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**CEE Based Model Questions  
Answer Key & Explanations  
(Set- A)**

# Answer Key + Explanations

## Zoology

| Q  | Answer | Explanation                                                                                                                |
|----|--------|----------------------------------------------------------------------------------------------------------------------------|
| 1  | B      | Species is the basic unit of biological classification.                                                                    |
| 2  | C      | Echinoderms possess a characteristic water vascular system used in locomotion, feeding and respiration.                    |
| 3  | B      | Chordates characteristically possess a notochord at least during some stage of development.                                |
| 4  | B      | Aschelminthes/Nematoda are pseudocoelomate animals.                                                                        |
| 5  | B      | Homologous structures have common evolutionary origin but may perform different functions, indicating divergent evolution. |
| 6  | C      | Sporozoites are injected into humans with the saliva of an infected female <i>Anopheles</i> mosquito.                      |
| 7  | C      | Sexual reproduction of <i>Plasmodium</i> occurs inside the female <i>Anopheles</i> mosquito.                               |
| 8  | C      | <i>P. falciparum</i> causes severe and potentially fatal malaria, including cerebral malaria.                              |
| 9  | B      | Typhlosole increases the internal surface area of the intestine, improving absorption.                                     |
| 10 | C      | Nephridia are the principal excretory organs of earthworms.                                                                |
| 11 | B      | Earthworms have a closed circulatory system in which blood remains within vessels.                                         |
| 12 | C      | Adult frogs respire through both lungs and moist skin.                                                                     |
| 13 | B      | The sinoatrial (SA) node generates the normal rhythmic electrical impulse of the heart.                                    |
| 14 | B      | The left ventricle pumps blood through systemic circulation, requiring greater pressure.                                   |
| 15 | C      | O-negative RBCs lack A, B and Rh(D) antigens and are commonly considered the universal RBC donor type.                     |
| 16 | B      | ADH increases water reabsorption, particularly in the collecting ducts.                                                    |
| 17 | C      | Blood is ultrafiltered through the glomerular capillaries into Bowman's capsule.                                           |
| 18 | B      | The nephron is the structural and functional unit of the kidney.                                                           |
| 19 | D      | Fertilization normally occurs in the ampullary region of the fallopian tube.                                               |
| 20 | B      | A mid-cycle LH surge triggers ovulation.                                                                                   |
| 21 | C      | Insulin promotes glucose uptake and storage, thereby lowering blood glucose.                                               |
| 22 | C      | The cerebellum coordinates balance, posture and fine muscular movements.                                                   |
| 23 | B      | The neuron is the basic structural and functional unit of the nervous system.                                              |
| 24 | B      | Haemoglobin in RBCs binds and transports most oxygen in blood.                                                             |

| Q  | Answer | Explanation                                                                                                                      |
|----|--------|----------------------------------------------------------------------------------------------------------------------------------|
| 25 | B      | Increased CO <sub>2</sub> and H <sup>+</sup> reduce haemoglobin's affinity for oxygen, facilitating oxygen unloading in tissues. |
| 26 | C      | The small intestine, particularly its villi and microvilli, is the major site of nutrient absorption.                            |
| 27 | C      | IgG is the most abundant immunoglobulin in normal serum.                                                                         |
| 28 | D      | IgE plays a major role in immediate hypersensitivity and allergic reactions.                                                     |
| 29 | C      | Platelets are essential for formation of the platelet plug and blood clotting.                                                   |
| 30 | B      | Thin, single-layered squamous cells allow rapid diffusion, as in alveoli.                                                        |
| 31 | B      | Adipose tissue stores energy primarily in the form of triglycerides.                                                             |
| 32 | B      | Tuberculosis is caused by the bacterium <i>Mycobacterium tuberculosis</i> .                                                      |
| 33 | A      | Cholera is caused by the bacterium <i>Vibrio cholerae</i> .                                                                      |
| 34 | B      | Vaccines stimulate the person's own immune system, producing active acquired immunity.                                           |
| 35 | B      | Activated B lymphocytes differentiate into plasma cells that secrete antibodies.                                                 |
| 36 | A      | T lymphocytes are central to cell-mediated immunity.                                                                             |
| 37 | C      | ADH is synthesized in the hypothalamus and released from the posterior pituitary.                                                |
| 38 | B      | Bile salts emulsify large fat globules into smaller droplets, increasing the surface area for lipase action.                     |
| 39 | C      | Ca <sup>2+</sup> binds to troponin, causing tropomyosin to move away from actin's myosin-binding sites.                          |
| 40 | B      | The sliding filament theory explains muscle contraction through relative sliding of actin and myosin filaments.                  |

## Botany

### Answers + Explanations

41. **B** — Cellulose forms the major structural framework of plant cell walls.
42. **B** — Amino acids are linked by peptide bonds.
43. **C** — Mitochondria generate ATP through aerobic respiration.
44. **C** — Chlorophyll-a is the primary photosynthetic pigment.
45. **B** — Bryophytes depend on water for sexual reproduction, hence the term amphibians.
46. **B** — The gametophyte is the dominant generation in bryophytes.
47. **B** — Gymnosperms produce exposed or "naked" seeds.
48. **B** — Pteridophytes have a dominant, independent sporophyte.
49. **D** — Double fertilization is a defining feature of angiosperms.
50. **C** — Solar energy drives most ecosystems through photosynthesis.
51. **B** — Approximately 10% of energy is transferred to the next trophic level.
52. **C** — Energy pyramids are always upright because energy is lost at each trophic transfer.
53. **B** — Biomagnification increases concentration of persistent toxins at higher trophic levels.
54. **B** — Ecological succession is the progressive change in community composition.

55. **B** — DNA synthesis occurs during S phase.
56. **A** — Crossing over occurs during pachytene of prophase I.
57. **B** — Crossing over exchanges genetic material between homologous chromosomes.
58. **A** — The two alleles of a gene separate during gamete formation.
59. **B** — A test cross uses a homozygous recessive individual.
60. **C** — A typical Mendelian dihybrid cross gives 9:3:3:1.
61. **B** — In codominance, both alleles are expressed in the heterozygote.
62. **B** — Lateral meristems, especially vascular cambium and cork cambium, cause secondary growth.
63. **B** — Xylem conducts water and dissolved minerals.
64. **C** — Phloem transports photosynthetic products and other organic solutes.
65. **B** — Collenchyma provides flexible support to growing parts.
66. **B** — Transpiration is loss of water vapour from aerial plant surfaces.
67. **A** — Changes in guard-cell turgor control stomatal opening.
68. **A** — Auxin promotes cell elongation and mediates phototropism.
69. **C** — Ethylene promotes fruit ripening.
70. **B** — Gibberellins promote elongation and can break seed dormancy.
71. **A** — ABA promotes dormancy and stress responses, including stomatal closure.
72. **C** — Photoperiodism is response to the relative duration of light and dark.
73. **B** — The Calvin cycle occurs in the chloroplast stroma.
74. **B** — Light reactions occur on thylakoid membranes.
75. **C** — Photosynthetic oxygen originates from splitting of water.
76. **C** — 3-PGA is the first stable product of  $C_3$  carbon fixation.
77. **B** — RuBisCO catalyzes carbon fixation in the Calvin cycle.
78. **B** — Mitochondria are the principal ATP-generating organelles.
79. **B** — Middle lamella is rich in pectic substances, particularly calcium pectate.
80. **B** — Stomata regulate gas exchange and water loss.

## Chemistry

### Answers + Explanations

81. **B** — One mole contains Avogadro's number,  $6.022 \times 10^{23}$  particles.
82. **B** — Empirical formula gives the simplest whole-number ratio of elements.
83. **B** — The limiting reagent is consumed first and determines maximum product.
84. **B** — The azimuthal quantum number determines orbital shape.
85. **B** — Each orbital can accommodate a maximum of two electrons with opposite spins.
86. **B** — No two electrons can possess the same set of four quantum numbers.
87. **B** — Increasing effective nuclear charge pulls electrons closer to the nucleus.
88. **B** — Effective nuclear charge generally increases across a period.
89. **B** — Nitrogen has a particularly stable half-filled  $2p^3$  configuration.
90. **B** — Fluorine has the highest electronegativity.
91. **B** — Ionic bonds involve electron transfer and electrostatic attraction.
92. **C** — Carbon is  $sp^3$  hybridized in methane.
93. **B** —  $sp^2$  orbitals form a trigonal planar arrangement.
94. **B** — Equilibrium shifts to counteract an applied change.
95. **B** — Higher pressure favours the side with fewer gas molecules.
96. **A** —  $pH = -\log[H^+]$ , so  $[H^+] = 10^{-3}$  M.
97. **C** — Buffers resist significant changes in pH.

98. **B** — Oxidation is loss of electrons.
99. **B** — Reduction is gain of electrons.
100. **B** — Oxygen in peroxide has oxidation state  $-1$ .
101. **C** — Catalysts lower activation energy through an alternative reaction pathway.
102. **B** — First-order half-life is independent of initial concentration.
103. **D** — Fluorine is the strongest oxidizing halogen.
104. **D** — In  $\text{KMnO}_4$ , Mn is  $+7$ .
105. **C** — Chromium is  $+6$  in dichromate.
106. **C** — Acid + carbonate produces  $\text{CO}_2$ , water and salt.
107. **B** — Haemoglobin contains iron in its haem group.
108. **B** — Chlorophyll contains magnesium at its centre.
109. **B** — Ligands donate electron pairs to central metal ions.
110. **C** — Coordination number counts directly attached donor atoms.
111. **B** — Saturated acyclic hydrocarbons follow  $\text{C}_n \text{H}_{2n+2}$ .
112. **A** — The  $\text{C}=\text{C}$  bond readily undergoes addition reactions.
113. **B** — Markovnikov's rule predicts orientation in addition to unsymmetrical alkenes.
114. **B** — Normal addition of  $\text{HBr}$  to propene gives mainly 2-bromopropane.
115. **B** — Alcohols contain the hydroxyl ( $-\text{OH}$ ) group.
116. **C** — Aldehydes contain  $-\text{CHO}$ .
117. **A** — Ketones contain a carbonyl group bonded to two carbon groups.
118. **B** — Primary alcohols oxidize initially to aldehydes.
119. **B** — Secondary alcohols oxidize to ketones.
120. **B** — Aldehydes generally give Tollens' silver-mirror test.
121. **B** — Alcohol + carboxylic acid forms ester + water.
122. **B** — Saponification is alkaline hydrolysis of esters.
123. **B** — Carboxylic acids contain  $-\text{COOH}$ .
124. **B** — Amino acids have amino and carboxyl groups.
125. **B** — Peptide bonds connect amino acids.
126. **B** — RNA normally contains uracil instead of thymine.
127. **B** — Extensive hydrogen bonding raises water's boiling point.
128. **B** — Molarity = moles of solute/litre of solution.
129. **A** — The ideal gas equation is  $PV = nRT$ .
130. **B** — At constant temperature, pressure is inversely proportional to volume.

## Physics

### Answers + Explanations

131. **B** — Newton is the SI unit of force.
132. **C** — Displacement has magnitude and direction.
133. **B** — Slope of velocity-time graph gives acceleration.
134. **A** — One basic equation of uniformly accelerated motion is  $v = u + at$ .
135. **B** — Maximum range on level ground occurs at  $45^\circ$ .

136. **B** — Newton's first law describes inertia.
137. **A** — Force equals rate of change of momentum; for constant mass,  $F = ma$ .
138. **A** — Momentum  $p = mv$ .
139. **B** — Total momentum remains conserved in an isolated system.
140. **B** — Centripetal acceleration points toward the centre.
141. **C** — Gravity provides the centripetal force.
142. **C** —  $W = Fs \cos\theta$ ; at  $90^\circ$ , work is zero.
143. **B** — Kinetic energy  $= \frac{1}{2}mv^2$ .
144. **B** — Earth's escape velocity is approximately 11.2 km/s.
145. **A** —  $v_e = \sqrt{(2GM/R)}$ , depending on planetary mass and radius.
146. **B** — Specific heat is heat required per unit mass per degree temperature rise.
147. **C** — Isothermal means constant temperature.
148. **B** — Isobaric means constant pressure.
149. **C** — The first law expresses conservation of energy.
150. **B** — Adiabatic processes involve no heat exchange.
151. **B** — Carnot efficiency rises as source temperature increases relative to sink temperature.
152. **B** — Absolute zero is  $0\text{ K} \approx -273.15^\circ\text{C}$ .
153. **A** — Wave speed  $v = f\lambda$ .
154. **B** — Sound propagates through air as a longitudinal wave.
155. **A** — Maximum amplitude occurs when driving and natural frequencies match.
156. **B** — TIR requires denser-to-rarer propagation and incidence angle above critical angle.
157. **B** — Lens power is measured in dioptres.
158. **B** — A concave lens diverges light and corrects myopia.
159. **B** — A convex lens converges light and corrects hypermetropia.
160. **B** —  $P = 1/f$  when  $f$  is measured in metres.
161. **B** — Young's experiment demonstrates interference of coherent light.
162. **A** — Ohm's law:  $V = IR$ .
163. **B** —  $R = \rho L/A$ , so doubling  $L$  doubles  $R$ .
164. **B** —  $R$  is inversely proportional to cross-sectional area.
165. **C** — Series resistance adds:  $R + R = 2R$ .
166. **C** — Parallel combination of two equal resistors gives  $R/2$ .
167. **A** — Electrical power  $P = VI$ .
168. **B** — Kirchhoff's current/junction law follows conservation of charge.
169. **B** —  $F = qvB \sin\theta$  is maximum at  $90^\circ$ .
170. **B** — Faraday discovered electromagnetic induction.
171. **B** — Lenz's law gives the direction opposing the change causing induction.
172. **B** — Transformers work through mutual electromagnetic induction.
173. **A** —  $F \propto q_1q_2/r^2$ .
174. **A** — Electric field is force per unit positive test charge.
175. **B** — Potential = work done per unit charge.
176. **A** — Electric field is the negative spatial gradient of potential.
177. **B** — A dielectric increases capacitance by reducing effective electric field.
178. **B** — Capacitor energy  $U = \frac{1}{2}CV^2$ .
179. **B** — Parallel capacitances add directly.
180. **A** — Photoelectron maximum kinetic energy increases with photon frequency above threshold.

# MAT

## Answers + Explanations

181. C — Each term is multiplied by 2: 2, 4, 8, 16, 32.
182. B — Differences are +3, +5, +7, +9; next is +11, giving 38.
183. A — Each letter shifts one position forward: D→E, O→P, G→H.
184. C — By Pythagoras, distance =  $\sqrt{(5^2 + 3^2)} = \sqrt{34}$  km.
185. C — The only definite conclusion is that all doctors are educated.
186. C — At 3:00, the hands are 90° apart.
187. C — Doubling workers halves time:  $5 \times 12 = 10 \times 6$ .
188. C —  $1.20 \times 0.80 = 0.96$ , so the result is 4% lower.
189. B — Sum = 150;  $150/5 = 30$ .
190. C —  $x = 12 - 5 = 7$ .
191. D — 9 is not a prime number; 2, 3 and 5 are prime.
192. B — The word is simply written backwards.
193. C —  $10 + 30 = 40$  years.
194. B — Total = 5, red = 3, so probability =  $3/5$ .
195. B — Since square  $\subset$  rectangle  $\subset$  quadrilateral, all squares are quadrilaterals.
196. C — Letter positions increase by +2, +3, +4, +5; next +6: O + 6 = U.
197. C —  $0.25x = 40$ , therefore  $x = 160$ .
198. C — Speed = distance/time =  $120/2 = 60$  km/h.
199. B — From  $P > Q > R > S$ , P is greater than S.
200. B — Facing north → right = east → right again = south.

\_\_Best Wishes\_\_