_2Cl_2$
- (3) $Hg_2Cl_2 > AgBr > Zn(OH)_2$ (4) $Zn(OH)_2 > AgBr > Hg_2Cl_2$

Answer (4)

Sol. K_{sp} values can only be compared directly when the salts share the same stoichiometry, so each must first

be converted to molar solubility s . For the 1:1 salt $AgBr$, $K_{sp} = s^2$ gives $s \approx 7.1 \times 10^{-7}$. For the 1:2 salts, $K_{sp} = 4s^3$: $Zn(OH)_2$ gives $s \approx 6.3 \times 10^{-6}$ and Hg_2Cl_2 gives $s \approx 6.9 \times 10^{-7}$. Ranking these, $Zn(OH)_2 > AgBr > Hg_2Cl_2$. NCERT Class 11, Equilibrium (solubility equilibria).

53. Among the following options, the correct trend in the electron gain enthalpy is

- (1) $F > Cl > Br > I$ (2) $Br > Cl > F > I$
- (3) $Cl > F > Br > I$ (4) $I > Br > Cl > F$

Answer (3)

Sol. Chlorine, not fluorine, releases the most energy on gaining an electron. The 2p subshell of fluorine is so compact that the incoming electron meets strong inter-electronic repulsion, which offsets the favourable nuclear attraction; chlorine's larger 3p shell has no such penalty. Down the rest of the group the value falls with increasing size, giving $Cl > F > Br > I$. NCERT Class 11, Classification of Elements and Periodicity in Properties.

54. Assertion (A): For an ideal solution formed by mixing liquids **P** and **Q**, $\Delta_{mix}H = 0$ and $\Delta_{mix}V = 0$

Reason (R): No interactions occur between **P** and **Q**

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

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

Answer (3)

Sol. The assertion is a defining property of an ideal solution: because the molecules pack and interact just as they did before mixing, neither heat nor volume changes on mixing. The reason misstates why. Interactions certainly DO occur between P and Q - the requirement is that the P-Q interaction be equal in strength to the P-P and Q-Q interactions it replaces, so the energy terms cancel. A solution with no intermolecular forces at all would be a gas, not a liquid mixture. NCERT Class 12, Solutions (ideal and non-ideal solutions).

55. The amino acid that gives a red-blood colour on treating its sodium fusion extract with sodium nitroprusside is

- (1) leucine (2) threonine
- (3) methionine (4) serine

Answer (3)

Sol. The sodium nitroprusside test detects SULPHUR: fusion with sodium converts organic sulphur to sulphide, which reacts with nitroprusside to give the intensely coloured complex $\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$. Of the four amino acids listed, only methionine contains sulphur - leucine is purely hydrocarbon in its side chain, while threonine and serine carry hydroxyl groups. NCERT Class 12, Biomolecules (amino acids); the detection method is from NCERT Class 11, Organic Chemistry: Some Basic Principles and Techniques.

56. The standard electrode potential (E°) for the half-cell reaction $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ at 298 K is (Given : $E^\circ(\text{Fe}^{3+}/\text{Fe}) = -0.04 \text{ V}$ and $E^\circ(\text{Fe}^{2+}/\text{Fe}) = -0.44 \text{ V}$ at 298 K)

- (1) +0.40 V (2) +0.76 V (3) -0.48 V (4) +0.92 V

Answer (2)

Sol. Electrode potentials are NOT additive when the electron counts differ; the additive quantity is $\Delta G^\circ = -nFE^\circ$. For $\text{Fe}^{3+} + 3\text{e}^- \rightarrow \text{Fe}$, $\Delta G_1^\circ = -3F(-0.04) = 0.12F$; for $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe}$, $\Delta G_2^\circ = -2F(-0.44) = 0.88F$. Subtracting, $\Delta G_3^\circ = 0.12F - 0.88F = -0.76F$, and since $n = 1$, $E^\circ = +0.76 \text{ V}$. NCERT Class 12, Electrochemistry (electrode potential and Gibbs energy).

57. In an acidic medium, 10 mL of 0.25 M oxalic acid is titrated with KMnO_4 solution. If the volume of KMnO_4 solution required to reach end point is 10 mL, the strength of the KMnO_4 solution is

- (1) 0.10 M (2) 0.20 M (3) 0.25 M (4) 0.15 M

Answer (1)

Sol. Oxalate is oxidised by two electrons ($\text{C}_2\text{O}_4^{2-} \rightarrow 2\text{CO}_2 + 2\text{e}^-$) so its n-factor is 2, while permanganate in ACIDIC medium is reduced by five electrons ($\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$) so its n-factor is 5. Equating equivalents, $(0.25 \times 2)(10) = (M \times 5)(10)$, giving $M = 0.10 \text{ M}$. NCERT Class 11, Redox Reactions (redox titrations).

58. According to crystal field theory, the correct order of ligands with respect to their decreasing order of field strength is

- (1) $\text{CO} > \text{NH}_3 > \text{H}_2\text{O} > \text{Cl}^-$ (2) $\text{CO} > \text{H}_2\text{O} > \text{NH}_3 > \text{Cl}^-$
 (3) $\text{Cl}^- > \text{H}_2\text{O} > \text{NH}_3 > \text{CO}$ (4) $\text{Cl}^- > \text{NH}_3 > \text{H}_2\text{O} > \text{CO}$

Answer (1)

Sol. The spectrochemical series orders ligands by the size of the crystal field splitting they produce. Carbon monoxide is the strongest field ligand in this set because it accepts electron density into its π^* orbitals; ammonia follows as a stronger sigma donor than water; and chloride, being a weak-field pi donor, is the weakest. The accepted sequence is $\text{CO} > \text{CN}^- > \text{NH}_3 > \text{H}_2\text{O} > \text{F}^- > \text{Cl}^-$. NCERT Class 12, Coordination Compounds (crystal field theory).

59. Two moles of an ideal gas undergo free expansion from 10 L to 100 L at 300 K. The values of ΔS_{system} and $\Delta S_{\text{surroundings}}$ are (R is universal gas constant)

- (1) $\Delta S_{\text{system}} = 0$; $\Delta S_{\text{surroundings}} = 0$
 (2) $\Delta S_{\text{system}} = 4.606 R$; $\Delta S_{\text{surroundings}} = -4.606 R$
 (3) $\Delta S_{\text{system}} = 0$; $\Delta S_{\text{surroundings}} = 4.606 R$
 (4) $\Delta S_{\text{system}} = 4.606 R$; $\Delta S_{\text{surroundings}} = 0$

Answer (4)

Sol. Free expansion is into vacuum, so no work is done and no heat is exchanged: $w = 0$, $q = 0$. The surroundings are therefore completely untouched and $\Delta S_{\text{surroundings}} = 0$. Entropy is a STATE function, so the system's change is computed along any reversible path with the same endpoints: $\Delta S = nR \ln \frac{V_2}{V_1} = 2R \ln 10 = 4.606 R$. The net positive total confirms the irreversibility. NCERT Class 11, Thermodynamics (entropy and spontaneity).

60. For the zero-order reaction $2\text{A} \rightarrow \text{B}$, the rate constant is $k = 1.0 \text{ mol L}^{-1}\text{min}^{-1}$. If the initial concentration of A is 2 M, then the time taken to complete 75% of the reaction will be

- (1) 1.5 min (2) 0.75 min
 (3) 1.0 min (4) 2.0 min

Answer (2)

Sol. The rate of REACTION is defined as $-\frac{1}{2} \frac{d[\text{A}]}{dt} = k$ because of the stoichiometric coefficient 2, so A itself disappears at $2k$ per minute. Integrating, $[\text{A}] = [\text{A}]_0 - 2kt$. Completing 75% means 1.5 M of A has been consumed, so $1.5 = 2(1.0)t$ and $t = 0.75 \text{ min}$. NCERT Class 12, Chemical Kinetics (integrated rate equation for zero order).

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

Assertion (A): Generally, 3d transition metals have high melting points.

Reason (R): Involvement of 3d-electrons in addition to 4s-electrons in the interatomic metallic bonding.

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

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

Answer (1)

Sol. Melting point tracks the strength of the metallic bond, which depends on how many electrons each atom contributes to the delocalised sea. In s-block metals only the ns electrons participate, but in the 3d series the unpaired 3d electrons join the 4s electrons in bonding, producing much stronger interatomic attraction and correspondingly high melting points. The trend peaks near the middle of the series, where the number of unpaired d electrons is greatest. R is therefore the correct explanation of A. NCERT Class 12, The d- and f-Block Elements.

62. For a salt **XY**, which is a strong electrolyte, the plot of Λ_m versus $\sqrt{c}$ has a slope of $-90.0 \text{ S cm}^2\text{mol}^{-3/2}\text{L}^{1/2}$ at 298 K. At 0.01 M concentration of **XY**, the value of Λ_m is $145.0 \text{ S cm}^2\text{mol}^{-1}$. The limiting molar conductivity of Y^- ion ($\lambda_{\text{Y}^-}^0$, in $\text{S cm}^2\text{mol}^{-1}$) at 298 K will be (Given : $\lambda_{\text{X}^+}^0 = 74.0 \text{ S cm}^2\text{mol}^{-1}$)

- (1) 80.0
- (2) 100.0
- (3) 90.0
- (4) 76.0

Answer (1)

Sol. For a strong electrolyte the Debye-Huckel-Onsager relation is $\Lambda_m = \Lambda_m^0 - A\sqrt{c}$, where the plot's slope is $-A$. At $c = 0.01 \text{ M}$, $\sqrt{c} = 0.1$, so $\Lambda_m^0 = 145.0 + (90.0)(0.1) = 154.0$. Kohlrausch's law then gives $\lambda_{\text{Y}^-}^0 = 154.0 - 74.0 = 80.0 \text{ S cm}^2\text{mol}^{-1}$. NCERT Class 12, Electrochemistry (variation of conductivity with concentration).

63. The amount of carbon dioxide evolved upon complete combustion of 116 g of n-butane is (Given: atomic mass in amu H = 1, C = 12 and O = 16)

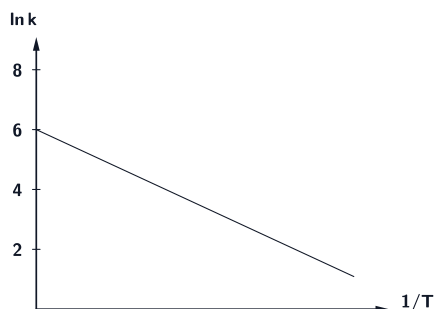
- (1) 352 g
- (2) 322 g
- (3) 176 g
- (4) 362 g

Answer (1)

Sol. n-Butane is C_4H_{10} with molar mass 58 g/mol, so 116 g is exactly 2 mol. The balanced combustion

$\text{C}_4\text{H}_{10} + 13/2\text{O}_2 \rightarrow 4\text{CO}_2 + 5\text{H}_2\text{O}$ yields 4 mol of CO_2 per mole of butane, hence 8 mol here. Mass of $\text{CO}_2 = 8 \times 44 = 352 \text{ g}$. NCERT Class 11, Some Basic Concepts of Chemistry (stoichiometry).

64. For an elementary chemical reaction, the Arrhenius plot is given below.



If the energy of activation is 6.64 kJ mol^{-1} and $R = 8.3 \text{ J K}^{-1}\text{mol}^{-1}$, the temperature at which the rate constant becomes $\text{e}^2 \text{ min}^{-1}$, is

- (1) 125 K
- (2) 150 K
- (3) 200 K
- (4) 250 K

Answer (3)

Sol. In logarithmic form the Arrhenius equation is $\ln k = \ln A - \frac{E_a}{RT}$, a straight line of slope $-E_a/R$ whose intercept on the $\ln k$ axis is $\ln A$. The graph shows that intercept at 6, so $\ln A = 6$. Setting $\ln k = 2$ gives $2 = 6 - \frac{6640}{8.3T}$, hence $\frac{6640}{8.3T} = 4$ and $T = 200 \text{ K}$. NCERT Class 12, Chemical Kinetics (temperature dependence of rate).

Why the other options are wrong:

- Option (1): at 125 K, $\frac{6640}{8.3 \times 125} = 6.4$, so $\ln k = 6 - 6.4 = -0.4$, not 2
- Option (2): at 150 K, $\frac{6640}{8.3 \times 150} \approx 5.33$, so $\ln k \approx 0.67$, not 2
- Option (4): at 250 K, $\frac{6640}{8.3 \times 250} = 3.2$, so $\ln k = 2.8$, not 2

65. Given below are two statements.

Statement I: Heating NaCl with concentrated H_2SO_4 and MnO_2 results in oxidation of Mn.

Statement II: Heating NaI with concentrated H_2SO_4 and MnO_2 results in reduction of Mn.

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

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

Answer (4)

Sol. In both reactions MnO_2 acts as the OXIDISING agent on the halide, so manganese itself goes from +4 down to +2 - it is REDUCED, not oxidised. Statement-I therefore states the opposite of what happens and is wrong, while Statement-II describes the same reduction correctly for the iodide. This is the classic laboratory route to chlorine, $\text{MnO}_2 + 2\text{NaCl} + 2\text{H}_2\text{SO}_4 \rightarrow \text{MnSO}_4 + \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O} + \text{Cl}_2$. NCERT Class 12, The p-Block Elements (Group 17, preparation of chlorine).

66. Among the species given below, the spin-only magnetic moment is highest for (Given: Atomic number of Ti = 22, Mn = 25, Fe = 26 and Co = 27)

- (1) $[\text{Mn}(\text{CN})_6]^{3-}$ (2) $[\text{Fe}(\text{CN})_6]^{3-}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$

Answer (1)

Sol. All four are octahedral with strong-field or moderate-field ligands, so the electrons pair up in t_{2g} before entering e_g . Counting d electrons: Mn^{3+} is d^4 , giving low-spin t_{2g}^4 with TWO unpaired electrons; Fe^{3+} is d^5 , giving t_{2g}^5 with one; Co^{3+} is d^6 , giving t_{2g}^6 with none; Ti^{3+} is d^1 with one. Since $\mu = \sqrt{n(n+2)}$ rises with n, the manganese complex has the highest moment at about 2.83 Bohr magneton (BM). NCERT Class 12, Coordination Compounds.

67. The lanthanide ion having four unpaired electrons is (Given : Atomic numbers of Ce = 58, Nd = 60, Tb = 65 and Ho = 67)

- (1) Nd^{3+} (2) Ce^{3+}
 (3) Tb^{3+} (4) Ho^{3+}

Answer (4)

Sol. Lanthanoid tripositive ions have the configuration $[\text{Xe}]4f^n$, where n is the atomic number minus 57. That gives $\text{Ce}^{3+} = 4f^1$, $\text{Nd}^{3+} = 4f^3$, $\text{Tb}^{3+} = 4f^8$ and $\text{Ho}^{3+} = 4f^{10}$. Filling seven f orbitals by Hund's rule, $4f^{10}$ places three pairs and leaves FOUR unpaired electrons, so Ho^{3+} is the answer. NCERT Class 12, The d- and f-Block Elements (lanthanoids).

68. The formula of tetraammineaquachloridocobalt(III) chloride is

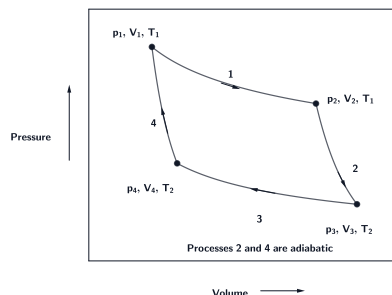
- (1) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2] \times \text{H}_2\text{O}$ (2) $[\text{Co}(\text{NH}_3)_4]\text{Cl}_3 \times \text{H}_2\text{O}$
 (3) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}$ (4) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$

Answer (4)

Sol. The name lists the coordination sphere first: four ammine, one aqua and one chlorido ligand around cobalt(III). Charge balance inside the brackets gives $+3 + 0 + 0 - 1 = +2$, so two chloride counter-ions are needed outside to neutralise the complex cation. The word 'chloride' at the end names those counter-

ions, not a ligand. NCERT Class 12, Coordination Compounds (IUPAC nomenclature).

69. Consider the reversible processes for 1.0 mol of an ideal gas as shown in the figure.



w_1, w_2, w_3 and w_4 represent work done (in calories) in the processes 1, 2, 3 and 4, respectively; ΔU_2 and ΔU_4 are changes in the internal energy for the processes 2 and 4, respectively. [use $R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$] The correct option is

- (1) $w_1 + w_3 = -2T_1 \ln \frac{V_2}{V_1} - 2T_2 \ln \frac{V_4}{V_3}$
 (2) $w_2 + w_4 = \Delta U_2 - \Delta U_4$
 (3) $w_1 + w_2 = 2T_1 \ln \frac{V_2}{V_1}$
 (4) $w_1 + w_2 + w_3 + w_4 = 0$

Answer (1)

Sol. The cycle is a Carnot-type sequence: steps 1 and 3 are isothermal (at T_1 and T_2) and steps 2 and 4 are adiabatic. For a reversible isothermal change $w = -nRT \ln \frac{V_f}{V_i}$, so with $n = 1$ and $R = 2$ the two isothermal contributions add to exactly the expression in option (1). NCERT Class 11, Thermodynamics (work in reversible isothermal and adiabatic processes).

Why the other options are wrong:

- (2) for an adiabatic step $q = 0$ so $w = \Delta U$ for EACH, giving $w_2 + w_4 = \Delta U_2 + \Delta U_4$; the minus sign is the error
- (3) gets the sign of the isothermal work backwards and wrongly treats the adiabatic w_2 as zero
- (4) confuses $\Delta U = 0$ over a cycle with $w = 0$; the net work equals the enclosed area and is non-zero

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

Assertion (A): The first ionization enthalpy of O is lower than that of N and F.

Reason (R): The loss of an electron from O leads to stable half-filled p orbital

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

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

Answer (1)

Sol. Oxygen is $[\text{He}]2s^22p^4$; the fourth 2p electron must pair up in an already-occupied orbital and suffers extra repulsion, so it is comparatively easy to remove. Losing it gives O^+ with the $2p^3$ half-filled configuration, which is extra stable through exchange energy. That is precisely why oxygen's first ionization enthalpy dips below nitrogen's despite nitrogen having a smaller nuclear charge, and stays below fluorine's. R therefore explains A. NCERT Class 11, Classification of Elements and Periodicity in Properties.

71. Consider the following statements about the solutions formed by mixing two liquids.

Statement I: An ideal solution thus formed obeys Raoult's law throughout the composition range.

Statement II: Mixture of chloroform and acetone shows negative deviation from Raoult's law.

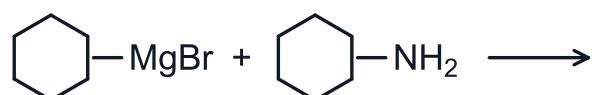
Statement III: Mixture of aniline and phenol shows positive deviation from Raoult's law.

- (1) I and II only
- (2) II and III only
- (3) I only
- (4) I and III only

Answer (1)

Sol. Statement I is the definition of ideality - Raoult's law must hold over the whole composition range, not merely at the dilute ends. Statement II is correct because chloroform's C-H is acidic enough to hydrogen-bond to acetone's carbonyl oxygen, an interaction stronger than either pure liquid had, so escaping tendency drops and the deviation is negative. Statement III is wrong for the same underlying reason: aniline and phenol also form strong hydrogen bonds with each other, which gives a NEGATIVE deviation, not a positive one. NCERT Class 12, Solutions.

72. One of the products formed in the following reaction is



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

Answer (4)

Sol. The reactants are cyclohexylmagnesium bromide and cyclohexylamine. A Grignard reagent is a very strong base and is destroyed by an acidic N-H proton:

$\text{C}_6\text{H}_{11}\text{MgBr} + \text{C}_6\text{H}_{11}\text{NH}_2 \rightarrow \text{C}_6\text{H}_{12} + \text{C}_6\text{H}_{11}\text{NHMgBr}$. The organic product derived from the Grignard reagent is therefore cyclohexane, option (4); no new C-C or C-N bond is formed. NCERT Class 12, Haloalkanes and Haloarenes (Grignard reagents).

Why the other options are wrong:

- (1) assumes the Grignard carbon substitutes at nitrogen; proton transfer occurs instead
- (2) assumes C-C coupling while retaining the amino group, but there is no electrophilic carbon or coupling catalyst
- (3) assumes direct coupling of the two cyclohexyl groups rather than acid-base proton transfer

73. The correct statement is

- (1) Boron has a maximum covalency of four.
- (2) Beryllium has three valence orbitals.
- (3) Magnesium has a maximum covalency of four.
- (4) Aluminium has five valence orbitals.

Answer (1)

Sol. Boron sits in the second period, where only one 2s and three 2p orbitals are available for bonding - four orbitals in all - and there are no 2d orbitals to expand into. Its covalency therefore cannot exceed four, as in BF_4^- and $[\text{BH}_4]^-$. NCERT Class 11, The p-Block Elements (anomalous properties of boron).

74. A protein undergoes reversible thermal denaturation from its initial state **N** to denatured state **D** according to $\text{N} \rightleftharpoons \text{D}$. At 60 °C, the concentrations of both **N** and **D** are equal at equilibrium, and the standard enthalpy change of denaturation is 666 kJ mol⁻¹. The standard entropy change (ΔS° in kJ K⁻¹mol⁻¹) of the protein upon denaturation at 60 °C is closest to

- (1) 2.0 (2) 2000.0 (3) 333.0 (4) 11.1

Answer (1)

Sol. Equal equilibrium concentrations mean $K = 1$, and since $\Delta G^\circ = -RT \ln K$, the standard free energy change is zero. Setting $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ = 0$ gives $\Delta S^\circ = \frac{\Delta H^\circ}{T} = \frac{666}{333} = 2.0 \text{ kJ K}^{-1}\text{mol}^{-1}$, using $T = 60 + 273 = 333 \text{ K}$. NCERT Class 11, Thermodynamics (Gibbs energy and equilibrium).

75. Match the species in List-I with their geometry in List-II.

List I	List II
P) PCl_5	I) Tetrahedral
Q) BrF_5	II) Square Planar
R) BF_4^-	III) Trigonal bipyramidal
S) $[\text{Ni}(\text{CN})_4]^{2-}$	IV) Square pyramidal

Choose the correct answer from the options given below:

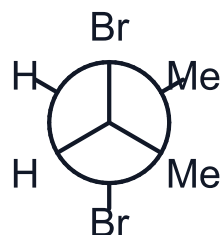
- (1) P-IV, Q-III, R-I, S-II (2) P-III, Q-IV, R-I, S-II
(3) P-III, Q-I, R-II, S-IV (4) P-III, Q-II, R-I, S-IV

Answer (2)

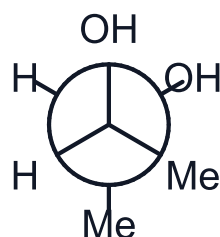
Sol. PCl_5 has five bond pairs and no lone pair, so it is trigonal bipyramidal (P-III). BrF_5 has five bond pairs plus one lone pair; the lone pair occupies one octahedral position and pushes the shape to square pyramidal (Q-IV). BF_4^- is four bond pairs with no lone pair, hence tetrahedral (R-I). $[\text{Ni}(\text{CN})_4]^{2-}$ is a $\text{Ni}^{2+} d^8$ complex with the strong-field cyanide ligand, forcing dsp^2 hybridisation and a square planar geometry (S-II). NCERT Class 11, Chemical Bonding and Molecular Structure; NCERT Class 12, Coordination Compounds.

76. Given below are two statements.

Statement I : trans-But-2-ene upon treatment with Br_2 in CCl_4 gives the following product.



Statement II : cis-But-2-ene upon treatment with alkaline KMnO_4 gives the following product.



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

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

Answer (4)

Sol. Bromine in CCl_4 adds ANTI through a cyclic bromonium ion, so trans-but-2-ene gives meso-2,3-dibromobutane. The Newman projection drawn has the two Br atoms anti but the two methyl groups gauche. In the meso isomer, Br anti to Br puts Me anti to Me as well, so the drawing is the chiral (2R,3R) isomer. Statement I is wrong. Alkaline KMnO_4 adds SYN through a cyclic manganate ester, and syn dihydroxylation of cis-but-2-ene does give meso-butane-2,3-diol, so Statement II is right. The rule worth remembering: for a symmetrically substituted alkene, anti addition to trans and syn addition to cis both give the meso product. NCERT Class 11, Hydrocarbons (addition reactions of alkenes).

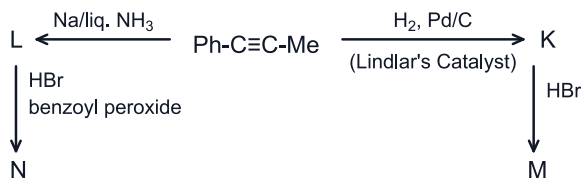
Why the other options are wrong:

- (1) accepts Statement I by assuming bromination of trans-but-2-ene gives the chiral (2R,3R) product drawn, confusing anti addition to trans with anti addition to cis
- (2) rejects Statement II as well, missing that syn dihydroxylation of the cis alkene genuinely gives the

meso diol

- (3) reverses both verdicts, applying syn stereochemistry to bromination and anti to permanganate

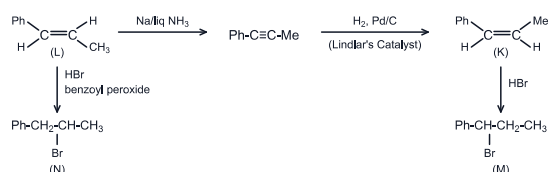
77. Consider the following reaction sequences and choose the correct option.



- (1) **K** and **L** are geometrical isomers
- (2) **K** and **L** are enantiomers
- (3) **M** and **N** are geometrical isomers
- (4) **M** and **N** are stereoisomers

Answer (1)

Sol. Dissolving-metal reduction with Na/liq. NH_3 proceeds through a trans vinyl radical anion and delivers the E (trans) alkene **L**, whereas Lindlar hydrogenation adds both hydrogens to the same face and gives the Z (cis) alkene **K**. Same formula, same connectivity, different arrangement about the double bond - geometrical isomers. The bromides are a different matter: **M** forms by Markovnikov addition at the benzylic carbon while **N** forms by peroxide-mediated anti-Markovnikov addition at the other carbon, so they are POSITIONAL isomers, not stereoisomers. NCERT Class 11, Hydrocarbons (alkynes and alkenes).



Why the other options are wrong:

- (2) enantiomers are non-superimposable mirror images; these alkenes are achiral diastereomers about a double bond
- (3) the two bromides differ in WHERE the bromine sits, which is constitutional isomerism, not geometrical
- (4) same error as (3) - different connectivity rules out any kind of stereoisomerism

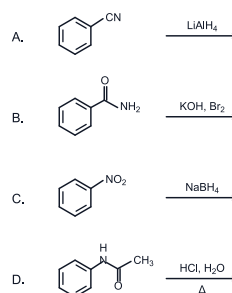
78. The complex which has facial and meridional isomers is (Given : py = pyridine and en = $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$)

- (1) $[\text{Cr}(\text{py})_3(\text{Cl})_3]$
- (2) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
- (3) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{3+}$
- (4) $[\text{Ni}(\text{en})_2(\text{H}_2\text{O})_2]^{2+}$

Answer (1)

Sol. Facial and meridional isomerism is specific to octahedral complexes of the type $[\text{Ma}_3\text{b}_3]$. In the fac isomer the three identical ligands occupy one triangular face; in the mer isomer they lie in a plane through the metal. $[\text{Cr}(\text{py})_3\text{Cl}_3]$ has exactly this 3:3 arrangement. NCERT Class 12, Coordination Compounds (geometrical isomerism).

79. Identify the reactions which give aniline as the major product.



Choose the correct answer from the options given below.

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

Answer (2)

Sol. Reaction B is the Hofmann bromamide degradation, which removes one carbon from an amide and delivers the amine with the nitrogen now bonded directly to the ring - aniline. Reaction D is simple acid hydrolysis of an anilide, cleaving the amide bond to regenerate aniline and acetic acid. Reaction A gives benzylamine, since LiAlH_4 reduces the nitrile carbon to CH_2 and leaves an extra carbon in the chain, and reaction C fails because NaBH_4 is too mild to reduce an aromatic nitro group. NCERT Class 12, Amines (methods of preparation).

Why the other options are wrong:

- (1) includes the nitrile reduction, forgetting that the nitrile carbon is retained and gives benzylamine
- (3) includes both the nitrile reduction and the NaBH_4 attempt, neither of which yields aniline
- (4) includes the NaBH_4 reduction, confusing it with Sn/HCl or catalytic hydrogenation

80. Match the vitamins in List I with their sources in List II.

List I	List II
P) vitamin A	I) meat
Q) vitamin B ₁₂	II) sunflower oil
R) vitamin E	III) green leafy vegetables
S) vitamin K	IV) carrots

Choose the correct answer from the options given below.

- (1) P-II, Q-III, R-IV, S-I (2) P-IV, Q-I, R-II, S-III
 (3) P-IV, Q-II, R-I, S-III (4) P-III, Q-I, R-IV, S-II

Answer (2)

Sol. Carrots are rich in β -carotene, the precursor of vitamin A (P-IV). Vitamin B₁₂ is essentially absent from plant foods and comes from animal sources such as meat (Q-I). Vitamin E is a fat-soluble antioxidant abundant in vegetable oils including sunflower oil (R-II). Vitamin K, needed for blood clotting, is supplied mainly by green leafy vegetables (S-III). NCERT Class 12, Biomolecules (vitamins).

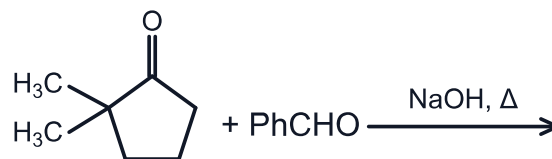
81. The correct decreasing order of oxidation state of the underlined atom in each molecule is

- (1) $\underline{\text{P}}\text{4O}_{10} > \underline{\text{S}}\text{O}_3 > \underline{\text{H}_2}\text{O}$
 (2) $\underline{\text{N}}_2\text{O}_5 > \underline{\text{Al}}_2\text{O}_3 > \underline{\text{H}_2}\text{S}$
 (3) $\underline{\text{Pb}}\text{O}_2 > \underline{\text{N}}_2\text{O}_3 > \underline{\text{S}}\text{O}_3$
 (4) $\underline{\text{P}}_4\text{O}_6 > \underline{\text{Cl}}_2\text{O}_7 > \underline{\text{Al}}\text{H}_3$

Answer (2)

Sol. Assigning oxidation numbers in option (2): nitrogen in N_2O_5 is +5, aluminium in Al_2O_3 is +3, and sulphur in H_2S is -2 (hydrogen is +1 because sulphur is the more electronegative partner). The sequence +5 > +3 > -2 is genuinely decreasing, so (2) is correct. NCERT Class 11, Redox Reactions (oxidation number rules).

82. The compound that CANNOT be obtained from the aldol condensation reaction shown below, is



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

Answer (1)

Sol. The ketone has α -hydrogens only at C-5, because C-2 already carries two methyl groups and no hydrogen. Cross-aldol with benzaldehyde followed by dehydration therefore gives the benzylidene product at C-5, available as both geometrical isomers (options (2) and (4)). Self-condensation between two ketone molecules places the new double bond BETWEEN the α -carbon of one ring and the former carbonyl carbon of the other, which is the exocyclic alkene of option (3). Option (1) shows the rings joined by a single bond with the alkene sitting inside the second ring - no addition-elimination sequence produces that connectivity. NCERT Class 12, Aldehydes, Ketones and Carboxylic Acids.

Why the other options are wrong:

- (2) is obtainable - the standard cross-aldol condensation product with the non-enolisable aldehyde
- (3) is obtainable - the self-aldol condensation product, since the ketone does possess one enolisable position
- (4) is obtainable - simply the other geometrical isomer of the same benzylidene product

83. Among the following, the compound having conjugated double bonds is

- (1) hepta-1,3-diene (2) hepta-1,4-diene
 (3) hepta-1,5-diene (4) hepta-1,6-diene

Answer (1)

Sol. Double bonds are conjugated when they alternate with exactly one single bond, letting the p orbitals overlap continuously. In hepta-1,3-diene the unsaturations are at C1-C2 and C3-C4, separated by the single C2-C3 bond, so the system is conjugated. The others place

two or more single bonds between the double bonds, making them isolated. NCERT Class 11, Hydrocarbons.

84. Given below are two statements.

Statement I: Oxidation of p-nitrotoluene with acidic KMnO_4 gives an acid that is stronger than benzoic acid.

Statement II: Reduction of p-nitrotoluene with Sn/HCl followed by neutralization gives an amine that is more basic than aniline.

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

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

Answer (1)

Sol. Each reagent attacks a different group on the same starting material. Acidic permanganate oxidises the methyl group to $-\text{COOH}$, leaving the nitro group intact; the resulting p-nitrobenzoic acid is stronger than benzoic acid because the electron-withdrawing nitro group stabilises the carboxylate anion. Sn/HCl instead reduces the nitro group to $-\text{NH}_2$, leaving the methyl in place; the resulting p-toluidine is more basic than aniline because the electron-releasing methyl group raises the electron density on nitrogen. Both statements are therefore correct. NCERT Class 12, Amines; Aldehydes, Ketones and Carboxylic Acids.

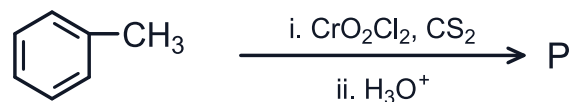
85. The green paramagnetic species formed by heating KMnO_4 at 513 K is

- (1) K_2MnO_4 (2) Mn_3O_4 (3) MnO (4) KO_2

Answer (1)

Sol. Heating permanganate near 513 K decomposes it as $2\text{KMnO}_4 \rightarrow \text{K}_2\text{MnO}_4 + \text{MnO}_2 + \text{O}_2$ at 513 K. The manganate ion MnO_4^{2-} has manganese in the +6 state with a d^1 configuration, so it is both intensely green and paramagnetic - permanganate itself, with d^0 manganese(VII), is purple and diamagnetic. NCERT Class 12, The d- and f-Block Elements (potassium permanganate).

86. Consider the following reaction, and choose the correct option.



- (1) On treating compound **P** with saturated NaHCO_3 solution, brisk effervescence is observed
- (2) Compound **P** can be prepared by treating benzene with anhydrous AlCl_3 and CH_3COCl
- (3) On treatment with bromine water, compound **P** gives a white precipitate
- (4) Compound **P** is obtained by the hydrogenation of benzoyl chloride with Pd on BaSO_4

Answer (4)

Sol. Chromyl chloride in carbon disulphide oxidises the methyl group of toluene only as far as the aldehyde, and hydrolysis of the chromium complex releases benzaldehyde - the Etard reaction. Benzaldehyde is exactly the product of Rosenmund reduction, in which benzoyl chloride is hydrogenated over palladium poisoned with barium sulphate, so option (4) is a genuine alternative preparation. NCERT Class 12, Aldehydes, Ketones and Carboxylic Acids (preparation of aldehydes).

Why the other options are wrong:

- (1) effervescence with bicarbonate is a test for carboxylic ACIDS; an aldehyde is not acidic enough to release CO_2
- (2) acylation of benzene with acetyl chloride gives acetophenone, a ketone, not benzaldehyde
- (3) a white precipitate with bromine water is characteristic of activated rings such as phenol or aniline, not of benzaldehyde

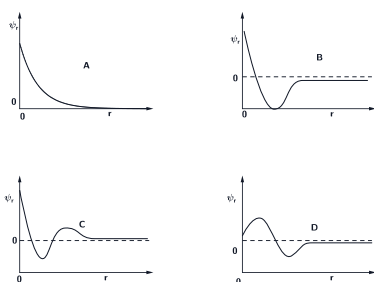
87. A 1 : 3 electrolyte in an aqueous solution is

- (1) $[\text{CoCl}_2(\text{NH}_3)_4]\text{Cl}$ (2) $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$
- (3) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (4) $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$

Answer (3)

Sol. Only the ions OUTSIDE the coordination sphere are released in solution; ligands bound to the metal stay put. $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ has all six ammonia molecules coordinated and three chlorides as counter-ions, so it dissociates into one complex cation and three chloride ions - a 1 : 3 electrolyte. NCERT Class 12, Coordination Compounds (Werner's theory, primary and secondary valence).

88. Consider the following schematic plots of orbital wavefunction (ψ_r) against distance (r) from the nucleus.



The figure representing two radial nodes in the orbital is

- (1) A (2) B (3) C (4) D

Answer (3)

Sol. A radial node is a distance at which the wavefunction actually CHANGES SIGN, so on a ψ_r versus r plot you simply count how many times the curve crosses the horizontal axis. Merely approaching zero asymptotically at large r does not count. The plot labelled C crosses the axis twice - once into negative values and once back up - so it has two radial nodes, matching an orbital with $n - l - 1 = 2$ such as 3s. NCERT Class 11, Structure of Atom (quantum mechanical model, nodes).

Why the other options are wrong:

- (1) shows a curve that decays without ever changing sign - zero radial nodes, as in 1s
- (2) crosses the axis only once, so it has a single radial node
- (4) crosses more often than twice, so its node count is higher than asked for

89. Arrange the following compounds in the increasing order of polarity.

Statement I: $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$

Statement II: $\text{CH}_3\text{CH}_2\text{OH}$

Statement III: CH_3COCH_3

Statement IV: CH_3COOH

Choose the correct answer from the options given below.

- (1) $\text{I} < \text{II} < \text{III} < \text{IV}$ (2) $\text{III} < \text{I} < \text{IV} < \text{II}$
 (3) $\text{III} < \text{I} < \text{II} < \text{IV}$ (4) $\text{I} < \text{III} < \text{II} < \text{IV}$

Answer (4)

Sol. Polarity here is judged by how strongly the functional group interacts through dipoles and hydrogen bonding, which is the ordering used in chromatography. Diethyl ether has no O-H and only weak dipolar interaction, so it is least polar. Acetone's

carbonyl is strongly polar but it can only ACCEPT hydrogen bonds, never donate one, so it ranks below ethanol, which has an O-H donor. Acetic acid combines a carbonyl, an O-H donor and acidic ionisation, making it the most polar. Hence $\text{I} < \text{III} < \text{II} < \text{IV}$. NCERT Class 11, Organic Chemistry: Some Basic Principles and Techniques (chromatographic separation).

90. The highest occupied molecular orbital for Ne_2 is

- (1) π_{2p} (2) σ_{2p}
 (3) π_{2p}^* (4) σ_{2p}^*

Answer (4)

Sol. Ne_2 has 20 electrons, enough to fill every molecular orbital derived from the 1s, 2s and 2p atomic orbitals. Filling in order, $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p}^2 \pi_{2p}^4 \pi_{2p}^{*4} \sigma_{2p}^{*2}$, the last two electrons enter σ_{2p}^* , which is therefore the HOMO. With every bonding orbital matched by its antibonding partner the bond order is zero, which is why Ne_2 does not exist as a stable molecule. NCERT Class 11, Chemical Bonding and Molecular Structure.

HALFWAY THROUGH

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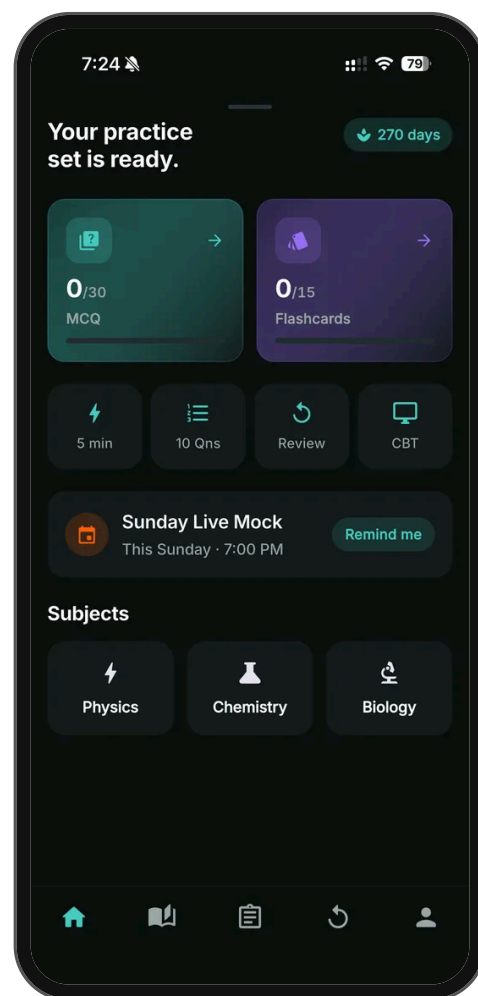
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BIOLOGY

91. The number of vertebrae in a human is _____.

- (1) 7 (2) 12 (3) 26 (4) 206

Answer (3)

Sol. The adult vertebral column contains 26 vertebrae. The count starts from 33 in the embryo but falls as the five sacral vertebrae fuse into a single sacrum and the four coccygeal vertebrae fuse into one coccyx: 7 cervical + 12 thoracic + 5 lumbar + 1 sacrum + 1 coccyx = 26. NCERT Class 11, Locomotion and Movement.

92. Symbiotic association between fungi and algae are called _____.

- (1) lichens (2) sponges
(3) mycorrhiza (4) chrysophytes

Answer (1)

Sol. In a lichen the algal partner (the phycobiont) photosynthesises and supplies food, while the fungal partner (the mycobiont) provides shelter, anchorage and absorbs mineral nutrients and water. Lichens are highly sensitive to pollution, which is why they are used as air-quality indicators. NCERT Class 11, Biological Classification.

93. Cell theory was formulated by _____.

- (1) Schleiden and Schwann
(2) Robert Brown
(3) Singer and Nicolson
(4) Antonie Von Leeuwenhoek

Answer (1)

Sol. Matthias Schleiden concluded in 1838 that all plants are composed of cells, and Theodore Schwann reached the same conclusion for animals in 1839; together they formulated the cell theory. Rudolf Virchow later added the crucial third element, that all cells arise from pre-existing cells. NCERT Class 11, Cell: The Unit of Life.

94. Which of the following are characteristics of prokaryotic cells?

Statement I: Ribosomes are made of 50S and 30S subunits

Statement II: They can have plasmids

Statement III: They contain mesosome

Statement IV: They have peroxisomes

Choose the correct answer from the options given below :

- (1) (II) and (III) only
(2) (I) and (III) only
(3) (I), (III) and (IV) only
(4) (I), (II) and (III) only

Answer (4)

Sol. Prokaryotic ribosomes are 70S, built from 50S and 30S subunits, in contrast to the 80S ribosomes of eukaryotes (Statement I). Many bacteria carry plasmids, small extrachromosomal circles of DNA that confer traits such as antibiotic resistance (Statement II). The mesosome is a distinctive infolding of the prokaryotic plasma membrane involved in cell wall formation and respiration (Statement III). Peroxisomes, however, are MEMBRANE-BOUND ORGANELLES found only in eukaryotic cells, so (Statement IV) is false. NCERT Class 11, Cell: The Unit of Life.

95. Which of the following is not a part of human central neural system?

- (1) Arachnoid (2) Dura mater
(3) Pia mater (4) Pericardium

Answer (4)

Sol. The pericardium is the double-walled sac enclosing the HEART and belongs to the circulatory system. The other three are the meninges - the tough outer dura mater, the web-like middle arachnoid and the delicate inner pia mater - which wrap the brain and spinal cord. NCERT Class 11, Neural Control and Coordination.

96. Mitochondrial inner membrane encloses _____.

- (1) matrix (2) cytosol
(3) mucus (4) aqueous humor

Answer (1)

Sol. The mitochondrion has two membranes. The inner membrane throws out folds called cristae and encloses the MATRIX, a dense fluid containing the enzymes of

the citric acid cycle, mitochondrial DNA and 70S ribosomes. The narrow space between the two membranes is the intermembrane space. NCERT Class 11, Cell: The Unit of Life.

97. Match List-I with List-II.

List I	List II
P) Cristae	I) Flat membrane sacs in stroma of chloroplast
Q) Cisternae	II) Infoldings in mitochondria
R) Thylakoids	III) Cell membrane
S) Phospholipid	IV) Disc shaped sacs in the Golgi apparatus

Choose the correct answer from the options given below:

- (1) P-III, Q-IV, R-I, S-II (2) P-II, Q-IV, R-I, S-III
 (3) P-II, Q-IV, R-III, S-I (4) P-IV, Q-III, R-I, S-II

Answer (2)

Sol. Cristae are the infoldings of the inner mitochondrial membrane that increase surface area for the electron transport chain (P-II). Cisternae are the flattened disc-shaped sacs stacked to form the Golgi apparatus (Q-IV). Thylakoids are the flattened membranous sacs suspended in the chloroplast stroma where the light reactions occur (R-I). Phospholipids form the bilayer that is the structural basis of the cell membrane (S-III). NCERT Class 11, Cell: The Unit of Life.

98. The plastid that stores xanthophyll is known as _____.

- (1) chloroplast (2) chromoplast
 (3) aleuroplast (4) amyloplast

Answer (2)

Sol. Chromoplasts are the coloured plastids that hold carotenoid pigments - carotenes and xanthophylls - giving fruits, flowers and some roots their yellow, orange and red colours. Leucoplasts, being colourless, are the storage plastids and are further divided by what they store: amyloplasts for starch, elaioplasts for oils and aleuroplasts for proteins. NCERT Class 11, Cell: The Unit of Life.

99. Which of the following statements related to pituitary gland are correct?

Statement I: It is divided anatomically into adenohypophysis and neurohypophysis

Statement II: It secretes follicle stimulating hormone

Statement III: It secretes melanocyte stimulating hormone

Statement IV: It does not secrete prolactin

Choose the correct answer from the options given below :

- (1) (I) and (II) only
 (2) (I), (II) and (III) only
 (3) (III) and (IV) only
 (4) (II) and (III) only

Answer (2)

Sol. The pituitary is anatomically divided into the adenohypophysis (anterior) and neurohypophysis (posterior), so (Statement I) is correct. The pars distalis of the adenohypophysis secretes FSH among other trophic hormones, making (Statement II) correct, and the pars intermedia secretes MSH, making (Statement III) correct. Statement IV is false: prolactin IS a pituitary hormone, secreted by the pars distalis to regulate mammary growth and milk production. NCERT Class 11, Chemical Coordination and Integration.

100. Photorespiration reaction catalyzed by RuBisCo is shown below: $\text{RuBP} + \text{O}_2 \rightarrow 3\text{-Phosphoglycerate} + \text{X}$. Identify "X" from the given options:

- (1) Phosphoenolpyruvate (2) 2-Phosphoglycolate
 (3) Oxaloacetate (4) Malate

Answer (2)

Sol. Ribulose biphosphate carboxylase-oxygenase (RuBisCO) has affinity for both CO_2 and O_2 at the same active site. When oxygen wins, the five-carbon ribulose biphosphate (RuBP) is split into one molecule of the three-carbon 3-phosphoglycerate and one molecule of the two-carbon 2-phosphoglycolate - note the carbon bookkeeping, $5 = 3 + 2$. This wasteful route consumes adenosine triphosphate (ATP) without fixing carbon or producing sugar. NCERT Class 11, Photosynthesis in Higher Plants.

101. Mad cow disease is caused by _____.

- (1) prions (2) viroids
 (3) *Aspergillus* sp. (4) *Mycoplasma* sp.

Answer (1)

Sol. Prions are abnormally folded PROTEIN particles with no nucleic acid at all. They act as templates that force the normal cellular protein into the same misfolded

shape, producing spongiform degeneration of the brain. Bovine spongiform encephalopathy in cattle and its human counterpart, Creutzfeldt-Jakob disease, are both prion diseases. NCERT Class 11, Biological Classification.

102. Which pigment has absorption peak at 700 nm in the photosynthetic reaction centre PS I (P700)?

- (1) Chlorophyll b (2) Chlorophyll a
(3) Xanthophylls (4) Carotenoids

Answer (2)

Sol. Only chlorophyll a occupies the reaction centre of a photosystem, and it is named for its absorption peak: P700 in photosystem I and P680 in photosystem II. All other pigments - chlorophyll b, xanthophylls and carotenoids - are ACCESSORY pigments in the light-harvesting complex that capture photons and funnel the energy to chlorophyll a. NCERT Class 11, Photosynthesis in Higher Plants.

103. In water, frogs respire using _____.

- (1) skin (2) buccal cavity
(3) lungs (4) trachea

Answer (1)

Sol. Submerged frogs rely entirely on CUTANEOUS respiration: the moist, thin, richly vascularised skin allows dissolved oxygen and carbon dioxide to diffuse directly across it. On land the frog switches to buccal cavity respiration and pulmonary respiration through the lungs. The skin route is the only one available underwater. NCERT Class 11, Structural Organisation in Animals.

104. Which of the following represents the correct sequence of arrangement of bones in the lower limb of humans?

- (1) Femur-tibia-patella-tarsal
(2) Patella-femur-tibia-tarsal
(3) Femur-patella-tibia-tarsal
(4) Femur-tarsal-patella-tibia

Answer (3)

Sol. Working downward from the hip: the femur is the thigh bone, the patella is the kneecap covering the knee joint, the tibia and fibula form the leg below the knee, and the tarsals make up the ankle. The sequence femur-patella-tibia-tarsal follows that anatomical order. NCERT Class 11, Locomotion and Movement.

105. Phyllotaxy is the pattern of arrangement of _____.

- (1) leaves (2) flowers (3) fruits (4) sepals

Answer (1)

Sol. Phyllotaxy is the arrangement of LEAVES on the stem or branch, and it comes in three patterns:

alternate (as in china rose), opposite (as in *Calotropis*) and whorled (as in *Alstonia*). The Greek root phyllon means leaf. The arrangement of flowers on the floral axis is called inflorescence, a separate term. NCERT Class 11, Morphology of Flowering Plants.

106. Match List-I with List-II.

List I	List II
P) Starch	I) Fights infection
Q) Antibody	II) Energy storage
R) Concanavalin A	III) Glucose transport
S) Glut-4	IV) Lectin

Choose the correct answer from the options given below :

- (1) P-I, Q-II, R-IV, S-III (2) P-II, Q-I, R-IV, S-III
(3) P-II, Q-I, R-III, S-IV (4) P-I, Q-II, R-III, S-IV

Answer (2)

Sol. Starch is the storage polysaccharide of plants, a reserve of energy (P-II). Antibodies are immunoglobulins that recognise and neutralise pathogens (Q-I). Concanavalin A is the standard textbook example of a lectin, a carbohydrate-binding protein (R-IV). GLUT-4 is the insulin-responsive transporter that carries glucose across the plasma membrane into muscle and fat cells (S-III). NCERT Class 11, Biomolecules (protein functions).

107. Given below are two statements :

Statement I: When any plane passing through the central axis of the body divides the organism into two identical halves, it is called radial symmetry.

Statement II: In phylum Echinodermata, both adults and larvae are radially symmetrical.

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

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

Answer (3)

Sol. Radial symmetry means that any plane through the central body axis divides an organism into similar halves. Adult echinoderms are radial, but their larvae are bilateral, consistent with a bilateral ancestry. Statement I is true and statement II is false.

108. Endomembrane system includes _____.

- (1) endoplasmic reticulum, Golgi complex, lysosomes and vacuole
- (2) endoplasmic reticulum, chloroplast, peroxisomes and vacuole
- (3) mitochondria, chloroplast, peroxisomes and vacuole
- (4) Golgi complex, chloroplast, peroxisomes and vacuole

Answer (1)

Sol. The endomembrane system is defined as those organelles whose functions are coordinated and whose membranes are continuous or exchanged through vesicles: the endoplasmic reticulum, Golgi complex, lysosomes and vacuoles. Mitochondria, chloroplasts and peroxisomes are deliberately excluded because their functions are not coordinated with this network. NCERT Class 11, Cell: The Unit of Life.

109. How many molecules of pyruvic acid are produced at the end of glycolysis from 206 molecules of glucose?

- (1) 206 (2) 309 (3) 103 (4) 412

Answer (4)

Sol. Glycolysis splits each six-carbon glucose into TWO three-carbon pyruvate molecules, so the yield is simply doubled: $206 \times 2 = 412$. The carbon count checks out, since $6 = 3 + 3$. NCERT Class 11, Respiration in Plants.

110. Which of the following plant growth regulators is used as herbicide?

- (1) 2, 4-D (2) Kinetin
- (3) Absciscic acid (4) Gibberellin

Answer (1)

Sol. 2,4-dichlorophenoxyacetic acid is a synthetic auxin widely used to kill dicotyledonous weeds while leaving mature monocotyledonous crops such as wheat and rice largely unharmed. At herbicidal concentrations it forces uncontrolled, disorganised growth in susceptible plants. NCERT Class 11, Plant Growth and Development.

111. Given below are two statements:

Statement I: In gymnosperms, the male and female gametophytes remain within the sporangia.

Statement II: In gymnosperms, seeds are not covered.

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

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

Answer (1)

Sol. Gymnosperms are heterosporous, and unlike in pteridophytes the gametophytes never become free-living: the reduced male gametophyte stays inside the pollen grain within the microsporangium, and the female gametophyte remains enclosed in the megasporangium (nucellus) on the ovule. The name itself, gymno meaning naked and sperma meaning seed, records the second fact - the ovules sit exposed on the megasporophyll with no ovary wall around them, so no fruit is formed. NCERT Class 11, Plant Kingdom.

112. Match List-I with List-II.

List I	List II
P) Spherical	I) Vibrio
Q) Rod	II) Cocci
R) Comma	III) Spirilla
S) Spirillum	IV) Bacilli

Choose the correct answer from the options given below :

- (1) P-I, Q-III, R-II, S-IV (2) P-III, Q-II, R-I, S-IV
- (3) P-II, Q-I, R-IV, S-III (4) P-II, Q-IV, R-I, S-III

Answer (4)

Sol. Bacteria are classified by shape into four basic forms: spherical cocci (P-II), rod-shaped bacilli (Q-IV), comma-shaped vibrio (R-I) and spiral spirilla (S-III). The names are worth learning together because each is simply the Latin word for the shape. NCERT Class 11, Biological Classification.

113. Which of the following are characteristic features of Solanaceae family?

Statement I: Flowers are bisexual and actinomorphic
 Statement II: Calyx have five sepals and are united
 Statement III: Androecium have five stamens and are epipetalous
 Statement IV: Ovary is inferior

Choose the correct answer from the options given below :

- (1) (I), (II) and (III) only
- (2) (IV) only
- (3) (I) and (II) only
- (4) (II), (III) and (IV) only

Answer (1)

Sol. The Solanaceae floral formula describes bisexual, actinomorphic flowers with a gamosepalous calyx of five united sepals, a gamopetalous corolla of five petals, and five epipetalous stamens attached to the corolla tube. Statement IV is the odd one out: the ovary in this family is bicarpellary, syncarpous and SUPERIOR, seated above the other floral parts. NCERT Class 11, Morphology of Flowering Plants.

114. Select the correct sequence of experiments that led to a gradual understanding of photosynthesis in green plants.

- (1) Absorption spectra of chlorophyll a and b → production of glucose → release of oxygen → role of air
- (2) Role of air → release of oxygen → production of glucose → absorption spectra of chlorophyll a and b
- (3) Release of oxygen → production of glucose → absorption spectra of chlorophyll a and b → role of air
- (4) Production of glucose → role of air → release of oxygen → absorption spectra of chlorophyll a and b

Answer (2)

Sol. The discoveries came in order of increasing refinement. Priestley first showed that plants restore something to 'injured' air. Ingenhousz then established that it is sunlight and the green parts that release oxygen. Sachs later demonstrated that glucose is produced and stored as starch in chloroplasts. Finally Engelmann worked out the action spectrum and the absorption properties of the chlorophylls. NCERT Class 11, Photosynthesis in Higher Plants (early experiments).

115. The number of action potentials generated by sino-atrial node (SAN) in a healthy human is _____ per minute.

- (1) 28 - 30
- (2) 70 - 75
- (3) 100 - 110
- (4) 120 - 140

Answer (2)

Sol. The sino-atrial node is the pacemaker of the heart because it generates action potentials faster than any other part of the conducting system - about 70 to 75 per minute, which sets the normal resting heart rate. The atrio-ventricular node and Purkinje fibres can also fire spontaneously but at slower rates, so they only take over if the SAN fails. NCERT Class 11, Body Fluids and Circulation.

116. How many turns of Calvin cycle are required for the formation of three molecules of glucose?

- (1) 6
- (2) 3
- (3) 1
- (4) 18

Answer (4)

Sol. Each turn of the Calvin cycle fixes ONE molecule of CO_2 , so building the six-carbon skeleton of one glucose needs six turns. Three glucose molecules therefore need $3 \times 6 = 18$ turns. The common trap is to forget that the cycle handles one carbon at a time, not one sugar. NCERT Class 11, Photosynthesis in Higher Plants.

117. Which of the following statements is incorrect?

- (1) Blood coagulates in response to an injury
- (2) Blood clot consists of fibrins
- (3) Fibrin is produced from fibrinogen
- (4) Fibrinogen is produced from fibrin

Answer (4)

Sol. During blood coagulation, thrombin converts soluble plasma fibrinogen into insoluble fibrin threads. Those threads form a mesh that traps blood cells to make the clot. Reversing fibrin and fibrinogen gives the wrong direction for this step.

118. Match List-I with List-II.

List I	List II
P) Family	I) Sapindales
Q) Genus	II) Dicotyledonae
R) Class	III) Anacardiaceae
S) Division	IV) Angiospermae
T) Order	V) <i>Mangifera</i>

Choose the correct answer from the options given below :

- (1) P-I, Q-V, R-II, S-IV, T-III
- (2) P-II, Q-I, R-III, S-IV, T-V
- (3) P-II, Q-III, R-V, S-I, T-IV
- (4) P-III, Q-V, R-II, S-IV, T-I

Answer (4)

Sol. NTA's paper printed Phylum in row S; it is corrected to Division, the rank NCERT uses for plants. For mango, the genus is *Mangifera* (Q-V), the family is Anacardiaceae (P-III), the order is Sapindales (T-I), the class is Dicotyledonae (R-II), and the division is Angiospermae (S-IV). Therefore option (4) is correct. NCERT Class 11, The Living World.

119. Arrange the following taxonomic categories in ascending order.

- Statement I: Genus
Statement II: Class
Statement III: Order
Statement IV: Phylum
Statement V: Family
Statement VI: Kingdom
Statement VII: Species

Choose the correct answer from the options given below :

- (1) (VII), (I), (V), (III), (II), (IV), (VI)
- (2) (I), (III), (IV), (VII), (VI), (II), (V)
- (3) (VII), (III), (IV), (II), (V), (I), (VI)
- (4) (VI), (III), (II), (VII), (IV), (V), (I)

Answer (1)

Sol. Ascending order means starting from the smallest, most specific category and working up to the broadest. The hierarchy runs Species, Genus, Family, Order, Class, Phylum (Division in plants), Kingdom - which is exactly (VII), (I), (V), (III), (II), (IV), (VI). Moving up the ladder, the number of shared characters falls while the number of organisms included rises. NCERT Class 11, The Living World.

120. Match List-I with List-II.

List I	List II
P) Marginal placentation	I) <i>Argemone</i>
Q) Axile placentation	II) Tomato
R) Parietal placentation	III) Primrose
S) Free central placentation	IV) Pea

Choose the correct answer from the options given below :

- (1) P-II, Q-IV, R-I, S-III
- (2) P-IV, Q-II, R-III, S-I
- (3) P-IV, Q-III, R-I, S-II
- (4) P-IV, Q-II, R-I, S-III

Answer (4)

Sol. Placentation describes where ovules attach inside the ovary. Marginal placentation has a single ridge along the ventral suture of a monocarpellary ovary, as in pea (P-IV). Axile placentation occurs in multilocular ovaries where the placenta is axial, as in tomato (Q-II). Parietal placentation puts the ovules on the inner ovary wall of a one-chambered ovary, as in *Argemone* (R-I). Free central placentation has ovules on a central axis with no septa, as in primrose (S-III). NCERT Class 11, Morphology of Flowering Plants.

121. Sphenopsida class belongs to _____.

- (1) bryophytes
- (2) angiosperms
- (3) gymnosperms
- (4) pteridophytes

Answer (4)

Sol. Pteridophytes are divided into four classes: Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Sphenopsida contains the horsetails, chiefly *Equisetum*, recognised by jointed ridged stems bearing whorls of scale leaves. These are the first vascular land plants, with true xylem and phloem. NCERT Class 11, Plant Kingdom.

122. Which of the following statements regarding photorespiration are correct?

- Statement I: Do not occur in C_3 plants
Statement II: CO_2 is consumed and O_2 is generated
Statement III: Phosphoglycolate is formed
Statement IV: No synthesis of ATP and NADPH

Choose the correct answer from the options given below:

- (1) (I) and (IV) only
- (2) (III) and (IV) only
- (3) (II) and (IV) only
- (4) (I) and (II) only

Answer (2)

Sol. Statement III is correct: the oxygenase activity of ribulose biphosphate carboxylase-oxygenase (RuBisCO) splits ribulose biphosphate (RuBP) into 3-phosphoglycerate and 2-phosphoglycolate.

Statement IV is also correct: photorespiration is purely wasteful, producing no sugar, no adenosine triphosphate (ATP) and no reduced nicotinamide adenine dinucleotide phosphate (NADPH) while consuming energy. Statement I is false because photorespiration is characteristic OF C_3 plants - it is C_4 plants that avoid it. Statement II reverses the gas exchange: photorespiration consumes O_2 and releases CO_2 . NCERT Class 11, Photosynthesis in Higher Plants.

123. Smooth endoplasmic reticulum _____.

- (1) has ribosomes attached to its surface
- (2) is the major site for the synthesis of lipids
- (3) is actively involved in protein synthesis
- (4) is a site for the synthesis of carbohydrates

Answer (2)

Sol. The smooth endoplasmic reticulum is defined by the ABSENCE of ribosomes on its surface, and it is the principal site of lipid synthesis - including steroid hormones in cells such as those of the adrenal cortex and gonads. It also handles detoxification, which is why it is abundant in liver cells. Ribosome-studded rough ER handles protein synthesis instead. NCERT Class 11, Cell: The Unit of Life.

124. Which one of the following statements is incorrect?

- (1) α -cells of pancreas secrete glucagon
- (2) α -cells of pancreas secrete insulin
- (3) Glucagon stimulates glycogenolysis
- (4) β -cells of pancreas secrete insulin

Answer (2)

Sol. The islets of Langerhans divide the labour cleanly: α -cells secrete glucagon, which raises blood glucose, and β -cells secrete insulin, which lowers it. Option (2) assigns insulin to the wrong cell type. Note that options (1) and (4) together give the correct pairing, so the two can be used to check each other. NCERT Class 11, Chemical Coordination and Integration.

125. Genus represents _____.

- (1) an individual plant or animal
- (2) a population of plants and animals
- (3) a group of closely related species
- (4) a group of closely related families

Answer (3)

Sol. A genus sits one rung above species and gathers together species that share a set of characters not found in other genera. *Panthera*, for instance, includes the lion, tiger and leopard. It is the first word of every binomial name, which is why it is always

written with a capital letter. NCERT Class 11, The Living World.

126. Which of the following is not a prokaryote?

- | | |
|-----------------------|----------------------|
| (1) Bacteria | (2) Blue green algae |
| (3) <i>Mycoplasma</i> | (4) Fungi |

Answer (4)

Sol. Fungi belong to Kingdom Fungi and are EUKARYOTES - they possess a true membrane-bound nucleus, mitochondria and other organelles. The other three are all prokaryotic members of Kingdom Monera: bacteria, cyanobacteria (blue-green algae) and the wall-less *Mycoplasma*. NCERT Class 11, Biological Classification.

127. Which of the following plant growth regulators promotes internode elongation prior to flowering in cabbage?

- | | |
|-------------------------|-----------------|
| (1) Absciscic acid | (2) Gibberellin |
| (3) Indole butyric acid | (4) Ethephon |

Answer (2)

Sol. The dramatic elongation of the internodes just before flowering is called BOLTING, and it is the classic gibberellin response in rosette plants such as cabbage and beet. Applying gibberellin causes the compressed rosette to shoot upward into a tall flowering stalk. NCERT Class 11, Plant Growth and Development.

128. The correct sequence of adult cell cycle phases is _____.

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

Answer (3)

Sol. Interphase runs G1, then S, then G2, and only then does the cell enter M phase to divide. The logic is that DNA must be replicated in S phase before the gap phase G2 allows the cell to check the copy and prepare for mitosis; dividing before replication would be fatal. NCERT Class 11, Cell Cycle and Cell Division.

129. Match List-I with List-II.

List I	List II
P) Fusion of protoplasts between gametes	I) Meiosis
Q) Fusion of two nuclei	II) Plasmogamy
R) Generation of haploid spores	III) Karyogamy

Choose the correct answer from the options given below :

- (1) P-II, Q-III, R-I (2) P-II, Q-I, R-III
 (3) P-III, Q-II, R-I (4) P-I, Q-III, R-II

Answer (1)

Sol. Sexual reproduction in fungi runs through three named steps in sequence. Plasmogamy is the fusion of the two protoplasts (P-II), karyogamy is the subsequent fusion of the two nuclei (Q-III), and meiosis in the resulting diploid zygote restores the haploid condition and generates spores (R-I). In many fungi plasmogamy and karyogamy are separated by a long dikaryotic phase, which is why they are named as distinct events. NCERT Class 11, Biological Classification.

130. Given below are two statements:

Statement I: The class name Reptilia refers to creeping or crawling mode of locomotion.

Statement II: All organisms belonging to Reptilia have three chambered heart.

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

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

Answer (3)

Sol. The class name comes from the Latin *reperere* or *reptum*, meaning to creep or crawl, so Statement I is correct. Statement II fails on a single well-known exception: CROCODILES have a four-chambered heart, while other reptiles such as lizards, snakes and turtles have three chambers. The word 'all' is what makes the statement false. NCERT Class 11, Animal Kingdom.

131. Given below are two statements :

Statement I: Chromosomes are fully condensed at the end of prophase I.

Statement II: Meiosis I resembles mitosis.

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

Answer (3)

Sol. Prophase I is the longest and most complex phase of meiosis, running through leptotene, zygotene, pachytene, diplotene and diakinesis; by diakinesis the chromosomes have reached maximum condensation, so Statement I holds. Statement II names the wrong division: it is MEIOSIS II that resembles mitosis, since sister chromatids separate and no pairing or crossing over occurs. Meiosis I is the reductional division, with homologues pairing, recombining and then separating - none of which happens in mitosis. NCERT Class 11, Cell Cycle and Cell Division.

132. Which of the following is not a characteristic of chordates?

- (1) Presence of notochord
 (2) Central nervous system is dorsal
 (3) Absence of gills
 (4) Presence of post anal part (tail)

Answer (3)

Sol. Chordates are defined by four fundamental features: a notochord, a dorsal hollow nerve cord, PAIRED PHARYNGEAL GILL SLITS and a post-anal tail. Gill slits are therefore present, not absent - even in terrestrial vertebrates they appear during embryonic development before being modified into other structures. NCERT Class 11, Animal Kingdom.

133. Length of the stem at time 0 is 20 cm. The arithmetic growth rate is 30 cm per day. What is the length of the stem at the end of the 7th day?

- (1) 50 cm (2) 170 cm (3) 230 cm (4) 460 cm

Answer (3)

Sol. Arithmetic growth adds a CONSTANT amount per unit time, described by $L_t = L_0 + rt$. Substituting, $L_7 = 20 + (30 \times 7) = 230$ cm. The contrast worth holding onto is with geometric growth, where the increment itself grows and the curve is exponential rather than a straight line. NCERT Class 11, Plant Growth and Development.

134. Arrange the following elements in descending order of their contribution to percentage weight of the human body.

Statement I: Oxygen
Statement II: Carbon
Statement III: Hydrogen
Statement IV: Nitrogen

Choose the correct answer from the options given below :

- (1) (I), (II), (III), (IV) (2) (III), (I), (II), (IV)
(3) (II), (III), (IV), (I) (4) (II), (I), (III), (IV)

Answer (1)

Sol. By WEIGHT the human body is roughly 65 per cent oxygen, 18 per cent carbon, 10 per cent hydrogen and 3 per cent nitrogen, so the order is oxygen, carbon, hydrogen, nitrogen. Oxygen dominates because most of the body is water and hydrogen contributes little mass despite being very abundant by number of atoms - a useful reminder that ranking by weight and ranking by atom count give different answers. NCERT Class 11, Biomolecules (elemental analysis).

135. In frogs, the number of pairs of cranial nerves arising from the brain are _____.

- (1) 6 (2) 9 (3) 10 (4) 12

Answer (3)

Sol. The frog's brain gives off TEN pairs of cranial nerves. This is a useful comparative point: humans and other mammals have twelve pairs, so the frog figure is a common target for confusion between the two. NCERT Class 11, Structural Organisation in Animals.

136. Which of the following is used as a clot buster?

- (1) Streptokinase (2) Penicillin
(3) Cyclosporin A (4) Statins

Answer (1)

Sol. Streptokinase is produced by the bacterium *Streptococcus* and modified by genetic engineering; it dissolves the clots that block blood vessels in patients with myocardial infarction, which is why it is called a clot buster. The other three are also microbial products but with quite different uses. NCERT Class 12, Microbes in Human Welfare.

137. The inactive form of Bt toxin is converted to the active form in the insect gut _____

- (1) due to alkaline pH (2) due to acidic pH
(3) by proteases (4) by nucleases

Answer (1)

Sol. *Bacillus thuringiensis* produces the toxin as an inactive PROTOXIN crystal, which is why the bacterium itself is not harmed. Once eaten by an insect, the alkaline pH of the insect gut solubilises the crystal and converts it to the active form, which then binds to the midgut epithelium and creates pores that swell and lyse the cells. The pH dependence is what makes the toxin selective for insects. NCERT Class 12, Biotechnology and its Applications.

138. Given below are two statements :

Statement I: Down's syndrome is caused by the absence of one of the X-chromosomes.

Statement II: Turner's syndrome is caused by the presence of an additional copy of the chromosomes.

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

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

Answer (2)

Sol. Both statements have been swapped. Down's syndrome is an AUTOSOMAL trisomy - an extra copy of chromosome 21, giving 47 chromosomes - and has nothing to do with the X chromosome. Turner's syndrome is the opposite kind of error: a MISSING X, giving the 45,X karyotype in a phenotypic female with rudimentary ovaries. So the descriptions belong to each other's conditions, and neither statement as written is correct. NCERT Class 12, Principles of Inheritance and Variation.

139. Which of the following disease is not sexually transmitted?

- (1) Syphilis (2) Tuberculosis
(3) Gonorrhoea (4) Genital warts

Answer (2)

Sol. Tuberculosis is caused by *Mycobacterium tuberculosis* and spreads through AIRBORNE droplets from coughing and sneezing, not through sexual contact. The other three appear on NCERT's list of sexually transmitted infections, alongside genital herpes, chlamydia, trichomoniasis, hepatitis-B and human immunodeficiency virus (HIV). NCERT Class 12, Reproductive Health.

140. Sperm motility is due to _____.

- (1) flagellar movement (2) ciliary movement
(3) amoeboid movement (4) muscular movement

Answer (1)

Sol. The sperm tail is a single long FLAGELLUM whose whip-like beating propels the cell forward. The energy comes from the mitochondria spiralled around the middle piece, which is why that region is packed with them. NCERT Class 12, Human Reproduction.

141. Natural selection can lead to _____.

Statement I: stabilisation
Statement II: genetic drift
Statement III: directional change
Statement IV: disruption

Choose the correct answer from the options given below :

- (1) (I) only
- (2) (I), (III) and (IV) only
- (3) (I), (II), (III) and (IV)
- (4) (I) and (III) only

Answer (2)

Sol. Natural selection operates in three modes, distinguished by which part of the trait distribution it favours: stabilising selection favours the average and narrows variation, directional selection shifts the mean toward one extreme, and disruptive selection favours both extremes and can split the population into two peaks. GENETIC DRIFT is not one of them - it is random change in allele frequency caused by chance in small populations, and is explicitly a non-selective mechanism. NCERT Class 12, Evolution.

142. The method of directly of injecting a sperm into ovum in assisted reproductive technology is called :

- (1) Gamete intra fallopian transfer (GIFT)
- (2) Zygote intra fallopian transfer (ZIFT)
- (3) Intra cytoplasmic sperm injection (ICSI)
- (4) Embryo transfer (ET)

Answer (3)

Sol. Intracytoplasmic sperm injection is a specialised in-vitro procedure in which a single sperm is injected DIRECTLY into the cytoplasm of the ovum, bypassing the need for the sperm to penetrate the zona pellucida on its own. It is used mainly for severe male-factor infertility. NCERT Class 12, Reproductive Health.

143. Which of the following structures is not a part of the male reproductive system?

- (1) Rete testis
- (2) Epididymis
- (3) Vasa efferentia
- (4) Infundibulum

Answer (4)

Sol. The infundibulum is the funnel-shaped opening of the FALLOPIAN TUBE, fringed with fimbriae that collect the ovum after ovulation - a female structure. The male duct system runs seminiferous tubules → rete testis → vasa efferentia → epididymis → vas deferens, and the other three options are all stages along it. NCERT Class 12, Human Reproduction.

144. Arrange the following in descending order of number of species in the Amazonian rain forest.

Statement I: Plants
Statement II: Birds
Statement III: Fishes
Statement IV: Invertebrates
Statement V: Mammals

Choose the correct answer from the options given below :

- (1) (Statement III) > (Statement II) > (Statement IV) > (Statement V) > (Statement I)
- (2) (Statement IV) > (Statement I) > (Statement III) > (Statement II) > (Statement V)
- (3) (Statement V) > (Statement II) > (Statement I) > (Statement III) > (Statement IV)
- (4) (Statement II) > (Statement I) > (Statement IV) > (Statement III) > (Statement V)

Answer (2)

Sol. NCERT's figures for the Amazonian rain forest are more than 1,25,000 invertebrate species, about 40,000 plant species, 3,000 fishes, 1,300 birds and 427 mammals - giving invertebrates > plants > fishes > birds > mammals. The broader pattern worth carrying away is that invertebrates dominate global species counts overwhelmingly, and vertebrates make up a very small slice. NCERT Class 12, Biodiversity and Conservation.

145. Given below are two statements:

Statement I: Ovulation is caused by LH surge leading to rupture of Graafian follicles.

Statement II: Graafian follicle remaining after ovulation transform into corpus luteum and secretes large amount of estrogen.

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

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

Answer (3)

Sol. A mid-cycle surge of luteinising hormone ruptures the mature Graafian follicle and releases the ovum. The remaining follicle forms the corpus luteum, whose main secretion is progesterone; it helps maintain the endometrium for implantation. Statement I is true, while statement II wrongly names oestrogen as the principal secretion.

146. Which of the following are primary consumers in a food chain?

- (1) Parasites (2) Predators
(3) Herbivores (4) Carnivores

Answer (3)

Sol. Primary consumers occupy the second trophic level and feed directly on the producers, which makes them by definition the herbivores. Carnivores that eat herbivores are secondary consumers at the third trophic level, and those that eat secondary consumers are tertiary. NCERT Class 12, Ecosystem.

147. A population of diploid organisms is at Hardy-Weinberg equilibrium. If the frequency of allele A is 0.1, the frequency of AA is _____.

- (1) 0.01 (2) 0.02 (3) 0.10 (4) 0.99

Answer (1)

Sol. Under Hardy-Weinberg equilibrium the genotype frequencies follow $p^2 + 2pq + q^2 = 1$, where p^2 is the frequency of the homozygous dominant genotype. With $p = 0.1$, the frequency of AA is $p^2 = 0.01$. The rare-allele lesson is worth noting: a 10 per cent allele frequency produces only 1 per cent homozygotes, which is why recessive disorders remain rare even when carriers are not. NCERT Class 12, Evolution.

148. Match List-I with List-II.

List I	List II
P) Excess growth hormone	I) Reabsorption of water and electrolytes in kidney
Q) Luteinizing hormone	II) Contraction of uterus during child birth
R) Vasopressin	III) Acromegaly
S) Oxytocin	IV) Ovulation

Choose the correct answer from the options given below:

- (1) P-III, Q-IV, R-II, S-I (2) P-III, Q-IV, R-I, S-II
(3) P-II, Q-IV, R-I, S-III (4) P-IV, Q-III, R-I, S-II

Answer (2)

Sol. Excess growth hormone in adults thickens the bones of the hands, feet and face, producing acromegaly (P-III). Luteinizing hormone triggers the rupture of the Graafian follicle at ovulation (Q-IV). Vasopressin, or

antidiuretic hormone (ADH), acts on the distal tubule and collecting duct to reabsorb water and electrolytes (R-I). Oxytocin drives the powerful uterine contractions of labour (S-II). NCERT Class 11, Chemical Coordination and Integration.

149. The opening between the right atrium and the right ventricle is guarded by _____.

- (1) bicuspid valve (2) tricuspid valve
(3) semilunar valve (4) sino-atrial node

Answer (2)

Sol. The right atrioventricular opening is guarded by a valve of three muscular flaps or cusps, hence the tricuspid valve. The left side carries the bicuspid or mitral valve with two cusps. An easy mnemonic is that 'tri' goes with 'right'. NCERT Class 11, Body Fluids and Circulation.

150. Sponges exchange O_2 with CO_2 by _____.

- (1) simple diffusion over their entire body surfaces
(2) moist cuticle
(3) tracheal tubes
(4) gills

Answer (1)

Sol. Lower invertebrates such as sponges, coelenterates and flatworms have no specialised respiratory organs at all. Their bodies are thin enough and their cells close enough to the surrounding water that simple DIFFUSION across the whole body surface suffices for gas exchange. NCERT Class 11, Breathing and Exchange of Gases.

151. How many theca are present in each lobe of a typical bilobed angiosperm anther ?

- (1) 2 (2) 6 (3) 8 (4) 12

Answer (1)

Sol. A typical angiosperm anther is bilobed, and each lobe contains two theca - the anther is therefore described as DITHECOUS. Since each theca houses one microsporangium, the whole anther has four microsporangia arranged at its corners, two per lobe. NCERT Class 12, Sexual Reproduction in Flowering Plants.

152. Muscle contraction is initiated by a signal sent by the central nervous system by the release of _____.

- (1) acetylcholine
(2) acetyl coenzyme A
(3) cyclic guanosine monophosphate
(4) cyclic adenosine monophosphate

Answer (1)

Sol. A motor neuron releases acetylcholine (ACh) at the neuromuscular junction. Acetylcholine binds to receptors on the muscle fibre membrane and generates an action potential. The action potential spreads along the sarcolemma and through the T-tubules, triggering the release of Ca^{2+} from the sarcoplasmic reticulum. Calcium then initiates the interaction between actin and myosin, leading to muscle contraction.

153. Which of the following statements about lac-operon is correct?

- (1) Gene i is constitutively expressed
- (2) Lactose activates repressor to bind to the operator
- (3) Genes i , z , y and a share single common promoter
- (4) Galactose can act as an inducer of lac operon

Answer (1)

Sol. The regulator gene i is transcribed continuously from its own promoter, independent of whether lactose is present, so the repressor protein is always available - that is what constitutive expression means. This is essential to the logic of the operon: the repressor must already exist in order to keep the structural genes switched off in the absence of lactose. NCERT Class 12, Molecular Basis of Inheritance (regulation of gene expression).

154. Which of the following in female gametophyte of an angiosperm helps in guiding the pollen tube for fertilizing the eggs?

- (1) Antipodals
- (2) Synergids
- (3) Central cells
- (4) Polar nucleus

Answer (2)

Sol. The two synergids flank the egg at the micropylar end and bear the FILIFORM APPARATUS, a set of thickened cell wall projections that secrete chemical attractants and guide the pollen tube into the embryo sac. The pollen tube in fact enters one of the synergids, not the egg directly, and releases the two male gametes there. NCERT Class 12, Sexual Reproduction in Flowering Plants.

155. Which of the following plants produces non-albuminous seeds?

- (1) Wheat
- (2) Maize
- (3) Barley
- (4) Pea

Answer (4)

Sol. Non-albuminous seeds lack endosperm at maturity because it is used up during embryo development. In pea, reserve food is stored in the cotyledons.

156. If the diploid chromosome number of typical angiosperm is 36, what would be the chromosome number in its endosperm?

- (1) 18
- (2) 36
- (3) 54
- (4) 72

Answer (3)

Sol. Endosperm arises by TRIPLE FUSION, in which one male gamete fuses with the two polar nuclei, so it is triploid. With $2n = 36$, the haploid number is $n = 18$ and the endosperm is $3n = 54$. The embryo, formed by the other male gamete fusing with the egg, remains diploid at 36. NCERT Class 12, Sexual Reproduction in Flowering Plants.

157. Which of the following statements about the reabsorption process in Henle's loop are correct?

Statement I: The descending limb of Henle's loop is permeable to water but almost impermeable to electrolytes.

Statement II: Urine gets concentrated in Henle's loop.

Statement III: Reabsorption of Na^+ and water takes place together in the ascending limb of Henle's loop.

Statement IV: Active or passive transport of electrolytes occurs in the ascending limb of Henle's loop.

Choose the correct answer from the options given below:

- (1) (I) and (II) only
- (2) (II), (III) and (IV) only
- (3) (I), (II) and (III) only
- (4) (I), (II) and (IV) only

Answer (4)

Sol. NTA's paper said only that sodium and water are reabsorbed in Henle's loop; statement III is worded more precisely here, because the two happen in different limbs. As written, statement III is false: the ascending limb transports electrolytes but is impermeable to water. Statement I is true because the descending limb is permeable to water and nearly impermeable to electrolytes. Statement II is true because tubular fluid becomes concentrated while descending. Statement IV is true because electrolytes leave the ascending limb by active or passive transport. Thus statements I, II and IV are correct, so the answer is option (4). NCERT Class 11, Excretory Products and their Elimination (counter-current mechanism).

158. Which of the following is the correct order of arrangement of vertebrate column from the head to toe?

- (1) Cervical vertebra, thoracic vertebra, sacrum, lumbar vertebra
- (2) Sacrum, lumbar vertebra, thoracic vertebra, cervical vertebra
- (3) Cervical vertebra, lumbar vertebra, thoracic vertebra, sacrum
- (4) Cervical vertebra, thoracic vertebra, lumbar vertebra, sacrum

Answer (4)

Sol. Running head to toe, the vertebral column is cervical (neck, 7), thoracic (chest, 12), lumbar (lower back, 5), then sacrum (5 fused) and finally coccyx (4 fused). NCERT Class 11, Locomotion and Movement.

159. Which of the following is not evidence for evolution?

- (1) Convergent evolution of traits like wings of birds and butterflies
- (2) Paleontological evidence from fossil records
- (3) Embryological support for evolution as proposed by Ernst Haeckel
- (4) Divergent evolution of anatomical structures such as forelimbs

Answer (3)

Sol. Ernst Haeckel's recapitulation proposal claimed that embryonic development repeats ancestral adult stages, but Karl Ernst von Baer's observations disproved that claim; NCERT therefore treats this proposed support as invalid evidence. Fossils are palaeontological evidence, analogous wings illustrate convergent evolution, and homologous forelimbs illustrate divergent evolution. NTA's paper spelled the name Heckel; it is corrected to Haeckel. NCERT Class 12, Evolution (evidence for evolution).

160. Given below are two statements :

Statement I: Modern *Homo sapiens* arose in Australia and moved across continents.

Statement II: *Homo sapiens* arose around 75000 to 10000 years ago.

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

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

Answer (4)

Sol. Modern *Homo sapiens* arose in Africa and migrated across continents. In the NCERT timeline used by this question, their emergence is placed during the ice age, about 75,000 to 10,000 years ago. Statement I names the wrong continent; statement II follows that textbook timeline.

161. Consider a population of 10 million cells. Given the per-capita birth rate of 0.002 (per unit time) and the per-capita death rate of 0.002 (per unit time), the expected number of cells after 10 generations is _____.

- (1) 1 million
- (2) 5 million
- (3) 10 million
- (4) 100 million

Answer (3)

Sol. The intrinsic rate of natural increase is $r = b - d$. Here the birth and death rates are identical, so $r = 0.002 - 0.002 = 0$ and the exponential growth equation $N_t = N_0 e^{rt}$ reduces to $N_t = N_0$. The population is at ZERO population growth and stays at 10 million however many generations pass. NCERT Class 12, Organisms and Populations.

162. During PCR, primers bind to the DNA strands in the _____ step.

- (1) denaturation
- (2) extension
- (3) annealing
- (4) ligation

Answer (3)

Sol. Polymerase chain reaction (PCR) cycles through three steps. Denaturation at about 94 °C separates the two DNA strands. ANNEALING at a lower temperature, typically 50-60 °C, lets the two short oligonucleotide primers base-pair with their complementary sequences on the separated strands. Extension then follows, with Taq polymerase building new strands from those primers. NCERT Class 12, Biotechnology: Principles and Processes.

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

Assertion (A): The logistic growth model of populations is considered more realistic than the exponential growth model.

Reason (R): Resources are finite.

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

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

Answer (1)

Sol. Exponential growth assumes unlimited resources and predicts a J-shaped curve rising without bound, which no real population sustains. Because resources are in fact finite, every habitat has a carrying capacity K beyond which it cannot support more individuals, and growth slows as the population approaches it - producing the S-shaped (sigmoid) logistic curve. Finite resources are therefore exactly the reason the logistic model is the realistic one. NCERT Class 12, Organisms and Populations.

164. Adaptive radiation in placental mammals and Australian Marsupials leading to similarity between distant species is an example of _____.

- (1) divergent evolution (2) convergent evolution
- (3) founder effect (4) genetic drift

Answer (2)

Sol. Two adaptive radiations happened independently - one among placental mammals and one among Australian marsupials - yet each produced strikingly similar forms occupying equivalent niches, such as the placental wolf and the Tasmanian wolf, or the flying squirrel and the flying phalanger. When UNRELATED lineages come to resemble one another under similar selection pressures, that is convergent evolution. NCERT Class 12, Evolution.

165. Which of the following are secondary lymphoid organs?

Statement I: Bone marrow

Statement II: Tonsils

Statement III: Spleen

Statement IV: Thymus

Choose the correct answer from the options given below:

- (1) (I) and (II) only (2) (II) and (III) only
- (3) (II) and (IV) only (4) (I) and (IV) only

Answer (2)

Sol. Primary lymphoid organs are where lymphocytes are produced and mature - the bone marrow and the thymus. Secondary lymphoid organs are where mature lymphocytes go to meet antigen and mount a response: the spleen, lymph nodes, tonsils, Peyer's patches of the small intestine and the appendix. Tonsils and spleen therefore belong to the secondary group. NCERT Class 12, Human Health and Disease.

166. Which of the following hormone is not secreted by human placenta?

- (1) hCG (2) Estrogen
- (3) Progesterone (4) LH

Answer (4)

Sol. The placenta functions as a temporary endocrine gland, producing human chorionic gonadotropin (hCG), human placental lactogen, oestrogens, progesterone and later relaxin. Luteinising hormone is not among them - LH is a gonadotropin secreted by the ANTERIOR PITUITARY. The placental hormone that mimics its role early in pregnancy is hCG, which sustains the corpus luteum. NCERT Class 12, Human Reproduction.

167. Which of the following enzymes synthesizes precursor mRNA?

- (1) RNA polymerase I (2) RNA polymerase II
- (3) RNA polymerase III (4) DNA polymerase

Answer (2)

Sol. Eukaryotes use three nuclear RNA polymerases with a clean division of labour. RNA polymerase II transcribes the precursor of messenger RNA (mRNA), the heterogeneous nuclear RNA (hnRNA), which is then capped, tailed and spliced into mature mRNA. RNA polymerase I handles the ribosomal RNAs and RNA polymerase III the transfer RNAs (tRNAs), 5S rRNA and small nuclear RNAs. NCERT Class 12, Molecular Basis of Inheritance.

168. Given below are two statements :

Statement I: Plasmids are autonomously replicating DNA.

Statement II: Plasmids are extrachromosomal DNA.

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

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

Answer (1)

Sol. Both statements are true and together explain why plasmids make such useful cloning vectors. They are small circular DNA molecules that sit OUTSIDE the bacterial chromosome, and because each carries its own origin of replication (ori) it can replicate independently of the host chromosome. Any foreign DNA spliced into a plasmid is therefore multiplied along with it. NCERT Class 12, Biotechnology: Principles and Processes.

169. For a person with blood group 'O', which of the following is not a possible combination of parents' blood group genotypes?

- (1) Father : $I^A i$ and Mother : $I^B i$
- (2) Father : $I^A i$ and Mother : $I^A i$
- (3) Father : $I^B i$ and Mother : $I^B i$
- (4) Father : $I^A I^B$ and Mother : $I^A i$

Answer (4)

Sol. Blood group O is the homozygous recessive genotype ii , so EACH parent must be able to contribute an i allele. A father of genotype $I^A I^B$ carries no i allele at all and can only pass on I^A or I^B , so option (4) cannot produce an O child. Every other option pairs two heterozygous carriers, each of whom can donate i . NCERT Class 12, Principles of Inheritance and Variation (multiple allelism).

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

Assertion (A): Forelimbs of human and bats are homologous.

Reason (R): Forelimbs of humans and bats have similar anatomical structure.

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

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

Answer (1)

Sol. Homology is defined by shared underlying anatomy inherited from a common ancestor, whatever the organ is now used for. The forelimbs of humans, bats, cheetahs and whales all contain the same bones - humerus, radius, ulna, carpals, metacarpals and phalanges - arranged in the same pattern despite performing very different functions. That common structural plan is precisely what makes them homologous, so R explains A. NCERT Class 12, Evolution.

171. Colostrum, secreted by mother during initial days of lactation, is abundant in _____.

- (1) IgG
- (2) IgM
- (3) IgA
- (4) IgD

Answer (3)

Sol. Colostrum, the yellowish fluid produced in the first few days after birth, is rich in immunoglobulin A (IgA) antibodies. Because these are ready-made antibodies handed directly to the infant rather than produced by the infant itself, this is a form of NATURAL PASSIVE IMMUNITY, protecting the newborn until its own immune system matures. NCERT Class 12, Human Health and Disease.

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

Assertion (A): Abingdon tortoise in Galapagos islands became extinct within a decade after goats were introduced.

Reason (R): Goats were more efficient at browsing than Abingdon tortoise.

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

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

Answer (1)

Sol. This is NCERT's standard illustration of competitive exclusion in the wild. Once goats were introduced to Abingdon Island they stripped the vegetation far more efficiently than the tortoises could, and the resulting shortage of food drove the tortoise to extinction within about ten years. Superior resource exploitation by the goats is therefore the direct cause of the tortoise's disappearance, so R explains A. NCERT Class 12, Organisms and Populations (interspecific interactions).

173. The covering of ovum at ovulation is _____.

- (1) endometrium (2) zona radiata
- (3) zona pellucida (4) chorion

Answer (3)

Sol. The zona pellucida is the transparent glycoprotein layer laid down around the oocyte during its growth, and it is the covering carried by the ovum at ovulation. It plays an active role at fertilisation, binding sperm and then hardening to block polyspermy once one sperm has entered. NCERT Class 12, Human Reproduction.

174. Match List-I with List-II.

List I	List II
P) Both species are harmed	I) Predation
Q) One species is harmed and the other is benefited	II) Mutualism
R) Both species are benefited	III) Competition
S) One is benefited while the other has no effect	IV) Commensalism

Choose the correct answer from the options given below:

- (1) P-III, Q-IV, R-II, S-I (2) P-I, Q-II, R-III, S-IV
- (3) P-II, Q-I, R-IV, S-III (4) P-III, Q-I, R-II, S-IV

Answer (4)

Sol. Interspecific interactions are classified by the sign of the effect on each partner. Competition harms both (P-III, - -). Predation benefits one at the cost of the other (Q-I, + -). Mutualism benefits both (R-II, + +). Commensalism benefits one and leaves the other unaffected (S-IV, + 0). Writing the sign pairs out is the quickest way to sort these. NCERT Class 12, Organisms and Populations.

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

Assertion (A): In an experiment, Mendel observed that the F_1 progeny plants are all tall and none are dwarf.

Reason (R): Stem height is a contrasting trait, with tall being dominant and dwarf being recessive.

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

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

Answer (1)

Sol. Crossing true-breeding tall and dwarf pea plants gave an F_1 generation that was uniformly tall, with no intermediates and no dwarfs - one of Mendel's central observations. The reason states exactly why: the F_1 plants are heterozygous Tt , and because the tall allele is dominant it masks the recessive dwarf allele in the phenotype. The dwarf allele reappears in the F_2 generation, confirming it was never lost. NCERT Class 12, Principles of Inheritance and Variation.

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

Assertion (A): In recombinant DNA technology, lysozyme is used for disrupting bacterial cells while cellulase is for plant cells.

Reason (R): Isolation of genetic material needs disruption of cells.

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

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

Answer (1)

Sol. DNA is locked inside cells behind a wall and membrane, so the first step in any recombinant DNA procedure is to break the cell open. The enzyme chosen must match the wall chemistry: lysozyme digests the peptidoglycan of bacterial walls, cellulase digests the cellulose of plant walls, and chitinase is used for fungi. The need to disrupt cells is therefore exactly why these particular enzymes are chosen, so R explains A. NCERT Class 12, Biotechnology: Principles and Processes.

177. Which of the following is used as an effective sedative and painkiller for treating post-surgery patients?

- (1) Interferon
- (2) Antibiotics
- (3) Morphine
- (4) Anti-retroviral drugs

Answer (3)

Sol. Morphine is an opioid extracted from the latex of *Papaver somniferum*. It binds to receptors in the central nervous system and is a very effective sedative and painkiller, which is exactly why it is used for patients recovering from surgery - and also why it carries a high risk of abuse and dependence. NCERT Class 12, Human Health and Disease.

178. Which of the following statements are Correct ?

Statement I: Energy flow from producers to consumers is unidirectional

Statement II: Energy pyramid can never be inverted

Statement III: Transfer of energy follows the 1% law

Choose the correct answer from the options given below :

- (1) (I), (II) and (III)
- (2) (I) and (II) only
- (3) (I) and (III) only
- (4) (II) and (III) only

Answer (2)

Sol. Energy enters an ecosystem as sunlight and moves in one direction only, from producers to successive consumer levels, being lost as heat at each step - it is never recycled the way nutrients are, so (Statement I) is correct. Because of that unavoidable loss, each level holds less energy than the one below it, so the pyramid of energy is ALWAYS upright and can never be inverted, making (Statement II) correct. Statement III misquotes Lindeman's rule, which is the 10 PER CENT law, not 1 per cent. NCERT Class 12, Ecosystem.

179. Which of the following statements is correct about *Plasmodium*?

- (1) Reproduces sexually in liver cells
- (2) Reproduces sexually in RBCs
- (3) Gametocytes develop in mosquito gut
- (4) Fertilization takes place in mosquito gut

Answer (4)

Sol. The division of labour between the two hosts is the key to this life cycle. In the human, *Plasmodium* multiplies ASEXUALLY - first in liver cells, then in red blood cells, where gametocytes also form. Those gametocytes are taken up when a female *Anopheles* bites; only inside the mosquito's gut do the gametes fuse, so fertilisation and subsequent development happen there. The mosquito is therefore the definitive host. NCERT Class 12, Human Health and Disease.

180. Match List-I with List-II.

List I	List II
P) Transformation	I) Restriction enzyme
Q) Cloning site	II) Transfer DNA to host bacteria
R) Selection	III) Replication
S) Ori	IV) Antibiotic

Choose the correct answer from the options given below:

- (1) P-II, Q-I, R-IV, S-III
- (2) P-I, Q-II, R-IV, S-III
- (3) P-III, Q-IV, R-II, S-I
- (4) P-IV, Q-I, R-III, S-II

Answer (1)

Sol. Transformation is the process by which recombinant DNA is taken up by a host bacterium (P-II). The cloning site is the recognition sequence where a restriction enzyme cuts the vector so foreign DNA can be inserted (Q-I). Selection uses an antibiotic resistance marker to identify which cells took up the vector (R-IV). The ori is the origin of replication, the sequence that allows the vector to be copied inside the host (S-III). NCERT Class 12, Biotechnology: Principles and Processes.

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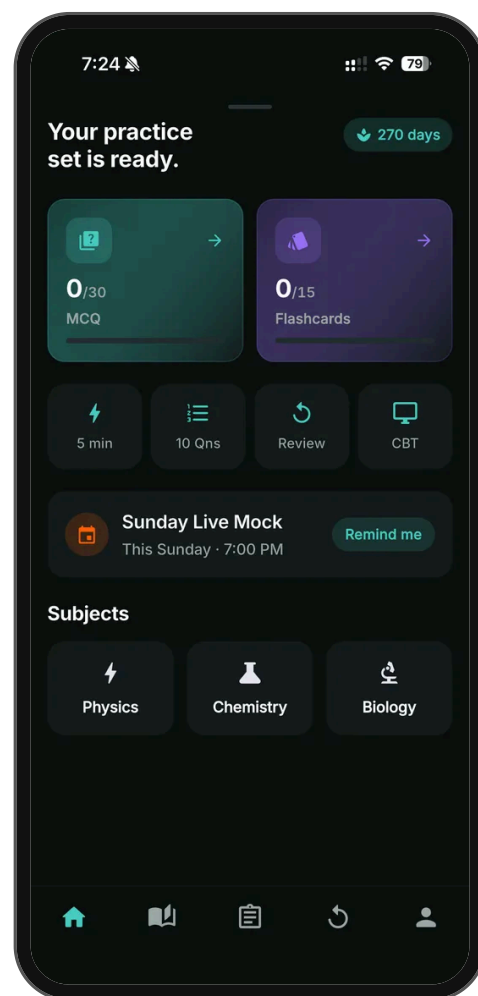
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