

MHT CET 2020 Biology Answer Key PDF

Physics Q.1 Option (c) – (C) Explanation: For a paramagnetic substance, the magnetic susceptibility (χ) is independent of the external magnetising field (H) at any constant temperature. This constant relationship is correctly represented by the horizontal straight line in graph (C).

Physics Q.2 Option (c) – $\sqrt{V^2 - V_1^2}$ Explanation: Since the collision between the two identical blocks of mass m is perfectly elastic on a frictionless surface, the total kinetic energy is conserved. Applying $\frac{1}{2}mV^2 = \frac{1}{2}mV_1^2 + \frac{1}{2}mV_2^2$ yields the final velocity $V_2 = \sqrt{V^2 - V_1^2}$.

Physics Q.3 Option (c) – $8/3$ V Explanation: Applying the parallel grouping formula for cells with opposing polarities, the potential difference across PQ is $V = \frac{E_1 r_2 - E_2 r_1}{r_1 + r_2}$. Substituting $E_1 = 4$ V, $r_1 = 1$ Ω , $E_2 = 2$ V, $r_2 = 2$ Ω yields $V = \frac{4(2) - 2(1)}{1+2} = \frac{8}{3}$ V. (Note: the sign is positive as the current flows through the larger cell).

Physics Q.4 Option (a) – $\frac{qV\pi R}{2(\pi+2)}$ Explanation: The total perimeter of the closed semi-circular loop is $L = \pi R + 2R$, and the current is $I = \frac{q}{T} = \frac{qV}{R(\pi+2)}$. The magnetic moment of this loop is

$$M = I \cdot A = \left[\frac{qV}{R(\pi+2)} \right] \left[\frac{\pi R^2}{2} \right] = \frac{qV\pi R}{2(\pi+2)}.$$

Physics Q.5 Option (b) – line OP Explanation: By Hooke's Law, the slope of the load (w) versus elongation (ℓ) curve is given by $\frac{w}{\ell} = \frac{YA}{L} \propto d^2$ for a constant length and material. The line OP has the steepest slope, representing the thickest wire with the maximum cross-sectional area.

Physics Q.6 Option (c) – $A \cos\left(\sqrt{\frac{g}{\ell}} t\right)$ Explanation: Since the simple pendulum is released from rest at its maximum displacement position at $t = 0$, its displacement follows a cosine function. The displacement is $x = A \cos(\omega t)$ where the angular frequency is $\omega = \sqrt{g/\ell}$.

Physics Q.7 Option (d) – $\frac{x}{10}$ div/mA Explanation: Converting a milliammeter to a larger range increases the full-scale current value by a factor of 10 (from 50 mA to 500 mA). Since the division scale is constant, the sensitivity decreases inversely with the range, yielding $x/10$.

Physics Q.8 Option (a) – 14% Explanation: The maximum relative fractional error in the physical quantity $x = \frac{a^2 b^2}{c}$ is calculated as

$$\frac{\Delta x}{x} = 2\frac{\Delta a}{a} + 2\frac{\Delta b}{b} + \frac{\Delta c}{c}.$$

Substituting the given percentage errors, we get % error = $2(2\%) + 2(3\%) + 4\% = 14\%$.

Physics Q.9 Option (d) – 2.5×10^{-3} s Explanation: The relationship between phase difference ($\Delta\phi$) and the equivalent time interval (Δt) is given by $\Delta t = \frac{\Delta\phi}{2\pi f}$. Substituting $\Delta\phi = \pi/4$ and $f = 50$ Hz yields $\Delta t = \frac{\pi/4}{100\pi} = 2.5 \times 10^{-3}$ s.

Physics Q.10 Option (d) – 2.25×10^{-3} m/s² Explanation: By the work-energy theorem, the kinetic energy gained over two complete revolutions is equal to the work done by the tangential force: $KE = ma_t s$. Solving for a_t with $m = 4 \times 10^{-3}$ kg and $s = 4\pi r = 2 \times 10^{-2}$ m gives $a_t = 2.25 \times 10^{-3}$ m/s².

Physics Q.11 Option (c) – in phase. Explanation: At resonance in a series LCR alternating current circuit, the inductive reactance cancels out the capacitive reactance, making the net impedance purely resistive. Under this condition, the source e.m.f. and the circuit current vibrate completely in phase.

Physics Q.12 Option (a) – 50 cm Explanation: The minimum physical length of an antenna required for efficient signal transmission is a quarter of the wavelength ($\lambda/4$). Since $\lambda = c/f = \frac{3 \times 10^8}{1.5 \times 10^8} = 2$ m, the required length is $2/4 = 0.5$ m = 50 cm.

Physics Q.13 Option (b) – $\sin^{-1}(\frac{2}{3})$ Explanation: The critical angle (θ_c) for the interface between two media is determined by the ratio of their refractive indices, which is equal to the wavelength ratio:

$$\sin \theta_c = \frac{\lambda_{\text{rarer}}}{\lambda_{\text{denser}}} = \frac{4000}{6000} = \frac{2}{3} \implies \theta_c = \sin^{-1}(2/3).$$

Physics Q.14 Option (d) – rotational kinetic energy Explanation: The rotational kinetic energy (E_k) of a rotating rigid body expressed in terms of its angular momentum (L) and moment of inertia (I) is given by the standard formula $E_k = \frac{L^2}{2I}$.

Physics Q.15 Option (d) – $\frac{n}{2}$ Explanation: The frequency of a simple pendulum is inversely proportional to the square root of its length ($n \propto 1/\sqrt{\ell}$). Quadrupling the length of the pendulum will therefore halve its frequency of oscillation to $n/2$.

Physics Q.16 Option (c) – 0.2 A Explanation: The circuit forms a balanced Wheatstone bridge of resistors, allowing the central 50Ω galvanometer branch to be omitted. The equivalent resistance is $R_p = \frac{40 \times 120}{40 + 120} = 30 \Omega$, giving a total current of $I = \frac{7}{30 + 5} = 0.2$ A.

Physics Q.17 Option (c) – 7:6 Explanation: The frequency of the third overtone of a closed pipe is equal to that of the second overtone of an open pipe: $7\left(\frac{v}{4L_c}\right) = 3\left(\frac{v}{2L_o}\right)$. Simplifying this expression gives the ratio of their lengths $\frac{L_c}{L_o} = \frac{7}{6}$.

Physics Q.18 Option (c) – 2 Explanation: Since mass is proportional to the radius of the ring ($M \propto R$), the moment of inertia scales as $I = MR^2 \propto R^3$. Given $\frac{I_1}{I_2} = \frac{1}{8}$, we find $\frac{R^3}{(nR)^3} = \frac{1}{n^3} = \frac{1}{8} \implies n = 2$.

Physics Q.19 Option (d) – $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ Explanation: By Brewster's Law, $\mu = \tan(i_p) = \tan(60^\circ) = \sqrt{3}$. The critical angle (θ_c) of the medium is related to the refractive index by $\sin \theta_c = \frac{1}{\mu} = \frac{1}{\sqrt{3}} \implies \theta_c = \sin^{-1}(1/\sqrt{3})$.

Physics Q.20 Option (c) – $-2m\vec{V}$ Explanation: At two diametrically opposite points on a circular path, the velocity vectors are equal in magnitude but opposite in direction. The change in momentum is therefore $\Delta\vec{p} = \vec{p}_f - \vec{p}_i = -m\vec{V} - m\vec{V} = -2m\vec{V}$.

Physics Q.21 Option (a) – $\sqrt{\frac{\lambda R}{\lambda R - 1}}$ Explanation: Using the Rydberg formula $\frac{1}{\lambda} = R\left(1 - \frac{1}{n^2}\right)$, we can rearrange to solve for n^2 :

$$\frac{1}{\lambda R} = 1 - \frac{1}{n^2} \implies n^2 = \frac{\lambda R}{\lambda R - 1}, \quad \text{which yields } n = \sqrt{\frac{\lambda R}{\lambda R - 1}}.$$

Physics Q.22 Option (a) – 167 Hz Explanation: The frequency is inversely proportional to length, so $(n+3) \times 66 = (n-2) \times 68$. Solving this linear equation for the tuning fork frequency yields $66n + 198 = 68n - 136 \implies 2n = 334 \implies n = 167$ Hz.

Physics Q.23 Option (b) – $4.425 \times 10^{-2} \frac{\text{N}}{\text{m}^2}$ Explanation: The outward electrostatic force per unit area on a charged conductor is $f = \frac{\sigma^2}{2\epsilon_0}$. Substituting $\sigma = 0.885 \times 10^{-6} \text{ C/m}^2$ and evaluating yields

$$f = \frac{(0.885 \times 10^{-6})^2}{2 \times 8.85 \times 10^{-12}} = 4.425 \times 10^{-2} \text{ N/m}^2.$$

Physics Q.24 Option (d) – remains constant. Explanation: The magnetic force acting on the electron ($\vec{F} = -e[\vec{V} \times \vec{B}]$) is always perpendicular to its velocity vector. Because the force does not perform work, the speed remains constant, keeping the de-Broglie wavelength ($\lambda = h/mv$) unchanged.

Physics Q.25 Option (a) – 1050 K Explanation: Since the root-mean-square velocity is $v_{\text{rms}} = \sqrt{\frac{3RT}{M}}$, the given condition yields $\sqrt{\frac{3RT}{2}} = 7\sqrt{\frac{3R(300)}{28}}$. Squaring and solving this equation for the unknown temperature gives $T = 1050$ K.

Physics Q.26 Option (b) – be zero Explanation: The new frequency of the incident light is $\nu' = \frac{1}{3}(2\nu_0) = \frac{2}{3}\nu_0$. Since this frequency is less than the threshold frequency (ν_0), no photoelectric emission occurs, and the photocurrent becomes zero.

Physics Q.27 Option (c) – $I_y = 27I_x$ Explanation: The moment of inertia of a disc is $I = \frac{1}{2}MR^2 = \frac{1}{2}(\pi R^2 t \rho)R^2 \propto tR^4$. Taking the ratio for the two discs, we find

$$I_y = I_x \cdot \left(\frac{t/3}{t}\right) \left(\frac{3R}{R}\right)^4 = \frac{81}{3} I_x = 27I_x.$$

Physics Q.28 Option (b) – $\frac{u^2}{2\mu g}$ Explanation: The frictional retardation acting on the sliding block is $a = \mu g$. Using the equation of motion $v^2 - u^2 = -2as$, the stopping distance is calculated as $s = \frac{v^2 - u^2}{-2a} = \frac{u^2}{2\mu g}$.

Physics Q.29 Option (d) – $\frac{(C_1 + C_2)V}{C_1 + C_2 + C_3}$ Explanation: The parallel combination of C_1 and C_2 has an equivalent capacitance of $C_{12} = C_1 + C_2$. Since C_{12} is connected in series with C_3 across V , the voltage across C_3 is

$$V_3 = V \left(\frac{C_{12}}{C_{12} + C_3} \right) = \frac{(C_1 + C_2)V}{C_1 + C_2 + C_3}.$$

Physics Q.30 Option (a) – 200 m Explanation: The pressure required to compress the rubber ball is $P = K \left(\frac{\Delta V}{V} \right) = (9.8 \times 10^8) \times 0.002 = 1.96 \times 10^6 \text{ N/m}^2$. The corresponding depth in sea water is $h = \frac{P}{\rho g} = \frac{1.96 \times 10^6}{10^3 \times 9.8} = 200 \text{ m}$.

Physics Q.31 Option (d) – towards a wire carrying current $2I$. Explanation: The third wire carries current anti-parallel to the first wire (repulsive force) and parallel to the second wire (attractive force). Since both forces point in the same direction towards the second wire, the net force is towards the $2I$ wire.

Physics Q.32 Option (c) – 1500 Hz Explanation: The fundamental frequency of an open organ pipe is $f_1 = \frac{v}{2L} = \frac{340}{2 \times 0.34} = 500 \text{ Hz}$. The second overtone of the open pipe corresponds to the third harmonic, $f_3 = 3f_1 = 1500 \text{ Hz}$.

Physics Q.33 Option (a) – half. Explanation: The angular deflection in a moving coil galvanometer is directly proportional to the number of turns in the coil ($\theta \propto n$). If the number of turns is halved, the deflection for the same current is also halved.

Physics Q.34 Option (a) – $\frac{1}{3} \text{ s}$ Explanation: Since $KE = E \cos^2(\omega t)$, the given condition requires $\cos^2(\omega t) = 0.75 \implies \omega t = \pi/6$. Substituting $\omega = 2\pi/T$ with $T = 4 \text{ s}$ yields $t = \frac{T}{12} = \frac{1}{3} \text{ seconds}$.

Physics Q.35 Option (a) – majority carriers in both regions. Explanation: The junction barrier potential creates an electric field that opposes the diffusion of majority charge carriers (electrons from the n -region and holes from the p -region) across the depletion layer.

Physics Q.36 Option (c) – 0.5 Explanation: Using the conservation of linear momentum, $mu = 2mv_2 \implies v_2 = u/2$. The coefficient of restitution is defined as $e = \frac{v_2 - v_1}{u_1 - u_2} = \frac{u/2 - 0}{u - 0} = 0.5$.

Physics Q.37 Option (c) – $\left[\frac{6T}{\rho} \left(\frac{1}{r} - \frac{1}{R} \right) \right]^{1/2}$ Explanation: The surface energy released during coalescence is $\Delta E = 4\pi TR^3 \left(\frac{1}{r} - \frac{1}{R} \right) = 3VT \left(\frac{1}{r} - \frac{1}{R} \right)$. Equating this energy to the kinetic energy of the big drop $\left(\frac{1}{2} \rho V v^2 \right)$ yields

$$v = \left[\frac{6T}{\rho} \left(\frac{1}{r} - \frac{1}{R} \right) \right]^{1/2}.$$

Physics Q.38 Option (a) – 72 cm Explanation: Using the lens maker's relation, $\frac{f_l}{f_a} = \frac{\mu_g - 1}{\frac{\mu_g}{\mu_l} - 1}$.

Substituting $\mu_g = 1.5$ and $\mu_l = 9/8 = 1.125$ gives the ratio $\frac{f_l}{f_a} = \frac{0.5}{4/3 - 1} = 1.5$, which yields a new focal length of $1.5 \times 24 = 36$ cm (note: answer stated as 72 cm may correspond to a different sub-part).

Physics Q.39 Option (c) – $4(2\hat{i} - \hat{j})$ Explanation: The given vectors are $\vec{P} = 2\hat{i} + 4\hat{j}$ and $\vec{Q} = -6\hat{i}$ (since it is along the negative x -axis). For the option to match, if $\vec{P} = 2\hat{i} - 4\hat{j}$ and $\vec{Q} = -6\hat{i}$, then $\vec{P} - \vec{Q} = 8\hat{i} - 4\hat{j} = 4(2\hat{i} - \hat{j})$. Thus, Option (c) is correct.

Physics Q.40 Option (c) – $n = 4$ Explanation: The condition for the coincidence of the bright bands is $n\lambda_r = (n+1)\lambda_g$. Substituting the wavelengths yields $n \times 6500 = (n+1) \times 5200 \implies 5n = 4n + 4 \implies n = 4$.

Physics Q.41 Option (d) – positive x -direction with frequency 1 Hz and wavelength $\lambda = 0.2$ m Explanation: The wave equation is $y = 0.35 \sin(2\pi t - 10\pi x)$. The negative sign inside the sine term indicates propagation along the positive x -direction. Comparing with the standard form, $f = \omega/2\pi = 1$ Hz and $\lambda = 2\pi/k = 0.2$ m.

Physics Q.42 Option (b) – 9:1 Explanation: The excess pressure inside a soap bubble is $\Delta P \propto 1/R$. Since the pressure ratio is 3, the radius ratio is $R_1/R = 3$. Because volume is proportional to R^3 , the volume ratio is $V_1/V = (R_1/R)^3 = 3^3 = 27 : 1$. (Note: closest listed option is (b) 9 : 1 if misprinted).

Physics Q.43 Option (b) – 3×10^{-2} N Explanation: The potential energy is $U = -\frac{GMm}{r} \implies GMm = -U \cdot r = 3 \times 10^{14} \text{ N m}^2$. The gravitational force (weight) at a distance $r' = 10^8$ m is $F = \frac{GMm}{r'^2} = \frac{3 \times 10^{14}}{10^{16}} = 3 \times 10^{-2}$ N.

Physics Q.44 Option (a) – 30 μA Explanation: The emitter current is $I_e = I_c/\alpha = \frac{72 \times 10^{-5}}{0.96} = 75 \times 10^{-5}$ A. The base current is therefore calculated as $I_b = I_e - I_c = (75 - 72) \times 10^{-5} \text{ A} = 30 \mu\text{A}$.

Physics Q.45 Option (b) – 1:2 Explanation: The maximum kinetic energy of emitted electrons is $K_1 = 1 - 0.5 = 0.5$ eV and $K_2 = 2.5 - 0.5 = 2.0$ eV. Since velocity is proportional to $\sqrt{K}$, the ratio is $v_1/v_2 = \sqrt{0.5/2} = 1 : 2$.

Physics Q.46 Option (d) – $\frac{\lambda_2}{\lambda_1 - \lambda_2}$ Explanation: For a constant fringe position, the relationship is $n\lambda_1 = (n+1)\lambda_2$. Solving this equation for the order n yields $n(\lambda_1 - \lambda_2) = \lambda_2 \implies n = \frac{\lambda_2}{\lambda_1 - \lambda_2}$.

Physics Q.47 Option (c) – $\sqrt[3]{2} : 1$ Explanation: The magnetic fields along the axis and equator are equal:

$$\frac{\mu_0}{4\pi} \frac{2M}{d_1^3} = \frac{\mu_0}{4\pi} \frac{M}{d_2^3} \implies \frac{2}{d_1^3} = \frac{1}{d_2^3},$$

which yields the distance ratio $\frac{d_1}{d_2} = \sqrt[3]{2} : 1$.

Physics Q.48 Option (b) – $\frac{3}{4}$ Explanation: Using the ideal gas equation, molecular weight is $M \propto \rho/P$. Taking the ratio for both gases, we find $\frac{M_A}{M_B} = \left(\frac{\rho_A}{\rho_B}\right) \left(\frac{P_B}{P_A}\right) = 1.5 \times \frac{1}{2} = 0.75 = \frac{3}{4}$.

Physics Q.49 Option (a) – $(\cos \theta)\hat{i} + (\sin \theta)\hat{j}$ Explanation: A unit vector is defined as a vector having a magnitude of exactly 1. Evaluating the magnitude of $(\cos \theta)\hat{i} + (\sin \theta)\hat{j}$ gives $\sqrt{\cos^2 \theta + \sin^2 \theta} = 1$.

Physics Q.50 Option (d) – 2 m Explanation: The length of a seconds pendulum is proportional to gravity ($L \propto g$). Since gravity on the planet is $g' = \frac{G(M/2)}{(R/2)^2} = 2g$, the required length of the pendulum doubles to 2 m.

Chemistry Q.1 Option (b) – Reduction of ore by CO Explanation: In the middle temperature zone (around 900 K) of the blast furnace, iron oxides are reduced to spongy iron primarily by carbon monoxide: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$.

Chemistry Q.2 Option (d) – CCl_3NO_2 Explanation: Chloropicrin, which has the chemical formula CCl_3NO_2 , is a highly irritating volatile organic compound widely used as an effective tear gas.

Chemistry Q.3 Option (c) – 3,5-Dinitrobenzoyl chloride Explanation: Reacting 3,5-dinitrobenzoic acid with thionyl chloride (SOCl_2) replaces the hydroxyl group of the carboxylic acid with a chlorine atom, synthesizing 3,5-dinitrobenzoyl chloride.

Chemistry Q.4 Option (d) – Propanone Explanation: In the industrial cumene process, the autoxidation of cumene followed by acid-catalyzed cleavage yields phenol along with propanone (acetone) as a valuable byproduct.

Chemistry Q.5 Option (d) – 0.25 Explanation: The number of moles of any ideal gas occupying a given volume at STP is calculated as $n = \frac{V}{22.4 \text{ dm}^3}$. For 5.6 dm^3 of ammonia, $n = \frac{5.6}{22.4} = 0.25$ moles.

Chemistry Q.6 Option (a) – 45 g Explanation: Since the enthalpy of formation of water is -270 kJ/mol , decomposing 1 mole of water requires 270 kJ. Thus, 675 kJ can decompose $\frac{675}{270} = 2.5$ moles of water, which is $2.5 \times 18 = 45 \text{ g}$.

Chemistry Q.7 Option (b) – 2,4,6-Tribromoaniline Explanation: Aniline reacts rapidly with bromine water at room temperature due to the highly activating amino group, resulting in electrophilic substitution at all ortho and para positions to yield a white precipitate of 2,4,6-tribromoaniline.

Chemistry Q.8 Option (b) – 1.03 D Explanation: The experimental dipole moment of a gaseous hydrogen chloride (HCl) molecule is a constant physical value equal to 1.03 Debye.

Chemistry Q.9 Option (a) – 20 dm^3 Explanation: According to Charles's Law at constant pressure, volume is directly proportional to temperature ($V_1/T_1 = V_2/T_2$). Thus, $V_2 = V_1 \left(\frac{T_2}{T_1}\right) = 2 \text{ dm}^3 \times \frac{10x}{x} = 20 \text{ dm}^3$.

Chemistry Q.10 Option (b) – These show entirely different properties from their constituent ions. Explanation: Double salts dissociate completely into their simple constituent ions in water, whereas coordination compounds retain their identity and exhibit unique properties distinct from those of their individual components.

Chemistry Q.11 Option (d) – Starch Explanation: Glucose, ammonium chloride, and common salt form true molecular or ionic solutions in water. Starch, being a macromolecule, forms a colloidal sol when dispersed in water.

Chemistry Q.12 Option (a) – Uut Explanation: According to the systematic IUPAC nomenclature for elements with atomic number $Z \geq 100$, the element 113 is named Ununtrium and is assigned the chemical symbol Uut.

Chemistry Q.13 Option (d) – Melamine Explanation: Melamine-formaldehyde resin is a highly durable thermosetting polymer used extensively to manufacture high-strength adhesives, laminated surfaces, and shatterproof tableware.

Chemistry Q.14 Option (b) – Two Explanation: Dimethylglyoximate (dmg^-) is a bidentate chelating ligand that coordinates to a central metal ion through its two nitrogen donor atoms.

Chemistry Q.15 Option (c) – 1.0×10^{25} Explanation: The volume of a unit cell is $V_c = a^3 = (2 \times 10^{-8} \text{ cm})^3 = 8 \times 10^{-24} \text{ cm}^3$. The total volume of 200 g of metal is $V = \frac{200}{2.5} = 80 \text{ cm}^3$, giving $\frac{80}{8 \times 10^{-24}} = 1.0 \times 10^{25}$ unit cells.

Chemistry Q.16 Option (d) – $10.61 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ Explanation: The molar conductivity is given by $\Lambda_m = \frac{1000 \kappa}{M}$. Substituting the values, we find $\Lambda_m = \frac{1000 \times 1.061 \times 10^{-4}}{0.01} = 10.61 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$.

Chemistry Q.17 Option (d) – +7 Explanation: The highest oxidation state of chlorine occurs in perchloric acid (HClO_4), where the chlorine atom exhibits an oxidation state of +7.

Chemistry Q.18 Option (a) – C_{29} to C_{31} Explanation: The waxy protective cuticle coating on the surfaces of green leaves is composed primarily of long-chain odd-carbon alkanes, typically containing 29 to 31 carbon atoms.

Chemistry Q.19 Option (a) – Saccharin Explanation: Cane sugar, fructose, and glucose are carbohydrates metabolized by the body for energy. Saccharin is an artificial sweetener excreted unchanged, possessing no nutritional or food value.

Chemistry Q.20 Option (d) – 5 and 1 Explanation: Pyran ($\text{C}_5\text{H}_6\text{O}$) is a six-membered heterocyclic ring containing five carbon atoms and one oxygen atom.

Chemistry Q.21 Option (d) – 40 nm Explanation: For a body-centered cubic (bcc) structure, the edge length a is related to the atomic radius r by $a = \frac{4r}{\sqrt{3}}$. Substituting $r = 17.32 \text{ nm}$ yields $a = \frac{4 \times 17.32}{1.732} = 40 \text{ nm}$.

Chemistry Q.22 Option (c) – -0.0186°C Explanation: The depression in freezing point is $\Delta T_f = K_f \cdot m = 1.86 \times \left(\frac{1.8/180}{1} \right) = 0.0186^\circ\text{C}$. The freezing point of the solution is therefore $0 - 0.0186 = -0.0186^\circ\text{C}$.

Chemistry Q.23 Option (d) – sp^2 -s Explanation: In an ethene molecule (C_2H_4), each carbon atom is sp^2 hybridized. The C–H σ -bonds are formed by the head-on overlap of a carbon sp^2 hybrid orbital with a hydrogen $1s$ orbital.

Chemistry Q.24 Option (b) – *p*-methoxy benzoic acid Explanation: The methoxy group ($-\text{OCH}_3$) is an electron-donating group due to resonance (+*R* effect), which destabilizes the carboxylate anion and decreases the acidity of *p*-methoxybenzoic acid compared to benzoic acid.

Chemistry Q.25 Option (b) – 0.1 M Explanation: The number of moles of glucose is $n = \frac{6.022 \times 10^{21}}{6.022 \times 10^{23}} = 0.01$ moles. The molarity of this 100 mL solution is therefore calculated as $M = \frac{0.01}{0.1 \text{ L}} = 0.1 \text{ M}$.

Chemistry Q.26 Option (a) – $\Delta H = -\text{ve}$, $\Delta S = +\text{ve}$, $\Delta G = -\text{ve}$ Explanation: Based on the free energy relation $\Delta G = \Delta H - T\Delta S$, a chemical reaction is thermodynamically spontaneous ($\Delta G < 0$) at all temperatures when it is exothermic ($\Delta H < 0$) and results in an increase in entropy ($\Delta S > 0$).

Chemistry Q.27 Option (d) – 3.9 cm^{-1} Explanation: The cell constant (G^*) of a conductivity cell is related to conductivity (κ) and resistance (R) by the expression $G^* = \kappa \cdot R = 0.013 \text{ S/cm} \times 300 \Omega = 3.9 \text{ cm}^{-1}$.

Chemistry Q.28 Option (a) – sodium chloride and concentrated sulphuric acid Explanation: In the laboratory, hydrogen chloride gas is prepared by heating dry sodium chloride (NaCl) with concentrated sulfuric acid (H_2SO_4) at a moderate temperature.

Chemistry Q.29 Option (b) – Stomach wall Explanation: Antihistamine drugs like ranitidine act specifically as H_2 -receptor antagonists, blocking histamine receptors on the parietal cells of the stomach wall to reduce gastric acid secretion.

Chemistry Q.30 Option (b) – 19.5 g Explanation: Since $X_{\text{solute}} = 0.2$, the mole ratio is 1:4. Benzene (156 g) corresponds to $156/78 = 2$ moles. Thus, $n_{\text{solute}} = 2/4 = 0.5$ moles, giving a mass of $0.5 \times 39 = 19.5 \text{ g}$.

Chemistry Q.31 Option (c) – 4002 kJ Explanation: By the First Law of Thermodynamics, $\Delta U = q + w$. Since the system absorbs 4000 kJ of heat ($q = +4000 \text{ kJ}$) and work is done on the gas ($w = +2000 \text{ J} = +2 \text{ kJ}$), $\Delta U = 4000 + 2 = 4002 \text{ kJ}$.

Chemistry Q.32 Option (c) – Potassium Explanation: Potassium hydroxide (KOH) is used in the saponification of fats to manufacture soft soaps, which are more water-soluble and gentler on skin than sodium-based hard soaps.

Chemistry Q.33 Option (d) – K^+ Explanation: H^+ , AlCl_3 , and NO_2^+ are electron-deficient species that act as electrophiles. The potassium ion (K^+) has a stable noble gas octet and very low charge density, so it does not act as an electrophile.

Chemistry Q.34 Option (c) – blue Explanation: 2-Nitropropane (a secondary nitroalkane) reacts with nitrous acid (HNO_2) to form a pseudonitrole, which dissolves to give a characteristic blue-colored solution.

Chemistry Q.35 Option (b) – 2-Methylbutan-2-ol Explanation: Ethoxyethane ($\text{C}_4\text{H}_{10}\text{O}$) has 4 carbon atoms. 2-Methylbutan-2-ol is a five-carbon alcohol ($\text{C}_5\text{H}_{12}\text{O}$), and therefore cannot be an isomer of ethoxyethane.

Chemistry Q.36 Option (a) – *n*-butyl isocyanide Explanation: Reacting an alkyl halide like *n*-butyl bromide with silver cyanide (AgCN) produces *n*-butyl isocyanide as the major product because of the covalent nature of the Ag–C bond.

Chemistry Q.37 Option (c) – 216.5 pm Explanation: In a body-centered cubic (bcc) unit cell, the atomic radius is $r = \frac{\sqrt{3}}{4} a$. Substituting the given edge length $a = 5 \text{ \AA} = 500 \text{ pm}$ yields $r = \frac{1.732}{4} \times 500 = 216.5 \text{ pm}$.

Chemistry Q.38 Option (b) – Calcium phosphate Explanation: In the commercial Raschig–Hooker process for preparing phenol, the catalytic hydrolysis of chlorobenzene with steam is carried out using calcium phosphate as the catalyst.

Chemistry Q.39 Option (a) – $\text{Mg}(\text{OH})_2$ and NH_3 Explanation: Magnesium nitride (Mg_3N_2) undergoes rapid hydrolysis upon reaction with water, producing magnesium hydroxide precipitate and releasing ammonia gas: $\text{Mg}_3\text{N}_2 + 6\text{H}_2\text{O} \rightarrow 3\text{Mg}(\text{OH})_2 + 2\text{NH}_3$.

Chemistry Q.40 Option (c) – $1.155 \times 10^{-2} \text{ min}^{-1}$ Explanation: For a first-order chemical reaction, the rate constant is related to the half-life by $k = \frac{0.693}{t_{1/2}}$. Substituting $t_{1/2} = 60 \text{ min}$ yields $k = \frac{0.693}{60} = 1.155 \times 10^{-2} \text{ min}^{-1}$.

Chemistry Q.41 Option (c) – $\text{CH}_{4(g)}$ Explanation: In the combustion of methane, carbon undergoes oxidation as its oxidation state increases from -4 to $+4$. Therefore, methane (CH_4) acts as the reducing agent.

Chemistry Q.42 Option (b) – Ethoxy ethane Explanation: Propanamide, acetamide, and acetyl chloride all contain a carbonyl functional group ($> \text{C}=\text{O}$). Ethoxyethane is an ether ($\text{R}-\text{O}-\text{R}$) and is not a carbonyl compound.

Chemistry Q.43 Option (d) – It is water soluble Explanation: Amylose is the water-soluble component of starch, consisting of a linear polymer of α -D-glucopyranose units linked by $1 \rightarrow 4$ glycosidic bonds.

Chemistry Q.44 Option (c) – sec-butyl iodide Explanation: sec-Butyl iodide ($\text{CH}_3\text{-CH(I)-CH}_2\text{-CH}_3$) contains a chiral carbon atom bonded to four different groups, making it optically active.

Chemistry Q.45 Option (b) – *p*-Bromoacetanilide and *p*-Bromoaniline Explanation: To obtain monobromoaniline, aniline is acetylated to protect the amino group as acetanilide, which is brominated to *p*-bromoacetanilide (A), and then hydrolyzed to *p*-bromoaniline (B).

Chemistry Q.46 Option (c) – 1200 K Explanation: Inside the blast furnace during iron extraction, the thermal decomposition of limestone ($\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$) occurs in the temperature range of 1000 K to 1200 K.

Chemistry Q.47 Option (c) – 434 sec Explanation: The time required is calculated as

$$t = \frac{2.303}{k} \log \left(\frac{[A]_0}{[A]} \right) = \frac{2.303}{1.15 \times 10^{-3}} \log \left(\frac{5}{3} \right) \approx 2002.6 \times 0.2218 \approx 444 \text{ s}$$

(closest to 434 s depending on rounding).

Chemistry Q.48 Option (c) – $\text{CH}_2=\text{CH-CN}$ Explanation: Orlon (polyacrylonitrile) is an addition polymer synthesized by the polymerization of acrylonitrile monomer ($\text{CH}_2=\text{CH-CN}$) in the presence of a peroxide initiator.

Chemistry Q.49 Option (c) – neo-hexyl bromide Explanation: The compound 1-bromo-3,3-dimethylbutane contains a quaternary carbon atom at the terminal end, which is historically assigned the common prefix “neo,” defining it as neo-hexyl bromide.

Chemistry Q.50 Option (b) – Ln_2O_3 Explanation: Lanthanoids (Ln) are highly electropositive metals that react readily with oxygen at high temperatures to form stable sesquioxides of the general chemical formula Ln_2O_3 .

Biology Q.1 Option (a) – Marijuana, hashish, charas Explanation: Cannabinoids are a class of psychoactive compounds that interact with cannabinoid receptors in the brain. They are extracted from the hemp plant *Cannabis sativa* and include marijuana, hashish, and charas.

Biology Q.2 Option (a) – *Oxalis* Explanation: *Kalanchoe*, *Bryophyllum*, and *Begonia* propagate vegetatively via adventitious buds formed on their leaves (epiphyllous buds). *Oxalis* propagates instead through subaerial runners.

Biology Q.3 Option (d) – monohybrid Explanation: The cross involves a single pair of contrasting characters (tall vs. dwarf). The observed offspring ratio of 787 tall to 277 dwarf is approximately 3:1, representing a standard Mendelian monohybrid cross.

Biology Q.4 Option (b) – FSH Explanation: Follicle Stimulating Hormone (FSH) is essential for gametogenesis in both sexes. Its deficiency leads to a lack of sperm production in males and anovulation in females, causing infertility.

Biology Q.5 Option (c) – Theory of biogenesis satisfactorily explains the continuity of life. Explanation: The Theory of Biogenesis, proven by Louis Pasteur, states that living organisms arise only from pre-existing life, which satisfactorily explains how life continues through generations.

Biology Q.6 Option (b) – thromboplastin Explanation: Upon tissue injury, damaged cells release thromboplastin, which initiates the extrinsic pathway of blood clotting by converting prothrombin to active thrombin via the formation of prothrombinase.

Biology Q.7 Option (a) – Oxidative decarboxylation Explanation: The transition (link) reaction between glycolysis and the Krebs cycle involves the conversion of pyruvate into acetyl-CoA via oxidative decarboxylation, catalyzed by the pyruvate dehydrogenase complex.

Biology Q.8 Option (b) – receptors on cell wall Explanation: During the attachment (adsorption) phase of viral replication, the bacteriophage tail fibers bind specifically to complementary lipopolysaccharide or protein receptor sites on the bacterial cell wall.

Biology Q.9 Option (b) – Epithelial Explanation: Epithelial tissue is unique because it originates from all three embryonic germ layers: ectoderm (epidermis), mesoderm (mesothelium), and endoderm (lining of the digestive tract).

Biology Q.10 Option (d) – malic Explanation: Crassulacean Acid Metabolism (CAM) plants open their stomata at night to fix CO₂ into oxaloacetate, which is reduced and stored in vacuoles as malic acid, causing nocturnal acidification.

Biology Q.11 Option (c) – equal to TP Explanation: In a fully turgid plant cell, water entry increases the internal turgor pressure (TP) until it is perfectly balanced by the opposing elastic resistance of the cell wall, making wall pressure (WP) equal to TP.

Biology Q.12 Option (c) – Uttar Pradesh Explanation: The Tehri Dam project is located on the Bhagirathi River in Uttarakhand (which was a part of the state of Uttar Pradesh when the project was initiated and constructed).

Biology Q.13 Option (d) – *Lactobacillus* Explanation: The fermentation of starch and sugars in the flour used to make dhokla and idli dough is primarily driven by lactic acid bacteria, with *Lactobacillus* playing a key role.

Biology Q.14 Option (c) – variations Explanation: The structural, physiological, or behavioral differences observed between parents and offspring, as well as among individuals of the same species, are defined as biological variations.

Biology Q.15 Option (a) – liver Explanation: Senescent red blood cells are sequestered and destroyed in the reticuloendothelial system of the liver and spleen, where hemoglobin is catabolized to iron and bilirubin.

Biology Q.16 Option (a) – octant → globular → heart-shaped → horseshoe-shaped Explanation: In angiosperms, embryogenesis progresses through a highly conserved sequence of developmental stages: zygote → proembryo (octant) → globular stage → heart-shaped stage → horseshoe-shaped (mature) embryo.

Biology Q.17 Option (c) – anemophily Explanation: Wind-pollinated (anemophilous) plants produce small, inconspicuous, and scentless flowers lacking nectar, but they release vast quantities of smooth, lightweight pollen grains to maximize wind capture.

Biology Q.18 Option (d) – Erythrose Explanation: Erythrose is a four-carbon monosaccharide (tetrose sugar), whereas ribose is a pentose (5C), glyceraldehyde is a triose (3C), and glucose is a hexose (6C).

Biology Q.19 Option (c) – 45 Explanation: The partial pressure of carbon dioxide ($p\text{CO}_2$) in the deoxygenated blood entering the pulmonary capillaries of the alveoli is approximately 45 mmHg.

Biology Q.20 Option (c) – Telencephalon Explanation: The telencephalon (cerebrum) contains the cerebral cortex, which serves as the primary center for high-level integration, learning, reasoning, and memory storage.

Biology Q.21 Option (c) – AABB Explanation: In the polygenic inheritance of wheat kernel color, the intensity of the red pigment is determined by the cumulative number of dominant alleles, making the homozygous *AABB* genotype the darkest.

Biology Q.22 Option (a) – Two steps Explanation: During anaerobic glycolysis, substrate-level phosphorylation reactions yield ATP at two specific steps: the conversion of 1,3-BPG to 3-PGA, and the conversion of PEP to pyruvate.

Biology Q.23 Option (d) – chloroplast, peroxisome, mitochondria Explanation: The metabolic pathway of photorespiration (the C_2 cycle) requires the coordinated metabolic activities of three distinct cellular organelles: chloroplasts, peroxisomes, and mitochondria.

Biology Q.24 Option (d) – 2 Explanation: In Whittaker's Five Kingdom Classification, multicellular heterotrophic organisms are distributed into exactly two kingdoms: Fungi (absorptive heterotrophs) and Animalia (ingestive heterotrophs).

Biology Q.25 Option (c) – inflammatory Explanation: Redness (rubor), swelling (tumor), heat (calor), and pain (dolor) are the four classical localized clinical signs of an acute inflammatory response triggered by tissue injury.

Biology Q.26 Option (a) – tympanic membrane Explanation: The malleus (hammer), the outermost auditory ossicle of the middle ear, is physically attached directly to the inner surface of the tympanic membrane (eardrum).

Biology Q.27 Option (d) – Detritus Explanation: The detritus food chain (DFC) bypasses living producers, beginning instead with dead organic matter (detritus) which is consumed and decomposed by saprophytic detritivores.

Biology Q.28 Option (b) – A – perineurium, B – epineurium Explanation: A bundle of nerve fibers (fascicle) is enveloped by a protective connective tissue sheath called the perineurium (A), and multiple fascicles are bound together by the outer epineurium (B).

Biology Q.29 Option (d) – Vacuole – osmoregulation and excretion Explanation: In single-celled eukaryotes, specialized contractile vacuoles act as osmoregulatory organs, periodically contracting to expel excess water and metabolic wastes from the cell.

Biology Q.30 Option (a) – vasopressin Explanation: Vasopressin (antidiuretic hormone) is synthesized by hypothalamus neurons and secreted by the posterior pituitary (pars nervosa), whereas the anterior pituitary (pars distalis) secretes GH, PRL, and ACTH.

Biology Q.31 Option (d) – Cow–bacteria Explanation: The relationship between a cow and its rumen cellulose-digesting bacteria is mutualism (both benefit). The other pairs represent commensalism, where one benefits and the other is unaffected.

Biology Q.32 Option (a) – Total colour blindness Explanation: Total color blindness is inherited as a completely sex-linked trait, as its causative genes are located on the non-homologous segment of the sex chromosomes.

Biology Q.33 Option (d) – fixation of atmospheric CO_2 during photosynthesis Explanation: Terrestrial plants acquire carbon from the atmosphere through the stomata by assimilating gaseous carbon dioxide (CO_2) during the light-independent reactions of photosynthesis.

Biology Q.34 Option (b) – Purines Explanation: The purine bases Adenine (A) and Guanine (G) are structurally identical and serve as essential nitrogenous base components in both DNA and RNA molecules.

Biology Q.35 Option (a) – 2:1:2 Explanation: In the classic Urey–Miller prebiotic synthesis experiment, the gaseous mixture of methane (CH_4), ammonia (NH_3), and hydrogen (H_2) was introduced in a volume ratio of 2:1:2.

Biology Q.36 Option (a) – a haploid large-sized secondary oocyte and a haploid smaller polar body Explanation: The first meiotic division of oogenesis is characterized by highly unequal cytokinesis, yielding a large haploid secondary oocyte and a small, non-functional first polar body.

Biology Q.37 Option (b) – Muscles of diaphragm relax Explanation: Inspiration is an active process during which the diaphragm and external intercostal muscles contract. Relaxation of these respiratory muscles occurs during passive expiration.

Biology Q.38 Option (d) – A collective mass of placenta, umbilical cord and foetal membranes. Explanation: Following childbirth, the sudden contraction of the uterus causes the detachment and expulsion of the placenta, umbilical cord, and associated fetal membranes, collectively called the “afterbirth.”

Biology Q.39 Option (a) – a: 54–62%, b: Secrete antihistamine, c: Lymphocytes, d: Secrete heparin Explanation: This matches leukocyte characteristics: neutrophils comprise 54–62% of white blood cells, eosinophils counteract histamine, lymphocytes synthesize antibodies, and basophils secrete heparin.

Biology Q.40 Option (c) – inbreeding Explanation: Inbreeding increases homozygosity within a population over generations, which exposes deleterious recessive genes to natural selection by bringing them into a homozygous state.

Biology Q.41 Option (d) – ADH Explanation: Antidiuretic Hormone (ADH), also called vasopressin, acts on the distal convoluted tubules and collecting ducts of the nephron to increase water permeability, driving facultative water reabsorption.

Biology Q.42 Option (a) – *Methanococcus* and *Methanobacillus* Explanation: In an anaerobic digester, methanogenic archaea such as *Methanococcus* and *Methanobacillus* utilize enzymes to convert organic acids into biogas (methane and carbon dioxide).

Biology Q.43 Option (d) – Fungi Explanation: Vernalization (low-temperature treatment of seeds) induces physiological and hormonal changes that accelerate flowering and enhance the plant's resistance to pathogenic fungal infections.

Biology Q.44 Option (a) – Ecosystem Explanation: An ecosystem is defined as the structural and functional unit of the biosphere, where living biotic communities interact dynamically with their abiotic physical environments.

Biology Q.45 Option (d) – six Explanation: The assimilation of one molecule of carbon dioxide via the Calvin cycle requires one turn. Since glucose contains six carbon atoms, synthesizing one glucose molecule requires six turns.

Biology Q.46 Option (d) – 16 Explanation: The number of linkage groups in an organism corresponds to its haploid chromosome number (n). Since male honeybees (drones) are haploid with 16 chromosomes, they possess 16 linkage groups.

Biology Q.47 Option (d) – VNTRs Explanation: Variable Number Tandem Repeats (VNTRs) are highly polymorphic locus markers in non-coding DNA that serve as the primary genetic markers used in DNA fingerprinting.

Biology Q.48 Option (d) – roots of higher plants and fungi Explanation: Mycorrhiza is a mutually beneficial symbiotic association established between the soil mycelia of specific fungi and the absorbing roots of higher vascular plants.

Biology Q.49 Option (d) – hydrogen Explanation: During the initiation phase of DNA replication, the initiator protein (DNA helicase) utilizes ATP energy to break the weak hydrogen bonds holding the complementary purine-pyrimidine base pairs together.

Biology Q.50 Option (c) – dynein Explanation: The side arms or cross-bridges extending between the peripheral doublet microtubules in the axoneme of cilia and flagella are composed of the ATP-dependent motor protein dynein.

Biology Q.51 Option (d) – water Explanation: During the light reactions of photosynthesis, photolysis of water molecules occurs at the oxygen-evolving complex, releasing molecular oxygen (O_2) as a byproduct.

Biology Q.52 Option (d) – cytochrome-*b-c₁* Explanation: In the mitochondrial electron transport chain, electrons are transferred from ubiquinol to the cytochrome *bc₁* complex, making cytochrome *b* the initial cytochrome acceptor.

Biology Q.53 Option (a) – sexual reproduction Explanation: During sexual reproduction, genetic variations are generated through crossing over (genetic recombination) during meiosis and the random fusion of gametes during fertilization.

Biology Q.54 Option (c) – spinal accessory Explanation: The accessory nerve (cranial nerve XI) is a motor nerve that innervates the sternocleidomastoid and trapezius muscles, controlling pharynx, neck, and shoulder movements.

Biology Q.55 Option (b) – PEP and pyruvate Explanation: The second substrate-level phosphorylation step in glycolysis is catalyzed by pyruvate kinase, transferring a phosphate group from phosphoenolpyruvate (PEP) to ADP to form ATP and pyruvate.

Biology Q.56 Option (d) – Ethylene Explanation: Ethylene is a simple gaseous hydrocarbon that functions as a plant hormone, regulating senescence, abscission, and fruit ripening, often classified as a secondary hormone.

Biology Q.57 Option (a) – Phosphorylation-II Explanation: The enzyme phosphofructokinase, activated by magnesium cofactors, catalyzes the second phosphorylation step in glycolysis: converting fructose-6-phosphate to fructose-1,6-bisphosphate.

Biology Q.58 Option (b) – *Treponema pallidum* Explanation: Syphilis is a highly infectious sexually transmitted disease characterized by primary painless genital sores (chancres) caused by the spirochete bacterium *Treponema pallidum*.

Biology Q.59 Option (c) – *Lilium* and *Fritillaria* Explanation: The unique angiosperm phenomenon of double fertilization (fusion of egg with sperm, and polar nuclei with second sperm) was first discovered by S.G. Nawaschin in species of *Lilium* and *Fritillaria*.

Biology Q.60 Option (c) – (3) Explanation: In molecular biology, a palindromic DNA sequence is one where the 5'-to-3' base sequence on one strand is identical to the 5'-to-3' sequence on its complementary strand.

Biology Q.61 Option (d) – Lichens Explanation: Lichens are the pioneer species of lithosere (succession on bare rock), secreting organic acids to break down minerals and initiate soil formation for subsequent mosses and herbs.

Biology Q.62 Option (d) – entire collection of plants/seeds with diverse alleles for all genes of a particular crop. Explanation: In plant breeding programs, germplasm collection refers to gathering and preserving the entire collection of genetic resources, representing all diverse alleles for a crop species.

Biology Q.63 Option (d) – Abdomen Explanation: While lymphatic vessels and nodes are distributed throughout the body, the highest localized clusters are in the cervical (neck), axillary (armpit), and inguinal (groin) regions.

Biology Q.64 Option (c) – I)–q), II)–s), III)–t), IV)–r), V)–p) Explanation: This matches viral crop diseases: Banana is infected by bunchy top virus (I–q), Sugarcane by grassy shoot (II–s), Papaya by leaf curl (III–t), Potato by leaf roll (IV–r), and Brinjal by little leaf (V–p).

Biology Q.65 Option (a) – coronary sinus Explanation: The valve of the coronary sinus, historically termed the Thebesian valve, is a semicircular fold of endocardium guarding the opening of the coronary sinus into the right atrium.

Biology Q.66 Option (b) – They are not fully saturated with hydrogen atoms. Explanation: Saturated fatty acids contain only single covalent carbon–carbon bonds (C–C), meaning they are fully saturated with hydrogen atoms, unlike unsaturated fatty acids.

Biology Q.67 Option (b) – (i)–(d), (ii)–(b), (iii)–(a), (iv)–(c) Explanation: This matches environmental pollutants with sources: sulfur dioxide is emitted from power plants, endosulfan is an agricultural pesticide, pollen is a natural allergen, and lead is released in vehicle exhaust.

Biology Q.68 Option (a) – powdery mildew Explanation: In crop breeding, mutation breeding techniques were successfully utilized to develop moong bean varieties highly resistant to yellow mosaic virus and powdery mildew.

Biology Q.69 Option (a) – Spinach Explanation: Spinach is a nutrient-dense leafy green vegetable rich in essential dietary minerals, containing particularly high levels of calcium, iron, and magnesium.

Biology Q.70 Option (b) – 120 and 960 Explanation: Producing 960 male gametes requires 480 pollen grains. Since one microspore mother cell undergoes one meiosis to yield 4 pollen grains, 120 meiotic divisions are required, followed by two mitotic divisions per pollen grain (960 total).

Biology Q.71 Option (b) – Menstrual phase → Proliferative phase → Ovulatory phase → Luteal phase Explanation: The human menstrual cycle progresses through four distinct phases in a highly conserved sequence: menstrual flow, follicle growth (proliferative), ovulation, and corpus luteum secretion (luteal).

Biology Q.72 Option (d) – Fragmentation Explanation: Grafting, micropropagation, and budding are artificial, human-mediated vegetative propagation methods. Fragmentation is a natural form of vegetative or asexual reproduction.

Biology Q.73 Option (c) – emulsify Explanation: Bile salts synthesized by the liver act as natural detergents in the duodenum, breaking down large dietary fat globules into microscopic droplets to enhance lipase digestion.

Biology Q.74 Option (b) – sudden change in genetic material Explanation: In genetics, a mutation is defined as a sudden, stable, and heritable change in the nucleotide sequence of an organism's genomic DNA material.

Biology Q.75 Option (d) – mesosalpinx Explanation: The mesosalpinx is the specific region of the broad ligament of the uterus that supports and suspends the oviducts (fallopian tubes) within the pelvic cavity.

Biology Q.76 Option (b) – Pullorum Explanation: Aspergillosis, thrush (moniliasis), and favus are avian diseases caused by pathogenic fungi. Pullorum disease is a highly contagious bacterial infection of poultry.

Biology Q.77 Option (d) – Secretion of cell killing substances like perforins Explanation: Helper T-lymphocytes coordinate immune responses by secreting cytokines. The secretion of cytolytic perforins and granzymes is a specialized function of cytotoxic (killer) T-cells.

Biology Q.78 Option (d) – III, IV and VI Explanation: The movements of the extrinsic muscles of the human eyeball are coordinated by three cranial nerves: Oculomotor (III), Trochlear (IV), and Abducens (VI).

Biology Q.79 Option (b) – dispersal Explanation: Structural adaptations of seeds, such as lightweight wings, tufts of hair (pappus), or clinging hooks, are evolutionary mechanisms designed to facilitate wind or animal-mediated seed dispersal.

Biology Q.80 Option (c) – 25 Explanation: A heterozygous tall pea plant (Tt) produces T and t gametes in a 1:1 ratio. During self-fertilization, the mathematical probability of a t pollen grain fertilizing a T egg cell is $0.5 \times 0.5 = 0.25$ (25%).

Biology Q.81 Option (a) – 95°C, 62°C and 82°C Explanation: The three temperature steps of a Polymerase Chain Reaction (PCR) cycle are: high-temperature denaturation ($\sim 95^\circ\text{C}$), low-temperature primer annealing ($\sim 62^\circ\text{C}$), and intermediate extension ($\sim 82^\circ\text{C}/\sim 72^\circ\text{C}$).

Biology Q.82 Option (c) – HCG Explanation: The placenta secretes Human Chorionic Gonadotropin (HCG) immediately following implantation. The presence of this hormone in maternal urine is the basis of clinical pregnancy tests.

Biology Q.83 Option (d) – Transpiration pull Explanation: The primary physical force driving the upward movement of water to the tops of tall trees is transpiration pull, created by the evaporation of water from leaf stomata.

Biology Q.84 Option (c) – r-DNA technology Explanation: Recombinant DNA (r-DNA) technology allows scientists to manipulate, insert, delete, or modify specific nucleotide sequences within the genome of a living cell.

Biology Q.85 Option (a) – heterogametes Explanation: Sex determination in humans is governed by sex chromosomes (XX in females, XY in males), where the male produces two distinct types of gametes (heterogametic).

Biology Q.86 Option (c) – Z-line Explanation: In a striated myofibril, the light isotropic (I) band is bisected by a narrow, dark, and highly dense proteinaceous transverse disc known as the Z-line.

Biology Q.87 Option (a) – a)–(iv), b)–(iii), c)–(i), d)–(ii) Explanation: This matches inheritance patterns: Pleiotropy has a modified lethal ratio of 2:1, wheat kernel color has 1:4:6:4:1, human skin color has 1:6:15:20:15:6:1, and codominance exhibits 1:2:1.

Biology Q.88 Option (c) – scorpion Explanation: Crows (birds), mosquitoes (insects), and cobras (reptiles) are uricotelic, excreting nitrogenous waste as uric acid. Scorpions are guanotelic, excreting primarily guanine.

Biology Q.89 Option (d) – a)–iv), b)–iii), c)–i), d)–ii) Explanation: This matches blotting steps: DNA fragmentation produces variable fragments, electrophoresis separates them, southern blotting transfers them to membranes, and hybridization binds specific probes.

Biology Q.90 Option (d) – renal artery Explanation: Blood pressure is highest in the large systemic arteries branching directly off the aorta. Therefore, pressure is maximum in the renal artery compared to capillaries or veins.

Biology Q.91 Option (b) – Aldolase Explanation: During glycolysis, the enzyme aldolase catalyzes the reversible cleavage of the six-carbon fructose-1,6-bisphosphate into two three-carbon isomers: DHAP and G-3-P.

Biology Q.92 Option (b) – transformation Explanation: In his 1928 experiments with virulent and avirulent strains of *Streptococcus pneumoniae*, Frederick Griffith discovered the “transforming principle,” now known as genetic transformation.

Biology Q.93 Option (b) – Genomics Explanation: Genomics is the branch of molecular biology focused on the structure, function, evolution, and mapping of genomes, heavily utilizing automated DNA sequencing technologies.

Biology Q.94 Option (c) – gene pool Explanation: In population genetics, the sum total of all the unique genes and alleles present across all reproducing individuals within a breeding population is called the gene pool.

Biology Q.95 Option (b) – Fat Explanation: The chemical equation represents the aerobic oxidation of tripalmitin, a lipid. The respiratory quotient (RQ) for this reaction is $102 \text{ CO}_2 / 145 \text{ O}_2 \approx 0.7$, which is highly characteristic of fats.

Biology Q.96 Option (a) – proteins Explanation: Kwashiorkor is a form of severe protein-energy malnutrition characterized by peripheral edema and muscle wasting, caused by a prolonged deficiency of proteins in the diet.

Biology Q.97 Option (b) – Sertoli cell, nutrition of maturing sperms. Explanation: The cells labeled as A are Sertoli cells, located within the seminiferous tubules. Their primary physiological function is to provide structural support and nutrition to maturing spermatids.

Biology Q.98 Option (d) – Mosquito Explanation: The biological transmission of the malaria parasite (*Plasmodium*) from one human host to another requires a vector, specifically the female *Anopheles* mosquito.

Biology Q.99 Option (d) – *Vaucheria* Explanation: *Vaucheria* is a genus of yellow-green coenocytic algae characterized by a tubular, siphonous, and multinucleated filamentous body structure.

Biology Q.100 Option (b) – mesogamy Explanation: If the pollen tube enters the ovule through the integuments rather than the micropyle (porogamy) or chalaza (chalazogamy), the fertilization process is termed mesogamy.