

MHT CET 2020 Biology Answer Key PDF

Answer Key

Section: Physics

Question 1 -Option- (4) V/r

Explanation: The angular speed of a particle in uniform circular motion is $\omega = V/r$. In one second, the angle described is $\theta = \omega t = V/r$.

Question 2 -Option- (4) short and large

Explanation: A compound microscope requires a short focal length objective to maximize magnification, while a telescope requires a large focal length objective to maximize light gathering.

Question 3 -Option- (4) 1.27 rad

Explanation: Rewriting Y_2 as a sine wave gives a phase of $50t + x/25 + \pi/2$. The phase difference is $(\pi/2) - 0.3 \approx 1.57 - 0.3 = 1.27$ rad.

Question 4 -Option- (3) $\frac{MR\omega}{2t}$

Explanation: The torque is $\tau = I\alpha = F \cdot R$. For a solid disc, $I = \frac{1}{2}MR^2$, which yields a tangential force of $F = \frac{MR\omega}{2t}$.

Question 5 -Option- (3) $\frac{4ML(R\omega^2 + g)}{\pi D^2 Y}$

Explanation: At the lowest point of a vertical circle, the tension is $T = M(R\omega^2 + g)$. Substituting this into the elongation formula yields the expression.

Question 6 -Option- (4) $[L^4]$

Explanation: Squaring both sides of the equation and solving for x in terms of dimensions gives $[x] = \frac{[M][L^3]}{[ML^{-1}T^{-2}][T^2]} = [L^4]$.

Question 7 -Option- (4) (B)

Explanation: In an LC parallel resonant circuit, the impedance reaches a maximum at the resonant frequency, which is correctly illustrated by the curve in graph (B).

Question 8 -Option- (1) $n/3$

Explanation: Applying shunt-to-galvanometer resistance ratios to double the current range dictates that the required additional parallel shunt value is $n/3$.

Question 9 -Option- (3) $\frac{2mL^3}{3}$

Explanation: The total mass of the rod is $M = 2mL$. The moment of inertia about the center is $I = \frac{1}{12}M(2L)^2 = \frac{2mL^3}{3}$.

Question 10 -Option- (3) $6\mu A$

Explanation: The displacement current is $I_d = C \frac{dV}{dt}$. Substituting the given capacity and voltage rate yields $2\mu F \times 3 V/s = 6\mu A$.

Question 11 -Option- (4) (A)

Explanation: Inside the Earth, gravity decreases linearly with depth, and outside, it decreases quadratically with height, which is represented by graph (A).

Question 12 -Option- (2) remains same

Explanation: The stopping potential is determined solely by the frequency of the incident light and is independent of its intensity.

Question 13 -Option- (3) $\pi/4$

Explanation: The areas of a square loop and a circular loop of equal perimeter are $L^2/16$ and $L^2/4\pi$ respectively. Their ratio is $\pi/4$.

Question 14 -Option- (4) $\frac{V}{\mu g}$

Explanation: The deceleration due to sliding friction is $a = \mu g$. The time taken to come to rest is given by $t = V/a = V/\mu g$.

Question 15 -Option- (2) 1000

Explanation: The current gain is $\beta = 1.5 \text{ mA}/20 \text{ } \mu\text{H} = 75$. The voltage gain is $A_v = \beta \frac{R_L}{R_i} = 75 \times \frac{2000}{150} = 1000$.

Question 16 -Option- (2) 24Ω

Explanation: Standard balancing equations for a meter bridge yield the smaller unknown resistance as 24Ω .

Question 17 -Option- (2) $2E$

Explanation: For a satellite in a stable circular orbit, the potential energy is twice the total mechanical energy ($V = 2E$).

Question 18 -Option- (4) 8.4 mm

Explanation: The level difference in a U-tube is $h = \frac{2T}{\rho g} \left(\frac{1}{r_2} - \frac{1}{r_1} \right)$. Substituting the values yields 8.4 mm.

Question 19 -Option- (4) $4 \times 10^5 \text{ A/m}$

Explanation: Volume $V = m/d = 10^{-5} \text{ m}^3$. The intensity of magnetization is $I = M/V = 4/10^{-5} = 4 \times 10^5 \text{ A/m}$.

Question 20 -Option- (2) n^0

Explanation: Since $L \propto n$ and $p \propto 1/n$, their product is proportional to n^0 , making it independent of the quantum number.

Question 21 -Option- (3) $\frac{d_1^2 + d_2^2}{2}$

Explanation: By the parallelogram law of vectors, the sum of the squares of the diagonals is equal to twice the sum of the squares of adjacent sides.

Question 22 -Option- (3) $(\mu - 1)$

Explanation: Refractivity of a medium is defined as the deviation per unit angle of incidence, mathematically expressed as $(\mu - 1)$.

Question 23 -Option- (2) $\frac{Mr}{\pi R^2 \rho \ell}$

Explanation: Applying Poisson's ratio definitions to a stretched wire under load yields the expression in option (2).

Question 24 -Option- (4) 4 : 1

Explanation: For capacitors in series, the potential difference across each is inversely proportional to its capacitance: $V_2/V_1 = C_1/C_2 = 4/1$.

Question 25 -Option- (1) be increased

Explanation: Decreasing the primary current reduces the potential gradient, thereby increasing the balancing length required for the same potential.

Question 26 -Option- (1) 25/21

Explanation: The ratio of the adiabatic constants is $\frac{\gamma_{\text{mono}}}{\gamma_{\text{dia}}} = \frac{5/3}{7/5} = \frac{25}{21}$.

Question 27 -Option- (2) $\left(\frac{r}{V}\right)^2 \alpha$

Explanation: Tangential acceleration is $r\alpha$ and radial is V^2/r , giving a ratio of $\frac{r^2 \alpha}{V^2}$.

Question 28 -Option- (1) 5λ

Explanation: Equating the two photoelectric equations $eV = hc/\lambda - W_0$ and $eV/6 = hc/3\lambda - W_0$ yields the threshold wavelength $\lambda_0 = 5\lambda$.

Question 9 -Option- (1) 10π

Explanation: The wavelength is $\lambda = 2\pi/0.4 = 5\pi$. For the 4th harmonic, the length of the string is $2\lambda = 10\pi$.

Question 30 -Option- (3) will not change

Explanation: The resonating frequency of the air column in a resonance tube is determined solely by the length of the column, independent of the liquid's density.

Question 31 -Option- (2) 1.77

Explanation: Equating the path positions: $8\lambda_m = 4.5\lambda \implies \mu = 8/4.5 \approx 1.77$.

Question 32 -Option- (1) 1.5 cm

Explanation: For a single surface of contact, $F = T \cdot C \implies C = F/T = 105/70 = 1.5$ cm.

Question 33 -Option- (2) 400Ω

Explanation: Since $V = I_g(G + 50)$ and $2V = I_g(G + 500)$, dividing the two equations yields the galvanometer resistance $G = 400\Omega$.

Question 34 -Option- (4) NAND

Explanation: The Boolean expression $C = \overline{A \cdot B}$ represents the logic operation of a NAND gate.

Question 35 -Option- (2) $\sqrt{13}P$

Explanation: By conservation of momentum, $\vec{P}_3 = -(\vec{P}_1 + \vec{P}_2) = 3P\hat{i} - 2P\hat{j}$, which has a magnitude of $\sqrt{13}P$.

Question 36 -Option- (3) 3 P

Explanation: Isothermal expansion yields $P_1 = P/9$. The subsequent adiabatic compression gives $P_f = P_1(9)^\gamma = \frac{P}{9}(27) = 3P$.

Question 37 -Option- (4) $\sqrt{2}n$

Explanation: Since velocity $v \propto \sqrt{T}$, doubling the tension increases the wave speed and frequency by a factor of $\sqrt{2}$.

Question 38 -Option- (4) 25 I and I

Explanation: $I_{\max} = (\sqrt{9I} + \sqrt{4I})^2 = 25I$ and $I_{\min} = (\sqrt{9I} - \sqrt{4I})^2 = I$.

Question 39 -Option- (1) $\frac{15hR}{16m}$

Explanation: The momentum of the emitted photon is $p = E/c$. By conservation of momentum, the recoil velocity of the hydrogen atom is $v = \frac{15hR}{16m}$.

Question 40 -Option- (3) F/18

Explanation: Since force $F \propto I_1 I_2 / d$, the new force is $F' \propto \frac{(I/3)(I/3)}{2d} = \frac{F}{18}$.

Question 41 -Option- (1) $\frac{K(N+1)}{N}$

Explanation: Spring constant is inversely proportional to length, giving $K_1 = K \frac{L}{L_1} = K \frac{N+1}{N}$.

Question 42 -Option- (4) $\frac{MgA^2}{2L}$

Explanation: The maximum potential energy of a simple pendulum is $U = \frac{1}{2}M\omega^2 A^2 = \frac{1}{2}M(g/L)A^2 = \frac{MgA^2}{2L}$.

Question 43 -Option- (2) $\sin^{-1}(5t/T)$

Explanation: Refractive index $\mu = \frac{c}{v} = \frac{T}{5t}$. The critical angle is $\theta_c = \sin^{-1}(1/\mu) = \sin^{-1}(5t/T)$.

Question 44 -Option- (3) $\frac{qV}{dm}$

Explanation: The electric field is $E = V/d$, which exerts a force $F = qE$, yielding an acceleration of $a = qV/md$.

Question 45 -Option- (2) $\frac{2B\sqrt{A^3}}{\mu_0\sqrt{\pi}}$

Explanation: The radius is $r = \sqrt{A/\pi}$. Substituting this into $B = \mu_0 I/2r$ and solving for $M = IA$ yields the expression.

Question 46 -Option- (4) $\sqrt{2gh}$

Explanation: Retaining $1/4$ of its energy means the rebound velocity is half the impact velocity, which is equivalent to $\sqrt{2gh}$.

Question 47 -Option- (4) $A/2$

Explanation: Since $K.E. = 3E/4 \implies P.E. = E/4$. Thus, $\frac{1}{2}kx^2 = \frac{1}{4}(\frac{1}{2}kA^2) \implies x = A/2$.

Question 48 -Option- (1) phaseshift

Explanation: In phase modulation, the phase shift of the carrier wave is varied in accordance with the modulating signal.

Question 49 -Option- (3) $\frac{8}{5}MR^2 + 2ML^2$

Explanation: Two spheres on the axis contribute $2(\frac{2}{5}MR^2)$, and two at distance L contribute $2(\frac{2}{5}MR^2 + ML^2)$, totaling $\frac{8}{5}MR^2 + 2ML^2$.

Question 50 -Option- (4) $2(F_1^2 + F_2^2)$

Explanation: By vector addition, the sum of the squares of the resultants of addition and subtraction of two vectors is $2(F_1^2 + F_2^2)$.

Section: Chemistry

Question 1 -Option- (4) Vitamin K

Explanation: Vitamin K is essential for the synthesis of prothrombin and other clotting factors to prevent hemorrhaging.

Question 2 -Option- (1) HDPE

Explanation: High-density polyethylene (HDPE) is synthesized using Ziegler-Natta catalysts under relatively mild conditions.

Question 3 -Option- (2) $Mg > Al > Cr > Fe$

Explanation: This order reflects the standard reduction potentials of the metals, where magnesium is the most easily oxidized.

Question 4 -Option- (1) Fe

Explanation: Iron (Fe) is placed below zinc in the reactivity series and therefore cannot displace zinc from its salt solutions.

Question 5 -Option- (3) 1.6605×10^{-24} g

Explanation: One atomic mass unit (amu) is defined as $1/12$ th of the mass of a carbon-12 atom, which is 1.6605×10^{-24} g.

Question 6 -Option- (1) oxygen atoms per molecule

Explanation: The oxidation state of chlorine in oxyacids (like $HClO_4$) increases with the number of oxygen atoms bonded to it.

Question 7 -Option- (1) Neutralize stomach acid

Explanation: Histamine stimulates the secretion of hydrochloric acid in the stomach; it does not neutralize it.

Question 8 -Option- (2) Cyclohexanone

Explanation: Alkaline hydrolysis of a gem-dihalide like 1,1-dichlorocyclohexane yields an unstable gem-diol which dehydrates to cyclohexanone.

Question 9 -Option- (4) 2-bromobutane only

Explanation: Hydrohalogenation of both but-1-ene and but-2-ene with HBr yields 2-bromobutane as the major product.

Question 10 -Option- (4) Baking Powder

Explanation: Baking powder is a mixture containing sodium bicarbonate, starch, and an acidic leavening agent like potassium hydrogen tartrate.

Question 11 -Option- (1) o, m and p

Explanation: In a strongly acidic medium, aniline gets protonated to form the meta-directing anilinium ion, yielding a mixture of ortho, meta, and para isomers.

Question 12 -Option- (2) association

Explanation: Acetic acid undergoes dimerization (association) in non-polar solvents like benzene through intermolecular hydrogen bonding.

Question 13 -Option- (3) Alkyl isocyanide

Explanation: The reaction of a primary amine with chloroform and KOH (carbylamine reaction) produces an alkyl isocyanide.

Question 14 -Option- (3) Cr^{3+} and Co^{2+}

Explanation: Both Cr^{3+} ($3d^3$) and Co^{2+} ($3d^7$) ions contain exactly three unpaired electrons, giving them the same spin-only magnetic moment.

Question 15 -Option- (4) Adding water to gold sol

Explanation: Dilution with water does not affect the stability or cause coagulation of a lyophobic gold sol.

Question 16 -Option- (4) Saran

Explanation: Saran (a copolymer of vinylidene chloride and vinyl chloride) exhibits low permeability to oxygen and is used for food packaging.

Question 17 -Option- (1) Kolbe's reaction

Explanation: The conversion of phenol to salicylic acid using sodium hydroxide and carbon dioxide is known as Kolbe's reaction.

Question 18 -Option- (4) $\Delta H = -$, $\Delta S = +$, $\Delta G = -$

Explanation: An exothermic reaction ($\Delta H = -$) accompanied by an increase in entropy ($\Delta S = +$) is spontaneous ($\Delta G = -$) at all temperatures.

Question 19 -Option- (2) Zinc Oxide

Explanation: Roasting zinc blende (ZnS) in the presence of excess oxygen at high temperatures yields zinc oxide (ZnO).

Question 20 -Option- (1) Two moles $AgCl$

Explanation: The coordination complex $[Co(NH_3)_5Cl]Cl_2$ releases two moles of chloride ions per mole, yielding two moles of $AgCl$ precipitate.

Question 21 -Option- (2) $[Co(NH_3)_6]Cl_3$

Explanation: Homoleptic complexes contain only one type of ligand coordinated to the central metal ion.

Question 22 -Option- (3) $i = M_{obs}/M_{theo}$

Explanation: The correct relationship is $i = M_{theoretical}/M_{observed}$, making option (3) incorrect.

Question 23 -Option- (3) Diethyl ether, ethanol

Explanation: Natalite is a fuel mixture primarily consisting of diethyl ether and ethanol.

Question 24 -Option- (3) Salvarsan

Explanation: Salvarsan is an organoarsenic antimicrobial agent featuring an $As = As$ double bond linkage.

Question 25 -Option- (3) Benzoquinone

Explanation: Controlled oxidation of phenol with chromic acid or Jones reagent yields para-benzoquinone.

Question 26 -Option- (2) Lecithin

Explanation: Lecithin is a phospholipid, which is classified as a complex lipid containing phosphoric acid and a nitrogenous base.

Question 27 -Option- (3) Cerium

Explanation: Cerium (Ce^{4+}) achieves a stable empty f -subshell configuration ($[Xe]4f^0$) in its +4 oxidation state.

Question 28 -Option- (3) Propanone

Explanation: Ozonolysis of tetramethyl ethylene followed by reductive workup breaks the double bond to yield two molecules of propanone (acetone).

Question 29 -Option- (4) isobutyl bromide

Explanation: The Wurtz coupling of isobutyl bromide in the presence of sodium metal yields 2,5-dimethylhexane.

Question 30 -Option- (2) H_3PO_3

Explanation: In phosphorous acid (H_3PO_3), the oxidation state of phosphorus is +3.

Question 31 -Option- (1) $2RCOOH + 2Na \rightarrow 2RCOONa + H_2$

Explanation: Carboxylic acids react with active metals like sodium to liberate hydrogen gas, demonstrating their acidic character.

Question 32 -Option- (2) Cl

Explanation: Photolytic cleavage of chlorine gas in the mechanism yields atomic chlorine (Cl) radicals as intermediates.

Question 33 -Option- (3) 60°

Explanation: The dihedral (torsion) angle between adjacent hydrogen atoms in the most stable staggered conformation of ethane is 60° .

Question 34 -Option- (4) Macroscopic

Explanation: Thermodynamics is a branch of physical science that deals solely with the macroscopic properties of matter.

Question 35 -Option- (4) Methane

Explanation: Carbon in methane is sp^3 hybridized, containing exactly 25% s -character and 75% p -character.

Question 36 -Option- (4) 130×10^{-23} g

Explanation: Mass of fcc unit cell is $\frac{z \cdot M}{N_A} = \frac{4 \times 197}{6.022 \times 10^{23}} \approx 130 \times 10^{-23}$ g.

Question 37 -Option- (3) 1.85×10^{-8} cm

Explanation: For bcc, $r = \frac{\sqrt{3}}{4}a$. Substituting $a = 4.29 \times 10^{-8}$ cm yields 1.85×10^{-8} cm.

Question 38 -Option- (4) 2

Explanation: Oxygen atoms involved in terminal double bonds or single bonds in oxyacids retain 2 lone pairs of electrons.

Question 39 -Option- (2) +7

Explanation: In perchloric acid ($HClO_4$), the oxidation state of chlorine is at its maximum value of +7.

Question 40 -Option- (3) Zero

Explanation: The molecular orbital configuration of Be_2 yields equal numbers of bonding and antibonding electrons, resulting in a bond order of zero.

Question 41 -Option- (1) B_2H_6

Explanation: Diborane (B_2H_6) is a polynuclear hydride containing bridge hydrogens, unlike mononuclear molecular hydrides.

Question 42 -Option- (4) $2^{(a-b)}$

Explanation: If the rate law is $r = k[A]^a[B]^b$, the new rate ratio is $r_2/r_1 = 2^a(1/2)^b = 2^{(a-b)}$.

Question 43 -Option- (2) Neopentane

Explanation: Neopentane has 12 equivalent primary hydrogens, so its free-radical chlorination yields only one monochloro derivative.

Question 44 -Option- (1) Cyclohexane

Explanation: Cyclohexane is a fully saturated alicyclic hydrocarbon containing no conjugated π systems, preventing resonance.

Question 45 -Option- (1) 212.3 kJ

Explanation: Maximum electrical work is $W_{\max} = -\Delta G^\circ = nFE^\circ = 2 \times 96500 \times 1.10 = 212.3 \text{ kJ}$.

Question 46 -Option- (3) 36 g

Explanation: Combustion of 1 mole of methane ($\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$) produces 2 moles of water, equivalent to 36 g.

Question 47 -Option- (4) Prop-2-en-1-amine

Explanation: The three-carbon chain containing an amine group at C-1 and a double bond starting at C-2 is named prop-2-en-1-amine.

Question 48 -Option- (3) Oxygen

Explanation: Oxygen is a non-polar gas with extremely weak intermolecular forces, making it difficult to liquefy compared to polar gases.

Question 49 -Option- (3) 140 pm

Explanation: For fcc, the atomic radius is $r = \frac{a}{2\sqrt{2}} = \frac{396}{2\sqrt{2}} \approx 140 \text{ pm}$.

Question 50 -Option- (3) $\text{Al}_2(\text{SO}_4)_3$

Explanation: Both $\text{K}_4[\text{Fe}(\text{CN})_6]$ and $\text{Al}_2(\text{SO}_4)_3$ completely dissociate to yield 5 ions per formula unit, giving them the same van't Hoff factor.

Section: Biology

Question 1 -Option- (1) a-iii, b-i, c-iv, d-ii

Explanation: Correctly matches chromosomes based on centromere position: metacentric, submetacentric, acrocentric, and telocentric.

Question 2 -Option- (4) High threshold-amino acids

Explanation: Amino acids are completely reabsorbed by active transport in the renal tubules, classifying them as high-threshold substances.

Question 3 -Option- (3) Bakane

Explanation: Bakane (foolish seedling) disease in rice is caused by the fungal pathogen *Gibberella fujikuroi*, which secretes excess gibberellins.

Question 4 -Option- (3) in-breeding

Explanation: Continuous self-fertilization or inbreeding exposes harmful recessive genes, allowing them to be eliminated by selection.

Question 5 -Option- (3) amoebocytes

Explanation: The outer chitinous layer of freshwater sponge gemmules is secreted by specialized amoebocytes.

Question 6 -Option- (2) shoot apical meristem

Explanation: Meristem tip culture (using the shoot apical meristem) is the most effective micropropagation technique to obtain virus-free plants.

Question 7 -Option- (3) Maturation

Explanation: Root hairs, which are cellular prolongations of the epidermal cells, develop primarily in the region of maturation.

Question 8 -Option- (4) estrogen

Explanation: The follicular cells (granulosa cells) of the developing Graafian follicle synthesize and secrete estrogen.

Question 9 -Option- (4) counter-current flow

Explanation: The counter-current flow mechanism (water and blood flowing in opposite directions) maximizes oxygen exchange efficiency in fish gills.

Question 10 -Option- (2) Bacteria, mitochondria, chloroplasts

Explanation: Prokaryotic cells (bacteria) and semi-autonomous eukaryotic organelles (mitochondria and chloroplasts) contain 70S ribosomes.

Question 11 -Option- (3) Wine

Explanation: Wine is an un-distilled alcoholic beverage produced directly by the fermentation of fruit juices (primarily grapes).

Question 12 -Option- (1) ii, iii, iv

Explanation: The sub-order Anthropoidea includes higher primates: monkeys (ii), apes (iii), and humans (iv).

Question 13 -Option- (1) liver

Explanation: Chronic alcohol abuse primarily damages liver tissues, leading to fat accumulation, inflammation, and irreversible liver cirrhosis.

Question 14 -Option- (1) DNase for emphysema

Explanation: This is incorrect because recombinant DNase is used to treat cystic fibrosis, whereas emphysema is treated with α -1-antitrypsin.

Question 15 -Option- (2) cytochrome - f

Explanation: Cytochromes are iron-containing hemeoproteins that serve as essential electron carriers in photosynthesis and respiration.

Question 16 -Option- (1) single, Golgi

Explanation: Lysosomes are single-membrane-bound vesicular organelles that originate by budding off from the trans-Golgi network.

Question 17 -Option- (4) oxaloacetic

Explanation: The first stable product of carbon fixation in C₄ plants is the 4-carbon dicarboxylic acid, oxaloacetic acid (OAA).

Question 18 -Option- (1) rotation of eyeball

Explanation: Eye rotation is controlled by cranial nerves III, IV, and VI, whereas the glossopharyngeal (IX) nerve controls swallowing, saliva, and taste.

Question 19 -Option- (1) hydrogen

Explanation: The denaturation step in PCR (94°C) uses thermal energy to break the hydrogen bonds holding the two DNA strands together.

Question 20 -Option- (3) 1

Explanation: The female gametophyte of angiosperms contains only one functional female gamete, which is the haploid egg cell.

Question 21 -Option- (1) SO₂

Explanation: Sulfur dioxide (SO₂) is a major air pollutant that oxidizes to form acid rain, leading to the deterioration of stone buildings.

Question 22 -Option- (1) a-iii, b-iv, c-ii, d-i

Explanation: Matches the common infectious human diseases with their respective causative pathogenic agents.

Question 23 -Option- (2) living cells active role

Explanation: According to the cohesion-tension theory, water translocation is a passive physical process; living xylem cells do not play an active role.

Question 24 -Option- (2) B and C

Explanation: Vitamins B and C are hydrophilic (water-soluble), whereas vitamins A, D, E, and K are lipophilic (fat-soluble).

Question 25 -Option- (3) 100

Explanation: Tachycardia is defined clinically as an abnormally rapid resting heart rate exceeding 100 beats per minute.

Question 26 -Option- (1) granulosa

Explanation: The corona radiata consists of an outer layer of follicular granulosa cells adhering closely to the zona pellucida of the oocyte.

Question 27 -Option- (4) delaying senescence

Explanation: The Richmond-Lang effect refers to the physiological delay of leaf senescence promoted by the application of cytokinins.

Question 28 -Option- (1) insects

Explanation: Both *Salvia* and *Cestrum* feature specialized floral adaptations to facilitate insect pollination (entomophily).

Question 29 -Option- (4) collecting → minor → major → pelvis

Explanation: Urine flows from the collecting ducts to the minor calyces, major calyces, renal pelvis, and then drains into the ureter.

Question 30 -Option- (1) Frag, leach, cat, hum, min

Explanation: The correct sequence of decomposition is: Fragmentation → Leaching → Catabolism → Humification → Mineralization.

Question 31 -Option- (1) x-DNA, y-inner, z-lamellae

Explanation: Correctly identifies the chloroplast structural compartments and components labeled in the diagram.

Question 32 -Option- (4) Isomerization

Explanation: Phosphoglyceromutase catalyzes the reversible isomerization of 3-phosphoglycerate into 2-phosphoglycerate in glycolysis.

Question 33 -Option- (3) Dr. Arnon

Explanation: Daniel Arnon and his colleagues first discovered and proposed the cyclic and non-cyclic photophosphorylation pathways in chloroplasts.

Question 34 -Option- (1) fungal

Explanation: Aspergillosis is a respiratory tract infection of poultry birds caused by the opportunistic fungus *Aspergillus fumigatus*.

Question 35 -Option- (3) A-toxoid, B-adjuvant

Explanation: Toxoids are chemically inactivated toxins used as antigens, and adjuvants are compounds added to enhance the host's immune response.

Question 36 -Option- (3) vasoconstriction

Explanation: Atrial Natriuretic Factor (ANF) acts as a powerful vasodilator, reducing blood pressure, and is not a vasoconstrictor.

Question 37 -Option- (2) 4 ATP

Explanation: During glycolysis, a total of 4 ATP molecules are synthesized directly by substrate-level phosphorylation (giving a net gain of 2 ATP).

Question 38 -Option- (2) shape

Explanation: The volume of the nucleus, its DNA content, and proteins determine its size, which is independent of its overall shape.

Question 39 -Option- (1) Cardiac autonomic SA

Explanation: This statement is incorrect as the SA node generates action potentials spontaneously (myogenic), though modulated by autonomic nerves.

Question 40 -Option- (3) joining gene into vector

Explanation: DNA ligase is used in genetic engineering to catalyze the formation of phosphodiester bonds, sealing the gene of interest into the vector.

Question 41 -Option- (3) Haeckel

Explanation: Ernst Haeckel proposed the three-kingdom classification system, introducing the third kingdom "Protista" for unicellular organisms.

Question 42 -Option- (2) Mono, Di, Tri

Explanation: Mendel performed monohybrid, dihybrid, and trihybrid crosses to formulate the laws of inheritance in pea plants.

Question 43 -Option- (3) 31 pairs

Explanation: Human beings possess 31 pairs of spinal nerves originating from the spinal cord, all of which are mixed nerves.

Question 44 -Option- (1) Folded

Explanation: Transfer RNA (tRNA) is a single-stranded molecule folded into a characteristic cloverleaf secondary structure.

Question 45 -Option- (2) mucous

Explanation: Goblet cells are specialized simple columnar epithelial cells whose primary function is to secrete mucous.

Question 46 -Option- (2) natality

Explanation: Population density increase is primarily driven by natality (birth rate) and immigration into the habitat.

Question 47 -Option- (1) apomictic

Explanation: Hybrid seeds must be bought every year due to genetic segregation. Utilizing apomixis prevents segregation, maintaining hybrid traits.

Question 48 -Option- (1) zero

Explanation: The water potential of pure water at standard temperature and pressure is conventionally defined as zero.

Question 49 -Option- (3) m-RNA

Explanation: Messenger RNA (mRNA) carries the transcribed genetic code from DNA to the ribosomes to direct polypeptide synthesis.

Question 50 -Option- (4) less than one

Explanation: The Respiratory Quotient (RQ) for proteins is less than one, typically averaging around 0.9.

Question 51 -Option- (2) vasc, vag, alb

Explanation: The protective tissue layers of the testis from innermost to outermost are Tunica vasculosa, Tunica albuginea, and Tunica vaginalis.

Question 52 -Option- (1) Cellulose

Explanation: Cellulose is a linear homopolysaccharide of glucose that is highly insoluble in water, unlike simple monosaccharides.

Question 53 -Option- (3) hybridization

Explanation: Molecular hybridization involves the pairing of a single-stranded target DNA sample with a complementary labeled single-stranded probe.

Question 54 -Option- (3) Dihybrid

Explanation: The ratio 315 : 108 : 101 : 32 is approximately equal to 9 : 3 : 3 : 1, which is the characteristic phenotypic ratio of an F_2 dihybrid cross.

Question 55 -Option- (2) Xanthomonas

Explanation: Certain pathogenic strains of the bacterium *Xanthomonas* are formulated and applied as bioherbicides to control specific weed species.

Question 56 -Option- (2) both dominant

Explanation: Codominance occurs when both alleles of a gene pair are fully and independently expressed in the phenotype of a heterozygote.

Question 57 -Option- (3) Oxalosuccinate

Explanation: The first decarboxylation in the Krebs cycle is the conversion of oxalosuccinate to α -ketoglutarate, releasing a molecule of CO_2 .

Question 58 -Option- (1) somatotropin hyposecretion

Explanation: Pituitary dwarfism in children is caused by the hyposecretion of growth hormone (somatotropin) during development.

Question 59 -Option- (2) Foliose

Explanation: Foliose (flat, leaf-like) lichens are anchored to the sub-stratum using specialized hair-like fungal structures called rhizines.

Question 60 -Option- (4) Transcription

Explanation: Restriction endonucleases, vectors, and host systems are key tools in rDNA technology, whereas transcription is a cellular pathway.

Question 61 -Option- (1) secondary oocyte

Explanation: During the first meiotic division of oogenesis, unequal cytokinesis concentrates nearly all the cytoplasm into the secondary oocyte.

Question 62 -Option- (1) community

Explanation: A biotic community is defined as the sum total of populations of different species coexisting and interacting in a shared habitat.

Question 63 -Option- (1) erythrocytes

Explanation: Erythrocytes (red blood cells) are the most abundant cellular elements in human blood, numbering about 5 million per cubic millimeter.

Question 64 -Option- (3) Haemophilia RBCs sickle

Explanation: This is incorrect because sickling of red blood cells is the characteristic feature of sickle cell anemia, not hemophilia.

Question 65 -Option- (1) High T, High I, Low CO_2

Explanation: Photorespiration (C2 cycle) is initiated when RuBisCO acts as an oxygenase under high temperature, high light intensity, and low CO_2 conditions.

Question 66 -Option- (4) skeletal

Explanation: Somatic reflexes are involuntary motor responses where the effector organs are always skeletal muscles.

Question 67 -Option- (3) reaction

Explanation: Species-specific fertilization is ensured by the compatible biochemical reaction between fertilizin (on egg) and antifertilizin (on sperm).

Question 68 -Option- (2) Phycomycetes

Explanation: Phycomycetes (lower fungi) are characterized by having aseptate, multinucleate, and coenocytic hyphae.

Question 69 -Option- (1) Ocean

Explanation: The global oceans act as the major sink and reservoir of carbon, holding about 71

Question 70 -Option- (4) Dryopithecus

Explanation: *Dryopithecus* is one of the oldest known Miocene fossil primates representing a common ancestor of both apes and humans.

Question 71 -Option- (2) Creatinine

Explanation: Glucose, amino acids, and fatty acids are organic nutrients, whereas creatinine is a nitrogenous metabolic waste product.

Question 72 -Option- (2) AB blood group

Explanation: The AB blood group in humans is a classic example of codominance, where both I^A and I^B alleles are fully expressed.

Question 73 -Option- (4) naming procedure

Explanation: The nomenclature of restriction endonucleases (like EcoRI) refers to a systematic naming procedure based on bacterial genus, species, strain, and order of isolation.

Question 74 -Option- (2) vital activities stop

Explanation: The medulla oblongata controls vital autonomic centers (cardiac, vasomotor, respiratory). Its injury stops these vital activities, causing sudden death.

Question 75 -Option- (3) iron

Explanation: Transgenic biofortified "golden rice" varieties are engineered to contain up to five times more iron than conventional varieties.

Question 76 -Option- (3) Twenty

Explanation: In polygenic inheritance of skin color (3 genes), the F_2 generation yields exactly 20/64 intermediate offsprings (mulattoes).

Question 77 -Option- (4) ZZ

Explanation: In birds, sex determination follows the ZW system, where the male is the homogametic sex carrying the ZZ sex chromosomes.

Question 78 -Option- (4) cytoplasm

Explanation: All the enzymatic reactions of glycolysis (EMP pathway) occur in the cytosol (cytoplasm) of the cell.

Question 79 -Option- (3) anemophily

Explanation: Flowers adapted for wind pollination (anemophily) are typically small, inconspicuous, and lack bright colors or nectar.

Question 80 -Option- (4) Tiger-deer

Explanation: The relationship between a tiger and a deer is a classic example of predation, where the predator kills and consumes the prey.

Question 81 -Option- (2) 64

Explanation: Standard developmental anatomy of plant microsporangia shows an average of 64 pollen mother cells per microsporangium.

Question 82 -Option- (3) thoracic volume increases

Explanation: This is incorrect because during passive expiration, the diaphragm and intercostal muscles relax, decreasing (not increasing) thoracic volume.

Question 83 -Option- (2) Extinct habit

Explanation: Studying fossil layers helps reconstruct the evolutionary history and extinct habits of ancient organisms.

Question 84 -Option- (2) Kwashiorkor

Explanation: Kwashiorkor is a form of severe protein malnutrition characterized by edema, stunted growth, and a bloated abdomen in children.

Question 85 -Option- (1) monkeys, apes, humans

Explanation: The menstrual cycle is a physiological reproductive cycle characteristic of female primates (monkeys, apes, and humans).

Question 86 -Option- (2) Jurassic

Explanation: The Jurassic period of the Mesozoic era is widely known as the Golden Age of Reptiles due to the worldwide dominance of dinosaurs.

Question 87 -Option- (2) Cytoplasm, Fibroblast

Explanation: Correctly identifies the cells and cellular components labeled in the given animal connective tissue diagram.

Question 88 -Option- (4) Ergot fungus

Explanation: Lysergic acid diethylamide (LSD) is a powerful semisynthetic psychedelic drug derived from ergot alkaloids produced by the fungus *Claviceps purpurea*.

Question 89 -Option- (4) larval

Explanation: The monarch butterfly acquires toxic cardiac glycosides during its caterpillar (larval) stage by feeding on poisonous milkweed plants.

Question 90 -Option- (4) $A+G=T+C$

Explanation: According to Chargaff's rules of base pairing, the sum of purines (Adenine + Guanine) is always equal to the sum of pyrimidines (Thymine + Cytosine).

Question 91 -Option- (1) Variations

Explanation: Since vegetative propagation is an asexual method of reproduction, the offspring are genetic clones of the parent and show no variations.

Question 92 -Option- (1) heparin

Explanation: Basophils are granulocytes that synthesize and secrete heparin (an anticoagulant) along with histamine and serotonin.

Question 93 -Option- (1) neurilemma

Explanation: The outermost nucleated sheath of Schwann cells surrounding the axon of a peripheral nerve fiber is the neurilemma.

Question 94 -Option- (2) release chain

Explanation: Release factors (R1, R2, and S) facilitate the termination of translation and catalyze the release of the newly synthesized polypeptide chain.

Question 95 -Option- (4) 149.6 Å

Explanation: In B-DNA, the distance between adjacent base pairs is 3.4 Å. Thus, a segment of 44 base pairs has a physical length of $44 \times 3.4 = 149.6$ Å.

Question 96 -Option- (4) cotton

Explanation: Bollworms are devastating insect pests that primarily attack and destroy cotton crops.

Question 97 -Option- (2) Siphonogamy

Explanation: Porogamy, chalazogamy, and mesogamy refer to the specific entry sites of the pollen tube, whereas siphonogamy is the general process of tube growth.

Question 98 -Option- (1) a-iii, b-i, c-ii, d-iv

Explanation: Correctly matches the biological structures and processes listed in columns a to d.

Question 99 -Option- (4) right side diaphragm

Explanation: The liver is the largest internal gland, anatomically located in the upper right quadrant of the abdominal cavity, just beneath the diaphragm.

Question 100 -Option- (4) Progesterone

Explanation: Progesterone, secreted by the corpus luteum and later by the placenta, is essential to maintain the endometrium during pregnancy.