

MHT CET 2020 Biology Answer Key PDF

Question 1 Option: (d) – 8 days

Explanation: The orbital radius is $r = R + 3R = 4R$. According to Kepler's Third Law ($T^2 \propto r^3$), the new orbital period is $T_2 = T_1 \left(\frac{4R}{R}\right)^{3/2} = 24 \times 8 = 192$ hours = 8 days.

Question 2 Option: (c) – $\frac{M_1}{(M_1+M_2)}$

Explanation: The common acceleration of both masses is $a = \frac{T_2}{M_1+M_2}$. Since the tension T_1 pulls only the mass M_1 , we get $T_1 = M_1 a$, which yields the ratio $\frac{T_1}{T_2} = \frac{M_1}{M_1+M_2}$.

Question 3 Option: (d) – $\frac{\pi a}{3}$

Explanation: The maximum particle velocity is $v_{\max} = a\omega = a\left(\frac{2\pi v}{\lambda}\right)$. Equating this to six times the wave velocity ($6v$) yields $a\left(\frac{2\pi v}{\lambda}\right) = 6v$, which simplifies directly to $\lambda = \frac{\pi a}{3}$.

Question 4 Option: (a) – 5λ

Explanation: From Einstein's photoelectric equation, $eV_0 = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$ and $\frac{eV_0}{6} = \frac{hc}{3\lambda} - \frac{hc}{\lambda_0}$. Multiplying the second equation by 6 and equating it to the first yields the threshold wavelength $\lambda_0 = 5\lambda$.

Question 5 Option: (b) – $\left(\frac{2mgh}{I+mr^2}\right)^{1/2}$

Explanation: Using conservation of mechanical energy, the loss in potential energy equals the gain in kinetic energy: $mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$. Substituting $v = r\omega$ and solving for the angular velocity yields $\omega = \left(\frac{2mgh}{I+mr^2}\right)^{1/2}$.

Question 6 Option: (a) – 0.66

Explanation: The reflected and refracted rays are perpendicular, meaning the angle of incidence is Brewster's angle, so $\tan i_p = \mu = 1.5$. The wavelength ratio is $\frac{\lambda_{\text{refracted}}}{\lambda_{\text{reflected}}} = \frac{1}{\mu} = \frac{1}{1.5} \approx 0.66$.

Question 7 Option: (c) – $\frac{L}{3}, \frac{2L}{3}, \frac{5L}{3}$

Explanation: For a sonometer wire vibrating in the third harmonic, nodes are formed at fixed fractions of the total length. These nodal points of zero displacement are located at distances of $\frac{L}{3}$ and $\frac{2L}{3}$ from one end.

Question 8 Option: (a) – 0.8 m

Explanation: The maximum height attained by the ball after its first rebound is given by the formula $h' = e^2 h$. Substituting the given values, we find $h' = (0.4)^2 \times 5 = 0.16 \times 5 = 0.8$ m.

Question 9 Option: (b) – $\frac{QE}{2}$

Explanation: The electric field acting on each plate due to the charge on the other plate is half of the total field, $E' = E/2$. The electrostatic attractive force between the plates is therefore $F = QE' = \frac{QE}{2}$.

Question 10 Option: (b) – E

Explanation: According to the kinetic theory of gases, the average kinetic energy of any ideal gas molecule depends solely on the absolute temperature of the system. Since both gases are at 300K, the average kinetic energy remains E.

Question 11 Option: (b) – 3.6×10^{-3} mm

Explanation: Poisson's ratio is defined as $\sigma = \frac{\Delta d/d}{\Delta l/l}$. Rearranging this to find the change in diameter gives $\Delta d = \sigma \cdot d \cdot \left(\frac{\Delta l}{l}\right) = 0.4 \times 3 \text{ mm} \times 3 \times 10^{-3} = 3.6 \times 10^{-3}$ mm.

Question 12 Option: (b) – $\frac{MgR}{5}$

Explanation: Weightlessness at the equator requires $R\omega^2 = g \implies \omega^2 = g/R$. The rotational kinetic energy of the Earth is then calculated as $K = \frac{1}{2}I\omega^2 = \frac{1}{2}\left(\frac{2}{5}MR^2\right)\left(\frac{g}{R}\right) = \frac{MgR}{5}$.

Question 13 Option: (d) – paramagnetic material.

Explanation: According to Curie's Law, the magnetic susceptibility (χ) of a paramagnetic substance is inversely proportional to its absolute temperature (T), which yields the constant product $\chi T = \text{constant}$.

Question 14 Option: (a) – In an intrinsic semiconductor, $n_e = n_h$

Explanation: In pure, undoped (intrinsic) semiconductors, thermal energy excites electrons to the conduction band, leaving behind an equal concentration of holes in the valence band, meaning $n_e = n_h$.

Question 15 Option: (b) – $R = (R_1^3 + R_2^3)^{\frac{1}{3}}$

Explanation: Under isothermal conditions, the total volume of the liquid remains conserved when the two drops coalesce: $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi R_1^3 + \frac{4}{3}\pi R_2^3$, which simplifies directly to $R = (R_1^3 + R_2^3)^{1/3}$.

Question 16 Option: (a) – $\cos^{-1}(\frac{12}{13})$

Explanation: Squaring $|\vec{P} + \vec{Q}| = 5|\vec{P} - \vec{Q}|$ with $P=Q$ gives $2P^2(1 + \cos \theta) = 50P^2(1 - \cos \theta)$. Solving this algebraic equation yields $26 \cos \theta = 24 \implies \cos \theta = \frac{12}{13}$.

Question 17 Option: (c) – $\frac{3mL^3}{8\pi^2}$

Explanation: The mass of the loop is $M = mL$ and its radius is $R = \frac{L}{2\pi}$. By the parallel axis theorem, the moment of inertia about a tangential axis in its plane is $I = \frac{3}{2}MR^2 = \frac{3}{2}(mL)\left(\frac{L}{2\pi}\right)^2 = \frac{3mL^3}{8\pi^2}$.

Question 18 Option: (b) – $\frac{n}{p}$

Explanation: In the Bohr hydrogen model, the orbital velocity of an electron is inversely proportional to the principal quantum number ($v_n \propto 1/n$). Therefore, the velocity ratio is given by $v_p : v_n = \frac{1}{p} : \frac{1}{n} = \frac{n}{p}$.

Question 19 Option: (d) – NOR

Explanation: The logic symbol shown consists of a standard two-input OR gate combined with a small inversion bubble at its output terminal, representing a NOR logic gate.

Question 20 Option: (c) – 10.5 J/m^3

Explanation: Potential energy density scales with the square of extension, $u \propto (\Delta l)^2$. Thus, $u_2 = 0.3 \times \left(\frac{0.75}{0.125}\right)^2 = 10.8 \text{ J/m}^3$, and the increase in energy is $10.8 - 0.3 = 10.5 \text{ J/m}^3$.

Question 21 Option: (b) – DDV

Explanation: The magnifying power of a simple microscope is $M = 1 + \frac{D}{f}$. This magnifying value is maximized when the virtual image is formed at the near point, also known as the distance of distinct vision (DDV).

Question 22 Option: (d) – $-4\hat{i}$

Explanation: Since the cross product of $\vec{F}_1 = \hat{i}$ and $\vec{F}_2$ is zero, the two vectors must be collinear. Given that the magnitude of $\vec{F}_2$ is 4, it must lie along the negative x-axis, represented by $-4\hat{i}$.

Question 23 Option: (a) – 1

Explanation: The pressure of an ideal gas on its container walls is $P = \frac{1}{3}\rho v^2 \propto T$. Since the average force is directly proportional to pressure, the force $F \propto T^1$, yielding $x = 1$.

Question 24 Option: (b) – 2 Hz

Explanation: Thermal tension is $T = YA\alpha\Delta\theta = (2 \times 10^{11}) \times 10^{-7} \times (1.2 \times 10^{-5}) \times 40 = 9.6 \text{ N}$. The fundamental frequency is calculated as $f = \frac{1}{2L}\sqrt{\frac{T}{m}} = \frac{1}{2(1)}\sqrt{\frac{9.6}{0.6}} = 2 \text{ Hz}$.

Question 25 Option: (b) – $\frac{hc}{\phi + eV_s}$

Explanation: From Einstein's photoelectric equation, the maximum kinetic energy is $eV_s = \frac{hc}{\lambda} - \phi$. Rearranging this equation to solve for the wavelength of the incident light yields $\lambda = \frac{hc}{\phi + eV_s}$.

Question 26 Option: (d) – increase.

Explanation: The natural frequency of a stretched wire is $f = \frac{1}{L \cdot d} \sqrt{\frac{T}{\pi \rho}}$. Decreasing both the length L and diameter d of the wire under constant tension will cause the frequency to increase.

Question 27 Option: (c) – $\cos^{-1}(0.5)$

Explanation: When the capillary tube of length h is depressed to a height h/2, the liquid adjusts its meniscus. The new contact angle θ' satisfies $h \cos(0^\circ) = \frac{h}{2} \cos \theta' \implies \cos \theta' = 0.5 \implies \theta' = \cos^{-1}(0.5)$.

Question 28 Option: (d) – $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right), 4 \times 10^{-5} \text{ T}$

Explanation: The angle of dip is given by $\tan \theta = V/H = \frac{2 \times 10^{-5}}{2\sqrt{3} \times 10^{-5}} = \frac{1}{\sqrt{3}} \implies \theta = \tan^{-1}(1/\sqrt{3})$. The total field is $B = \sqrt{V^2 + H^2} = 4 \times 10^{-5} \text{ T}$.

Question 29 Option: (c) – $\frac{d^2x}{dt^2} + 49x = 0$

Explanation: The angular frequency is $\omega = 2\pi f = 2\pi \left(\frac{7}{2\pi}\right) = 7 \text{ rad/s}$. The differential equation of simple harmonic motion is given by $\frac{d^2x}{dt^2} + \omega^2 x = 0 \implies \frac{d^2x}{dt^2} + 49x = 0$.

Question 30 Option: (b) – 45°

Explanation: The angle of inclination θ with the vertical for a safe turn on a curved road is given by $\tan \theta = \frac{v^2}{rg}$. Substituting the values yields $\tan \theta = \frac{20^2}{40 \times 10} = 1 \implies \theta = 45^\circ$.

Question 31 Option: (b) – 2

Explanation: Midpoint magnetic fields give $B_1 \propto (i_1 - i_2) = 10 \mu\text{T}$ and $B_2 \propto (i_1 + i_2) = 30 \mu\text{T}$. Solving the ratio $\frac{i_1 + i_2}{i_1 - i_2} = 3$ yields $4i_2 = 2i_1 \implies i_1/i_2 = 2$.

Question 32 Option: (a) – no current will be induced in another coil.

Explanation: Because the two coils are mutually perpendicular, their magnetic axes are perpendicular. The magnetic flux produced by changing current in one coil does not link with the other coil, so no current is induced.

Question 33 Option: (b) – 3°

Explanation: For dispersion without deviation, the net deviation is zero: $(\mu_1 - 1)A_1 = (\mu_2 - 1)A_2$. Substituting the values, $(1.48 - 1) \times 4^\circ = (1.64 - 1)A_2 \implies 0.48 \times 4 = 0.64A_2 \implies A_2 = 3^\circ$.

Question 34 Option: (c) – r^2

Explanation: The magnetic dipole moment of a circular current-carrying coil is given by $M = n I A$. Since the area of the circular loop is $A = \pi r^2$, the magnetic moment is directly proportional to r^2 .

Question 35 Option: (b) – 4.95Ω

Explanation: Let x be the series resistance added to the galvanometer. The shunt formula is $I_g(G + x) = (I - I_g)S$. Substituting the values, $0.04(20 + x) = (20 - 0.04) \times 0.05 \implies 20 + x = 24.95 \implies x = 4.95 \Omega$.

Question 36 Option: (b) – $2\pi \text{ rad}$.

Explanation: At the first minimum of a single-slit diffraction pattern, the path difference between waves from opposite edges of the slit is λ . This path difference corresponds to a phase difference of 2π radians.

Question 37 Option: (a) – area of bottom surface.

Explanation: The hydrostatic pressure exerted by a column of liquid is given by $P = \rho gh$. This pressure depends on density, height of the liquid, and gravity, but is independent of the cross-sectional area of the tank.

Question 38 Option: (d) – Hydrogen Chloride (HCl)

Explanation: Hydrogen chloride (HCl) is a polar diatomic molecule due to the significant difference in electronegativity between the hydrogen and chlorine atoms, creating a permanent dipole.

Question 39 Option: (c) – $E_1 - I_1(R_1 + R_2 + R_3) + I_2 R_3 = 0$

Explanation: Applying Kirchhoff's Voltage Law to the closed loop ABEFA in a clockwise direction, we sum the potential differences across all resistors and active emf sources to obtain the correct loop equation.

Question 40 Option: (a) – $F = 0$

Explanation: The magnetic force acting on a moving charge is $\vec{F} = q(\vec{v} \times \vec{B})$. Since the particle moves along the axis of the solenoid, its velocity vector is parallel to the magnetic field vector, making their cross product zero.

Question 41 Option: (c) – $2\pi\sqrt{\frac{M}{\eta L}}$

Explanation: The restoring shear force for a cube under shear deformation is $F = -\eta A\theta = -\eta L^2(x/L) = -\eta Lx$. Comparing this to the harmonic force equation $F = -kx$ gives effective stiffness $k = \eta L$, leading to $T = 2\pi\sqrt{M/\eta L}$.

Question 42 Option: (c) – $\frac{8E\pi^2 n^2}{v^2}$

Explanation: The total energy is $E = \frac{1}{2}mv^2 \Rightarrow m = 2E/v^2$. The spring constant is $k = m\omega^2$. Substituting m and $\omega = 2\pi n$ into this relation gives $k = \left(\frac{2E}{v^2}\right)(4\pi^2 n^2) = \frac{8E\pi^2 n^2}{v^2}$.

Question 43 Option: (c) – $10\sqrt{3}$ cm

Explanation: The phase difference between the two waves is $\phi = \pi/3$. The resultant amplitude is $A = \sqrt{A_1^2 + A_2^2 + 2A_1 A_2 \cos \phi} = \sqrt{100 + 100 + 200 \cos(60^\circ)} = \sqrt{300} = 10\sqrt{3}$ cm.

Question 44 Option: (b) – $[L^1 M^{-1} T^2]$

Explanation: Since C and S are added, $[C] = [S] = [L]$. From $P = \frac{C}{D}$, we get the dimensions of D as $[D] = \frac{[L]}{[ML^{-1}T^{-2}]} = [M^{-1}L^2T^2]$. Therefore, the dimensions of D/C are $[M^{-1}L^1T^2]$.

Question 45 Option: (a) – $(100 - \ell)$

Explanation: In a balanced meter bridge, the ratio of resistances in the gaps is proportional to the ratio of balancing lengths. Interchanging and doubling the resistances inverts this ratio, shifting the null point to $(100 - \ell)$.

Question 46 Option: (c) – 7.5×10^{16}

Explanation: The number of elapsed half-lives is $n = 60/15 = 4$. The remaining active nuclei is $N = N_0(1/2)^4 = \frac{N_0}{16}$, meaning the number of decayed nuclei is $N_0 - N = \frac{15}{16}(8 \times 10^{16}) = 7.5 \times 10^{16}$.

Question 47 Option: (d) – m

Explanation: The centripetal force is given by $F = \frac{mv^2}{r}$. Substituting the linear-to-angular velocity relationship $v = r\omega \Rightarrow \frac{v}{r} = \omega$ into the force equation yields $F = m\omega v$.

Question 48 Option: (a) – $100\pi^2$ J

Explanation: The moment of inertia of the flywheel is $I = Mk^2 = 2 \times (0.5)^2 = 0.5$ kg m². The rotational kinetic energy is $E_k = \frac{1}{2}I\omega^2 = \frac{1}{2}(0.5)(2\pi \times 10)^2 = 100\pi^2$ J.

Question 49 Option: (b) – Transmitter

Explanation: In the standard block diagram of a general communication system, the signal travels

from the transmitter through the channel (where noise is introduced) and is then processed by the receiver before reaching the user.

Question 50 Option: (c) – 3×10^{-3} s

Explanation: Using Faraday's law of electromagnetic induction, $e = M \frac{dI}{dt} \implies 2 \times 10^3 = 2 \times \frac{6-3}{dt}$. Solving this for the time interval yields $dt = \frac{3}{1000} = 3 \times 10^{-3}$ seconds.

Question 51 Option: (d) – HBr, C_2H_5COOAg

Explanation: Addition of HBr to ethene yields bromoethane (A). Reacting bromoethane with silver propionate (C_2H_5

Question 52 Option: (a) – NH_3

Explanation: In group 15 hydrides, basic strength decreases down the group as the size of the central atom increases and

Question 53 Option: (c) – 2,3-dimethyl butane-2,3-diol

Explanation: Pinacol is a symmetrical vicinal diol prepared by the reduction of acetone. Its IUPAC name is determined as 2,3-dimethylbutane-2,3-diol.

Question 54 Option: (c) – 0.1, 0.9

Explanation: Moles of ethanol = $46/46 = 1$. Moles of water = $162/18 = 9$. The mole fraction of ethanol is $1/(1+9) = 0.1$ and the mole fraction of water is $9/(1+9) = 0.9$.

Question 55 Option: (d) – Group - 11, period - 5

Explanation: The outer electronic configuration $[Kr]4d^95s^2$ corresponds to silver (Ag), which is located in Group 11 (d block transition metal) and Period 5 of the periodic table.

Question 56 Option: (b) – PH_3

Explanation: Holme's signal utilizes a mixture of calcium carbide and calcium phosphide. When placed in water, calcium

Question 57 Option: (d) – 68.4 g mol^{-1}

Explanation: For isotonic solutions, molar concentrations are equal: $\frac{W_1}{M_1} = \frac{W_2}{M_2}$. Substituting the values, $\frac{5}{342} = \frac{1}{M_2} \implies M_2 = \frac{342}{5} = 68.4 \text{ g/mol}$.

Question 58 Option: (b) – 7.0 %

Explanation: At STP, 22.4 mL of N_2 corresponds to 10^{-3} moles, which has a mass of 28 mg = 0.028 g. The mass percentage of nitrogen is $\frac{0.028}{0.4} \times 100 = 7.0\%$.

Question 59 Option: (b) – $r = 0.414R$

Explanation: According to the radius ratio rules for ionic crystals, a cation can perfectly occupy an octahedral interstitial void in a close-packed anion lattice when $r/R = 0.414$.

Question 60 Option: (b) – 1° amine and 2° amine

Explanation: The molecular formula C_2H_7N represents a saturated open-chain amine. This formula can only correspond to

Question 61 Option: (d) – Ethyl methyl ketone

Explanation: Dry distillation of a mixture of calcium acetate (yielding acetyl groups) and calcium propionate (yielding propionyl groups) results in the formation of ethyl methyl ketone.

Question 62 Option: (b) – Concentrated hydrochloric acid with zinc chloride.

Explanation: Lucas reagent is defined as an equimolar mixture of concentrated hydrochloric acid (HCl) and anhydrous zinc chloride ($ZnCl_2$), used to distinguish primary, secondary, and tertiary alcohols.

Question 63 Option: (d) – $-NO_2$

Explanation: The nitro group ($-NO_2$) is a strong electron-withdrawing group due to both inductive and resonance effects.

Question 64 Option: (d) – $H_2(g)$

Explanation: During the electrolysis of aqueous NaCl, hydrogen ions (H^+) have a higher reduction potential than sodium ions.

Question 65 Option: (a) – $-k$

Explanation: The integrated rate equation for a zero-order reaction is $[A]_t = -kt + [A]_0$. A plot of concentration $[A]_t$ against time t yields a straight line with a slope equal to $-k$.

Question 66 Option: (d) – 1, 2

Explanation: Stachyose is a tetrasaccharide composed of one glucose unit, one fructose unit, and two galactose units. Complete acidic or enzymatic hydrolysis of 1 mole of stachyose yields 1 mole of fructose and 2 moles of galactose.

Question 67 Option: (d) – 10^3 nm

Explanation: Colloidal particles have a characteristic size range between 1 nm and 1000 nm (10^3 nm). Thus, the maximum possible size limit for a starch colloidal particle is 10^3 nm .

Question 68 Option: (a) – Benzene

Explanation: Benzene is a highly symmetrical aromatic hydrocarbon with all paired electrons in its molecular orbitals, making it diamagnetic (not paramagnetic) in nature.

Question 69 Option: (b) – $\text{C}_6\text{H}_5\text{NO}_2$

Explanation: Benzenediazonium chloride reacts with fluoroboric acid (HBF_4) to form benzenediazonium fluoroborate.

Question 70 Option: (b) – $(\sigma 1s^2)(\sigma^* 1s^2), \sigma 2s^2, \sigma^* 2s^2$

Explanation: A beryllium molecule (Be_2) contains a total of 8 electrons. According to Molecular Orbital Theory, the

Question 71 Option: (c) – 4.0 % C, hard and brittle

Explanation: Cast iron typically contains a high carbon content of about 2% to 4.5%. This high carbon percentage prevents dislocation movement, making the alloy very hard but brittle.

Question 72 Option: (b) – Melting point

Explanation: An intensive property is a physical property of a system that does not depend on the system size or the amount of material. Melting point remains constant regardless of the sample mass.

Question 73 Option: (d) – Finkelstein reaction

Explanation: The nucleophilic substitution reaction of alkyl chlorides or bromides with sodium iodide (NaI) in dry acetone to synthesize alkyl iodides is known as the Finkelstein reaction.

Question 74 Option: (b) – 72 g

Explanation: By Gay-Lussac's law, 8 volumes of H_2 react with 4 volumes of O_2 to produce 8 volumes of water vapor. $18 \times 4 = 72 \text{ g}$.

Question 75 Option: (c) – H_3O^+

Explanation: The acid-catalyzed hydrolysis of the nitroalkene group using hydronium ions (H_3O^+) cleaves the carbon-carbon double bond, yielding nitromethane and propanal as products.

Question 76 Option: (d) – 75 %

Explanation: A first-order reaction with 50% completion in 16 minutes has a half-life of 16 minutes. After 32 minutes (two half-lives), the remaining reactant is 25%, meaning 75% of the reactant has reacted.

Question 77 Option: (c) – (i) cold Conc. H_2SO_4 , (ii) H_2O

Explanation: The hydration of but-1-ene to butan-2-ol proceeds via Markovnikov addition. This is achieved by reagents (i) cold concentrated H_2SO_4 and (ii) H_2O .

Question 78 Option: (c) – Hydrate

Explanation: The two coordination compounds differ only in the number of water molecules present as ligands inside the coordination sphere versus water of crystallization outside, defining hydrate (solvate) isomerism.

Question 79 Option: (a) – Vapour pressure of a solution containing a non volatile solute is always less than vapour pressure of pure solvent.

Explanation: According to Raoult's law, adding a non-volatile solute reduces the fraction of volatile solvent molecules at the liquid surface, thereby lowering the vapour pressure of the solution compared to the pure solvent.

Question 80 Option: (d) – Kevlar

Explanation: Kevlar is a highly rigid synthetic aromatic polyamide (aramid) polymer. Its exceptional tensile strength-to-weight ratio makes it ideal for manufacturing body armor and helmets.

Question 81 Option: (a) – Mg

Explanation: Magnesium (Mg) has the highest oxidation potential (most negative standard reduction potential) among the given metals, indicating it has the greatest tendency to lose electrons and undergo oxidation.

Question 82 Option: (b) – Beryllium

Explanation: Beryllium (Be) has the highest ionization enthalpy in Group 2. It exhibits a diagonal relationship with aluminum (Al) due to their similar ionic charge-to-size ratios.

Question 83 Option: (a) – n-hexadecyl trimethyl ammonium chloride

Explanation: Cationic detergents are quaternary ammonium salts where the active hydrophilic part is a cation. n-Hexadecyltrimethylammonium chloride is a well-known cationic surfactant.

Question 84 Option: (c) – Aniline

Explanation: Aniline undergoes diazotization at 273K to form benzenediazonium chloride, which upon subsequent warming with dilute sulfuric acid undergoes hydrolysis to yield phenol.

Question 85 Option: (a) – 60.71 g/L

Explanation: The volume strength of H_2O_2 is related to concentration by $V = 11.2 \times N$. For 20 volume H_2O_2 , normality $N = 20/11.2 = 1.785$ eq/L. $Strength = Molarity \times \text{Molar Mass} = 1.785 \times 34 = 60.71$ g/L.

Question 86 Option: (b) – Tetrahedral and paramagnetic

Explanation: In $[NiCl_4]^{2-}$, nickel is in the +2 oxidation state (d^8 configuration). Because chloride is a weak-field ligand, no pairing occurs, resulting in sp^3 hybridization (tetrahedral) and two unpaired electrons (paramagnetic).

Question 87 Option: (d) – Propan-1-ol

Explanation: Propan-1-ol is a primary alcohol capable of forming strong intermolecular hydrogen bonds, which require significant thermal energy to overcome, resulting in a higher boiling point than the other polar/nonpolar options.

Question 88 Option: (c) – V_2O_5

Explanation: Vanadium pentoxide (V_2O_5) is used as the heterogeneous catalyst in the Contact process to facilitate the

Question 89 Option: (d) – $5.065 \times 10^4 \text{ Nm}^{-2}$

Explanation: Using Boyle's law ($P_1 V_1 = P_2 V_2$), the final pressure is $P_2 = \frac{P_1 V_1}{V_2}$. Substituting the values, $P_2 = \frac{1.013 \times 10^5 \times 2.27}{4.54} = 5.065 \times 10^4 \text{ N/m}^2$.

Question 90 Option: (a) – 32.66 kJ

Explanation: The molar mass of benzene is 78 g/mol. A mass of 780 mg corresponds to 0.01 moles. The heat liberated is the product of moles and molar enthalpy of combustion: $0.01 \times 3266 \text{ kJ} = 32.66 \text{ kJ}$.

Question 91 Option: (c) – 4

Explanation: In a carbon dioxide (CO_2) molecule, each of the two oxygen atoms forms a double bond with the central carbon atom, giving a total of 4 lone pairs.

Question 92 Option: (a) – 128 g mol^{-1}

Explanation: The represented skeletal structure is 3-ethyl-4-methylhexane, which has the molecular formula C_9H_{20} . The molar mass is calculated as $9(12) + 20(1) = 128 \text{ g/mol}$.

Question 93 Option: (c) – Buna-N

Explanation: A heteropolymer (copolymer) is made from more than one type of monomer. Buna-N is synthesized by the copolymerization of 1,3-butadiene and acrylonitrile.

Question 94 Option: (c) – $\frac{4r}{\sqrt{3}}$

Explanation: In a body-centered cubic (bcc) unit cell, the atoms touch along the body diagonal, which gives the relation $\sqrt{3}a = 4r$. Rearranging this for the edge length yields $a = \frac{4r}{\sqrt{3}}$.

Question 95 Option: (b) – N_2O_3

Explanation: Nitrogen sesquioxide is the chemical name for dinitrogen trioxide, which has the molecular formula N_2O_3 .

Question 96 Option: (b) – Presence of all six carbon atoms in a straight chain

Explanation: The reduction of glucose with hydrogen iodide (HI) and red phosphorus yields n-hexane, which provides direct structural evidence that all six carbon atoms are linked in a continuous open chain.

Question 97 Option: (c) – $\Delta H = \text{negative}$, $\Delta S = \text{positive}$, at all temperatures.

Explanation: From the Gibbs Helmholtz equation $\Delta G = \Delta H - T\Delta S$, the free energy change ΔG is always negative (spontaneous process) when the reaction is exothermic ($\Delta H < 0$) and entropy increases ($\Delta S > 0$).

Question 98 Option: (c) – 0.005 M

Explanation: Molar conductivity is related to conductivity by $\Lambda_m = \frac{1000\kappa}{M}$. Rearranging to solve for molarity yields $M = \frac{1000 \times 6.0 \times 10^{-4}}{120} = \frac{0.6}{120} = 0.005 \text{ M}$.

Question 99 Option: (b) – $\text{O}_{2(g)}$

Explanation: In the combustion of methane, oxygen gas (O_2) undergoes reduction as its oxidation state decreases from 0 to -2, which makes it the oxidizing agent.

Question 100 Option: (b) – Penicillin

Explanation: Penicillin is an antibiotic drug used systemically to treat internal bacterial infections. Bithionol, chloroxylenol, and iodine are applied topically as antiseptics.

Question 101 Option: (d) – Two

Explanation: In the polygenic inheritance of wheat kernel color, the phenotypic ratio is 1:4:6:4:1. The parental combinations (dark red and white) correspond to the extreme phenotypes, which represent $1 + 1 = 2$ out of the 16 offspring.

Question 102 Option: (a) – cellulose

Explanation: In herbivorous animals, the caecum and its vermiform appendix contain symbiotic microorganisms that secrete cellulase enzymes to ferment and digest complex plant cellulose.

Question 103 Option: (c) – Sphaerosome

Explanation: Sphaerosomes (or oleosomes) are small, single membrane-bound plant organelles that specialize in the biosynthesis, accumulation, and storage of lipids (fats).

Question 104 Option: (c) – inferior vena cava

Explanation: The Eustachian valve (valve of the inferior vena cava) is a fold of endocardium that guards the junction of the inferior vena cava with the right atrium in the fetal heart.

Question 105 Option: (b) – genetic engineering

Explanation: Genetic engineering allows for the horizontal transfer of specific genes between completely unrelated plant species, bypassing the barriers of sexual reproduction.

Question 106 Option: (b) – to study chromosomal types.

Explanation: DNA fingerprinting is used in forensics, paternity analysis, and phylogenetics. Studying chromosomal types (karyotyping) is done using cytogenetic staining, not DNA profiling.

Question 107 Option: (d) – sodium ions

Explanation: The renal tubules selectively secrete hydrogen ions, potassium ions, ammonia, and creatinine into the tubular fluid, while sodium ions are actively reabsorbed back into the blood.

Question 108 Option: (c) – heterocysts

Explanation: In blue-green algae (cyanobacteria), nitrogen fixation is restricted to specialized, thick-walled cells called heterocysts, which maintain an anaerobic environment for the oxygen-sensitive nitrogenase enzyme.

Question 109 Option: (b) – A-plasma cells, B-antibodies

Explanation: Upon exposure to an antigen, sensitized B-lymphocytes undergo clonal expansion to differentiate into active plasma cells (A), which produce and secrete specific antibodies (B).

Question 110 Option: (a) – black rot

Explanation: Pusa Shubhra is a disease-resistant cultivar of cauliflower developed through hybridization to provide resistance against the highly destructive black rot disease.

Question 111 Option: (b) – gut

Explanation: The insecticidal crystal proteins (Bt toxins) ingested by insect larvae bind to specific receptors in the alkaline midgut (gut) epithelial cells, causing pore formation and lysis.

Question 112 Option: (c) – RNA molecule

Explanation: The 30-nm chromatin solenoid fiber is a higher-order structure composed of nucleosome beads (DNA wrapped around basic histone octamers), but it does not contain structural RNA.

Question 113 Option: (c) – Small pox – Morbilli virus

Explanation: Smallpox is caused by the Variola virus, which belongs to the Poxviridae family. Morbillivirus is the causative agent of measles, making this pair incorrect.

Question 114 Option: (d) – kingdom

Explanation: In the hierarchical taxonomic classification system, kingdom is the highest and most comprehensive category, while species is the lowest and most specific level.

Question 115 Option: (d) – Two

Explanation: In aerobic respiration, Coenzyme-A (CoA) is utilized at two key steps: the transition (link) reaction to form acetyl-CoA, and the oxidation of α -ketoglutarate to succinyl-CoA.

Question 116 Option: (a) – diastema

Explanation: A diastema is a naturally occurring space or gap in the dental arch, typically located between the incisors and premolars/canines in many non-human primates.

Question 117 Option: (b) – Grave's disease

Explanation: Graves' disease (hyperthyroidism) accelerates metabolism, leading to weight loss, tachycardia, hypertension, and exophthalmos (accumulation of fat behind the eyes).

Question 118 Option: (c) – $1/4$

Explanation: In C_3 plants, the oxygenase activity of RuBisCO initiates photorespiration, which can release and waste

Question 119 Option: (d) – 940 c.c.

Explanation: Fossil discoveries indicate that Java Man (*Homo erectus erectus*) had an average cranial capacity of approximately 900 to 940 cubic centimeters.

Question 120 Option: (b) – One

Explanation: Among the statements, only statement (iv) is true: an allelic pair occupies the same locus on homologous chromosomes and controls a single trait (or alternative forms of it).

Question 121 Option: (d) – A - arbor vitae, B - cerebellum

Explanation: The deep, highly branched pattern of myelinated white matter tracts located within the cortex of the cerebellum is anatomically referred to as the arbor vitae.

Question 122 Option: (c) – root pressure

Explanation: Exudation (bleeding) of sap from the cut end of a plant stem is driven by positive hydrostatic pressure developed in the roots, known as root pressure.

Question 123 Option: (d) – epiphyllous buds

Explanation: *Kalanchoe* propagates vegetatively via adventitious buds, called epiphyllous buds, that develop along the notched margins of its fleshy leaves.

Question 124 Option: (d) – It is ambiguous.

Explanation: The genetic code is strictly unambiguous, meaning each individual codon specifies only one particular amino acid, preventing any translational errors.

Question 125 Option: (d) – 1:1:1:1

Explanation: Crossing a heterozygous dihybrid pea plant (YyRr) with a double recessive parent (yyrr) represents a dihybrid test cross, yielding a characteristic phenotypic ratio of 1:1:1:1.

Question 126 Option: (a) – males

Explanation: On average, adult human males exhibit a lower resting heart (pulse) rate than females, children, or individuals in excited or active states.

Question 127 Option: (b) – Gram

Explanation: Gram is a leguminous *C₃ plant*, whereas sugarcane, amaranthus, and maize are adapted to arid environments.

Question 128 Option: (b) – N-terminal and C-terminal

Explanation: The free amino end of a polypeptide chain is designated as the N-terminal, while the opposite free carboxyl end is designated as the C-terminal.

Question 129 Option: (c) – 7.5 to 8.5

Explanation: Human spermatozoa exhibit optimal motility and viability in a slightly alkaline environment, typically within a pH range of approximately 7.5 to 8.5.

Question 130 Option: (b) – x-generative cell, y-tube nucleus, z-pollen tube

Explanation: In a germinating pollen grain, the smaller cell is the generative cell (x), the larger vegetative nucleus is the tube nucleus (y), and the growing structure is the pollen tube (z).

Question 131 Option: (b) – rare

Explanation: *Psilotum nudum* is a primitive, rootless vascular plant (whisk fern) that is categorized as a rare and protected species in many botanical conservation listings.

Question 132 Option: (a) – calcitriol

Explanation: The endocrine function of the kidney is demonstrated by its synthesis and secretion of calcitriol (the active form of Vitamin D), erythropoietin, and renin.

Question 133 Option: (d) – incompletely dominant.

Explanation: The law of dominance is not universal because alleles can display incomplete dominance or co-dominance, resulting in intermediate phenotypes in heterozygous individuals.

Question 134 Option: (b) – mesothelium

Explanation: The epicardium (the visceral layer of the serous pericardium) is composed of a single layer of flattened epithelial cells known as the mesothelium.

Question 135 Option: (c) – 104

Explanation: The partial pressure of oxygen (pO_2) in the blood immediately after gas exchange across the alveolar-capillary membrane is approximately 104 mmHg.

Question 136 Option: (d) – frog, turtle, rat

Explanation: Ureotelic animals excrete urea as their primary nitrogenous waste. Frogs, turtles, and rats are ureotelic, whereas bony fish like *Labeo* are ammonotelic.

Question 137 Option: (a) – platelets

Explanation: Lymph is a filtered interstitial fluid containing water, dissolved solutes, antibodies, and lymphocytes, but it does not contain platelets or red blood cells.

Question 138 Option: (b) – *Mycobacterium genitalium*

Explanation: *Mycobacterium genitalium* is a parasitic bacterium that has one of the smallest known genomes of any self-replicating organism, containing only about 580 kbp.

Question 139 Option: (a) – 2

Explanation: The correct sequential phases of the Calvin cycle (dark reaction) are: (1) Carboxylation of RuBP, (2) Reduction of 3-PGA, and (3) Regeneration of RuBP.

Question 140 Option: (a) – yeast

Explanation: cDNA libraries are constructed from processed mRNA molecules (which lack introns), making them highly useful for cloning genes from intron-containing eukaryotic organisms like yeast.

Question 141 Option: (a) – plasmids

Explanation: In recombinant DNA technology, plasmids are widely used as vectors (transfer agents) because they can autonomously replicate inside host bacterial cells.

Question 142 Option: (a) – synaptic vesicles.

Explanation: Neurotransmitters are stored in small, membrane-bound secretory sacs called synaptic vesicles, located in the presynaptic axon terminals of neurons.

Question 143 Option: (a) – bacteria

Explanation: Lysozyme is a bactericidal enzyme present in tears and saliva that hydrolyzes the $\beta(1 \rightarrow 4)$ glycosidic bonds in the peptidoglycan cell walls of bacteria.

Question 144 Option: (d) – corticosteroids

Explanation: Near the end of gestation, fetal pituitary signals trigger the release of fetal adrenal corticosteroids, which initiate the hormonal cascade for parturition.

Question 145 Option: (a) – 5

Explanation: In a double-stranded B-DNA molecule, one complete 360° helical turn (spiral) contains 10 base pairs (20 nucleotides). Therefore, a segment with 100 nucleotides (50 base pairs) contains 5 complete spirals.

Question 146 Option: (d) – Coccidiosis

Explanation: Coccidiosis is a highly contagious, parasitic protozoan disease of poultry caused by apicomplexan parasites of the genus *Eimeria* infecting the intestinal tract.

Question 147 Option: (a) – A-Inner mass of cells; B- Blastocoel

Explanation: The diagram shows a human blastocyst. Label A indicates the inner cell mass (embryoblast), and label B indicates the fluid-filled cavity known as the blastocoel.

Question 148 Option: (b) – Cells → Tissues → Organs → Systems

Explanation: The structural hierarchy of multicellular animals progresses from basic cells, which aggregate into tissues, which form functional organs, which organize into organ systems.

Question 149 Option: (d) – 12

Explanation: The complete aerobic oxidation of one molecule of acetyl-CoA through the Krebs cycle and oxidative phosphorylation yields a net total of 12 ATP molecules (not 15).

Question 150 Option: (d) – Movement of solvent molecules takes place from chamber 'B' to chamber 'A' till equilibrium.

Explanation: In osmosis, solvent (water) molecules spontaneously diffuse across a semipermeable membrane from a region of lower solute concentration (chamber B) to higher solute concentration (chamber A).

Question 151 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.

Question 152 Option: (d) – cytochrome - b - c_1

Explanation: In the mitochondrial electron transport chain, electrons are transferred from ubiquinol to the cytochrome

Question 153 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.

Question 154 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.

Question 155 Option: (b) – PEPA 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.

Question 156 Option: (a) – 2, 4 -D

Explanation: The synthetic auxin 2,4-dichlorophenoxyacetic acid (2,4-D) acts as a selective herbicide, destroying broad-leaved dicotyledonous weeds without affecting narrow-leaved monocotyledonous crops.

Question 157 Option: (b) – F_1 hybrid and recessive parent.

Explanation: A test cross is a specific type of backcross designed to determine zygosity, performed by crossing an F_1 in

Question 158 Option: (a) – It acts as a passage for urine.

Explanation: In human females, the urinary and reproductive tracts are completely separate. The urethra serves as the passage for urine, while the vagina serves as the copulatory organ and birth canal.

Question 159 Option: (d) – maturation phase of oogenesis.

Explanation: During the maturation phase of oogenesis, unequal cytokinesis occurs during meiosis I and II, producing a single large haploid ootid and small non-functional polar bodies.

Question 160 Option: (a) – a-iii, b-iv, c-ii, d-i

Explanation: This matches asexual reproduction modes: binary fission occurs in *Amoeba*, conidia are formed in *Penicillium*, budding occurs in yeast, and fragmentation is seen in *Spirogyra*.

Question 161 Option: (b) – Cardiac muscles show presence of intercalated disc.

Explanation: Intercalated discs are specialized anchoring junctions containing desmosomes and gap junctions that are unique structural features of cardiac muscle tissue, enabling synchronized contraction.

Question 162 Option: (a) – bollworms

Explanation: Cotton cultivars with smooth, hairless leaves and no nectar glands are less attractive to ovipositing female moths, preventing damage by destructive bollworms.

Question 163 Option: (b) – Epiglottis

Explanation: The epiglottis is a flexible, leaf-shaped cartilaginous flap that acts as a lid, covering the glottis during swallowing to prevent food from entering the trachea.

Question 164 Option: (b) – c - iv

Explanation: The Bundle of His consists of specialized cardiac muscle fibers that exit the atrioventricular (AV) node (c-iv) and descend along the interventricular septum to distribute electrical impulses.

Question 165 Option: (b) – predation

Explanation: The interaction between an herbivorous animal consuming plant biomass and a carnivorous predator represents a food chain dynamic driven by predation.

Question 166 Option: (a) – a-iv, b-i, c-ii, d-iii

Explanation: This matches transitional evolutionary links: *Seymouria* links amphibians and reptiles, *Ichthyostegia* links fish and amphibians, *Archaeopteryx* links reptiles and birds, and *Australopithecus* links apes and humans.

Question 167 Option: (a) – Murrah, Nagpuri, Nili

Explanation: Murrah, Nagpuri, and Nili-Ravi are prominent indigenous water buffalo breeds of India, valued for their high milk yield and agricultural utility.

Question 168 Option: (c) – subaerial axillary buds of the stem.

Explanation: Runners are modified subaerial stems that develop from axillary buds on the main stem. They grow horizontally along the soil surface, forming adventitious roots at nodes.

Question 169 Option: (b) – host cell wall

Explanation: Endolysin is a peptidoglycan hydrolase enzyme produced by bacteriophages during the late stage of their lytic cycle to degrade and break down the host bacterial cell wall.

Question 170 Option: (a) – a-iii, b-iv, c-i, d-ii

Explanation: This matches outbreeding mechanisms: Sunflowers exhibit protandry, Castor exhibits unisexuality, *Michelia* exhibits protogyny, and Orchids exhibit self-incompatibility.

Question 171 Option: (b) – aneuploidy

Explanation: Euploidy represents the loss or gain of complete chromosome sets (diploidy, triploidy, polyploidy). Aneuploidy involves the loss or gain of individual chromosomes, not whole sets.

Question 172 Option: (c) – in situ

Explanation: In angiosperms, the initial stages of male gametophyte development (such as the mitotic division of the microspore) take place *in situ* within the microsporangium of the anther.

Question 173 Option: (b) – 3 to 13

Explanation: The normal physiological reference range for total serum bilirubin in a healthy adult is typically between 3 and 13 micromoles per liter ($\mu\text{mol/L}$).

Question 174 Option: (b) – Vermiform appendix, nictitating membrane and coccyx of man.

Explanation: The vermiform appendix, nictitating membrane (plica semilunaris), and the tail-bone (coccyx) are classic examples of vestigial structures retained in humans.

Question 175 Option: (b) – 0.02 %

Explanation: Of the total solar radiation reaching the Earth's atmosphere, only about 0.02% (or up to 1-2% of photosynthetically active radiation) is successfully captured and stored via photosynthesis.

Question 176 Option: (d) – they are re-absorbed in the vas deferens.

Explanation: If ejaculation does not occur, senescent spermatozoa within the male duct system undergo cell death and are subsequently phagocytosed and reabsorbed in the vas deferens.

Question 177 Option: (b) – dead organic matter

Explanation: The detritus food chain (DFC) begins with dead organic matter (detritus), which is decomposed and consumed by microscopic and macroscopic detritivores.

Question 178 Option: (b) – prevention of ends of the chromosomes from sticking together.

Explanation: Telomeres are repetitive nucleoprotein structures capping the ends of eukaryotic chromosomes, protecting them from degradation and preventing end-to-end chromosomal fusion.

Question 179 Option: (b) – Speech

Explanation: Broca's area, located in the frontal lobe of the dominant hemisphere, is the motor speech area. Injury to this region results in motor aphasia (impaired speech production).

Question 180 Option: (b) – Non- specificity

Explanation: The defining features of acquired (adaptive) immunity include high specificity for distinct antigens, immunological memory, diversity, and self/non-self discrimination.

Question 181 Option: (c) – Three

Explanation: The three nitrogenous bases common to both DNA and RNA polynucleotide chains are the purines Adenine and Guanine, and the pyrimidine Cytosine.

Question 182 Option: (b) – large amount of extra-cellular fat.

Explanation: White adipose tissue appears opaque and yellow/white due to the accumulation of a single large, hydrophobic lipid droplet containing triacylglycerols within each adipocyte.

Question 183 Option: (a) – include the activities of bee-keeping, dairy management, water harvesting, composting along with agriculture in the village.

Explanation: Integrated organic farming is a zero-waste, cyclic system where waste products from one process are utilized as nutrients for another, optimizing sustainability.

Question 184 Option: (c) – Retinitis pigmentosa

Explanation: Retinitis pigmentosa is a hereditary degenerative eye disease that can exhibit incomplete sex-linkage, as its genes are located on homologous regions of the X and Y chromosomes.

Question 185 Option: (d) – Carl Linnaeus

Explanation: The binomial system of nomenclature, which designates each species with a two-part scientific name (genus and species epithet), was established by Swedish botanist Carl Linnaeus.

Question 186 Option: (c) – phycobilins

Explanation: Red algae (Rhodophyta) contain accessory photosynthetic light-harvesting complexes called phycobiliproteins, which contain water-soluble phycobilin pigments.

Question 187 Option: (c) – Mixing of chromosomes of male and female pronuclei – Karyogamy

Explanation: The fusion of two nuclei is karyogamy, while the physical mixing of parental chromosomes following the breakdown of pronuclear membranes is termed amphimixis.

Question 188 Option: (d) – imbibition

Explanation: The initial phase of seed germination involves the passive absorption of water by hydrophilic dry colloids (proteins and cellulose) in the seed coat, a process called imbibition.

Question 189 Option: (b) – Contaminants

Explanation: During the tertiary (advanced) treatment phase of sewage treatment, physical and chemical precipitation methods isolate chemical pollutants and heavy metal contaminants.

Question 190 Option: (c) – degeneracy of genetic code.

Explanation: Crick's wobble hypothesis explains the degeneracy of the genetic code, showing how a single tRNA anticodon can recognize multiple codon triplets due to non-standard pairing at the third position.

Question 191 Option: (d) – DNA fragmentation

Explanation: In DNA profiling (fingerprinting), the step where isolated genomic DNA is cut into smaller, variable-sized fragments using restriction endonucleases is called DNA fragmentation.

Question 192 Option: (c) – cilia

Explanation: Prokaryotic bacterial cells can possess surface appendages such as flagella, pili, and fimbriae, but they do not possess eukaryotic cilia.

Question 193 Option: (c) – parenchyma

Explanation: In plant tissue culture, a callus is defined as an unorganized, proliferating mass of actively dividing, undifferentiated parenchyma cells.

Question 194 Option: (c) – α - ketoglutarate

Explanation: During the citric acid cycle, α -ketoglutarate undergoes oxidative decarboxylation catalyzed by the α -ketoglutarate dehydrogenase complex, releasing CO_2 and reducing NAD^+ to NADH.

Question 195 Option: (c) – Boron

Explanation: Boron is an essential micronutrient for cell wall structural integrity. Its deficiency leads to impaired pectin cross-linking, making plant cell walls brittle.

Question 196 Option: (a) – Plasmodium and Man

Explanation: The relationship between *Plasmodium* and humans is parasitism, where the parasite benefits at the host's expense. The other options represent mutually beneficial mutualistic relationships.

Question 197 Option: (a) – inguinal canal

Explanation: The inguinal canal is a bilateral oblique passage through the lower anterior abdominal wall that connects the abdominal cavity with the scrotal sacs.

Question 198 Option: (a) – Mixing 'Polyblend' in bitumen to be used.

Explanation: Polyblend is a fine powder of recycled modified plastic. Mixing Polyblend with hot bitumen significantly improves the water-repellent properties and durability of asphalt roads.

Question 199 Option: (c) – one and two

Explanation: In angiosperms, a diploid microspore mother cell undergoes one meiotic division to form four haploid microspores, each of which undergoes two mitotic divisions to form a mature three-celled male gametophyte.

Question 200 Option: (d) – insect

Explanation: The corona (a bright, prominent accessory floral structure) in the passion flower is an adaptation that attracts insect pollinators, facilitating entomophilous cross-pollination.