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

# Answer Key + Explanations

## Zoology

### Answers + Explanations

#### Q. Answer Explanation

- 1 B The Miller–Urey experiment used electrical sparks to simulate lightning in the primitive atmosphere and investigate the formation of organic molecules.
- 2 C Similarities in early embryonic development can provide evidence of evolutionary relationships and common ancestry.
- 3 B Neo-Darwinism combines natural selection with genetic variation, mutation, recombination, and population genetics.
- 4 B Echinoderms possess a water vascular system used in locomotion, feeding, and other functions.
- 5 C Ascaris is a pseudocoelomate; its body cavity is not completely lined by mesoderm.
- 6 A The notochord is a supportive rod along the dorsal side of chordates, at least during some stage of development.
- 7 B Nervous tissue receives and transmits electrical signals through neurons.
- 8 C Schwann cells form myelin sheaths around axons in the peripheral nervous system.
- 9 A Adipose tissue stores fat, provides insulation, and cushions organs.
- 10 B Cilia move mucus and trapped dust or microorganisms toward the throat.
- 11 C Sexual reproduction of Plasmodium occurs in the female Anopheles mosquito.
- 12 B Sporozoites enter humans through the bite of an infected female Anopheles mosquito.
- 13 B Earthworm nephridia remove metabolic wastes and help regulate water and ionic balance.
- 14 C The clitellum secretes material involved in cocoon formation during reproduction.
- 15 B A frog's thin, moist, vascular skin permits cutaneous gas exchange.
- 16 B The nephron is the structural and functional unit of the kidney.
- 17 B During ventricular systole, left ventricular pressure rises and ejects blood into the aorta.
- 18 C The sinoatrial node initiates the normal heartbeat and acts as the heart's natural pacemaker.
- 19 C In the ABO system, group AB red cells possess both A and B antigens.
- 20 B Most oxygen binds reversibly to haemoglobin in red blood cells.

## Q. Answer Explanation

- 21 B      Oxygen and carbon dioxide cross the alveolar-capillary membrane down their partial-pressure gradients.
- 22 A      The medulla oblongata contains vital centres involved in respiratory and cardiovascular regulation.
- 23 B      Antidiuretic hormone increases water reabsorption in the kidney collecting ducts.
- 24 B      Thyroid hormones are essential for normal brain development and physical growth in childhood.
- 25 B      A surge in luteinizing hormone triggers ovulation in a typical menstrual cycle.
- 26 B      Enzymes in the sperm acrosome help the sperm penetrate the egg's protective coverings.
- 27 B      Tuberculosis is caused by the bacterium *Mycobacterium tuberculosis*.
- 28 C      Passive immunity occurs when preformed antibodies are transferred to an individual.
- 29 A      Live attenuated vaccines contain weakened pathogens that can stimulate immunity without usually causing disease in healthy recipients.
- 30 B      Activated B lymphocytes can differentiate into plasma cells that secrete antibodies.
- 31 B      Tissue matching helps reduce immune-mediated rejection of a transplanted organ.
- 32 B      IVF involves fertilization outside the body under controlled laboratory conditions.
- 33 B      Properly treated drinking water reduces exposure to many waterborne pathogens.
- 34 B      Biological control uses natural enemies, such as predators or parasites, to suppress pests.
- 35 B      A reflex is a rapid response mediated through a reflex arc, often without conscious planning.
- 36 A      Seasonal migration often helps birds find favourable climates, food, and breeding sites.
- 37 B      Sulfur dioxide can form acids in the atmosphere and contribute to acid rain.
- 38 C      Critically Endangered indicates an extremely high risk of extinction in the wild.
- 39 B      A streamlined body reduces resistance while moving through water.
- 40 B      Ramsar sites are designated for the conservation and wise use of wetlands.

# Botany

## Answers + Explanations

### Q. Answer Explanation

- 41 A      The enzyme's active site binds the substrate and supports the catalytic reaction.
- 42 B      In a hypertonic solution, water leaves a plant cell and the protoplast pulls away from the cell wall; this is plasmolysis.
- 43 B      Magnesium is the central metal ion in the chlorophyll molecule.
- 44 B      Binomial nomenclature assigns each species a two-part scientific name: genus and specific epithet.
- 45 C      Bacteria are prokaryotes and lack a membrane-bound nucleus.
- 46 A      Certain cyanobacteria fix atmospheric nitrogen and contribute to nutrient cycling.
- 47 B      Viruses require host-cell machinery to reproduce.
- 48 B      Ascomycetes are traditionally known as sac fungi because they form sexual spores in asci.
- 49 B      A lichen is a symbiotic association involving a fungus and a photosynthetic alga or cyanobacterium.
- 50 A      Phycoerythrin is a red accessory pigment that helps many red algae capture light.
- 51 B      In bryophytes, the gametophyte is the dominant, conspicuous generation.
- 52 A      Fern sporangia are commonly grouped into clusters called sori.
- 53 C      Gymnosperms produce seeds that are not enclosed within an ovary-derived fruit.
- 54 A      In *Pinus*, the pollen grain represents the highly reduced male gametophyte.
- 55 B      After fertilization, the ovary typically develops into the fruit.
- 56 B      A gamopetalous flower has petals fused together.
- 57 A      Fabaceae includes pea and bean and commonly has a papilionaceous corolla.
- 58 B      Solanaceae commonly has five stamens attached to the corolla (epipetalous).
- 59 B      Neem's scientific name is *Azadirachta indica*.
- 60 B      *Rauwolfia serpentina*, or Sarpagandha, is a source of reserpine.
- 61 A      Phytoplankton photosynthesize and serve as primary producers in many aquatic ecosystems.
- 62 B      Nitrogen fixation converts atmospheric nitrogen into compounds usable by organisms.
- 63 A      Carbon dioxide is a major greenhouse gas released by fossil-fuel combustion.

## Q. Answer Explanation

- 64 B Primary succession begins on a substrate where developed soil is absent.
- 65 B Xerophytes possess adaptations for living in dry environments.
- 66 B Mitochondria are the main site of aerobic respiration in eukaryotic cells.
- 67 A The fluid-mosaic model describes a flexible lipid bilayer containing proteins and other components.
- 68 A The Golgi apparatus modifies, sorts, and packages many proteins and lipids.
- 69 B Chromosomes align at the equatorial plate during metaphase.
- 70 B Crossing over occurs during pachytene of prophase I in meiosis.
- 71 A DNA polymerase adds nucleotides to synthesize a new DNA strand.
- 72 B The central dogma describes the usual information flow from DNA to RNA to protein.
- 73 B With complete dominance, the dominant allele determines the phenotype of a heterozygote, Aa.
- 74 B Codominance occurs when both alleles are fully expressed in the heterozygote.
- 75 B Down syndrome most commonly results from an extra copy of chromosome 21.
- 76 B Xylem transports water and dissolved minerals, mainly from roots toward the shoot.
- 77 A Transpiration creates tension, while cohesion between water molecules helps maintain the continuous water column in xylem.
- 78 B The Calvin–Benson cycle takes place in the chloroplast stroma.
- 79 A Auxin promotes cell elongation and contributes to apical dominance.
- 80 B Totipotency is the capacity of a plant cell to regenerate an entire plant under suitable conditions.

# Chemistry

## Answers + Explanations

### Q. Answer Explanation

- 81 B Moles =  $9/18 = 0.50 = 9/18 = 0.50 = 9/18 = 0.50$  mol, because the molar mass of water is 18 g/mol.
- 82 B Isotopes have the same atomic number but different mass numbers. Chlorine-35 and chlorine-37 both have atomic number 17.
- 83 B The maximum electron capacity of a principal shell is  $2n^2$ . For  $n=3$ , it is  $2(3)^2 = 18$ .
- 84 C The magnetic quantum number  $m_l$  specifies an orbital's orientation in space.
- 85 C Fluorine has the highest electronegativity on the usual Pauling scale.
- 86 B Ammonia has three bonding pairs and one lone pair, giving a trigonal-pyramidal molecular shape.
- 87 A Each carbon in ethyne has two electron domains and is  $sp$ -hybridized.
- 88 D Water has a bent shape, so its O–H bond dipoles do not cancel.
- 89 B Hydrogen bonding is the strongest important intermolecular attraction between ordinary water molecules.
- 90 B Magnesium loses electrons to form  $Mg^{2+}$ , so it is oxidized.
- 91 A  $0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$  molecules.
- 92 D Avogadro's law states that equal gas volumes contain equal numbers of molecules at the same temperature and pressure.
- 93 B Boyle's law gives  $P \propto 1/V$  for a fixed amount of gas at constant temperature.
- 94 C The equilibrium constant changes with temperature; concentration, pressure, and catalysts do not change its value at fixed temperature.
- 95 B Adding heat to an exothermic reaction favours the reverse direction, which absorbs heat.
- 96 C Molarity =  $0.2/0.5 = 0.4 = 0.2/0.5 = 0.4 = 0.2/0.5 = 0.4$  mol/L.
- 97 B For a strong acid at this dilute concentration,  $[H^+] \approx 10^{-5}$  M, so pH is approximately 5.
- 98 B Sodium hydroxide is a strong base and produces a solution with pH greater than 7 at 25°C.
- 99 B A buffer contains a weak acid/base and its conjugate partner, which neutralize small additions of acid or base.

**Q. Answer Explanation**

- 100 B For a first-order reaction,  $t_{1/2} = 0.693/k$ , independent of initial concentration.
- 101 B A catalyst provides an alternative pathway with lower activation energy.
- 102 B Oxidation occurs at the anode in both galvanic and electrolytic cells.
- 103 A Faraday's laws relate the amount of material deposited to the charge passed.
- 104 A Entropy describes energy dispersal and the number of accessible microscopic arrangements.
- 105 B At constant temperature and pressure, a process is spontaneous when  $\Delta G < 0$ .
- 106 C Carbon-14 decays over time and is used to estimate the age of suitable once-living materials.
- 107 B Anhydrous sodium carbonate can be prepared and weighed accurately and is commonly used as a primary standard.
- 108 C In  $\text{H}_2\text{SO}_4$ ,  $2(+1) + \text{S} + 4(-2) = 0$ , giving sulfur an oxidation number of +6.
- 109 C Aluminium oxide reacts with both acids and bases, so it is amphoteric.
- 110 B Hydrogen chloride dissolves in moisture to form hydrochloric acid, turning moist blue litmus red.
- 111 A Methane is generally the major component of natural gas.
- 112 B Graphite has delocalized electrons that can move along its layered structure.
- 113 B Bauxite is the principal commercial ore of aluminium.
- 114 B A flux reacts with gangue to form slag, which can be separated from the metal.
- 115 B Chromium forms a thin, adherent oxide layer that protects stainless steel against further corrosion.
- 116 B Haemoglobin's heme groups contain ferrous iron,  $\text{Fe}^{2+}$ , which binds oxygen reversibly.
- 117 A Zinc is an essential cofactor in numerous enzymes and contributes to normal immune function.
- 118 A Lead exposure can harm the nervous system and interfere with blood formation, among other effects.
- 119 B An aldehyde contains the terminal functional group  $-\text{CHO}$ .
- 120 A  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  has three carbon atoms and an OH group on carbon 1: propan-1-ol.

**Q. Answer Explanation**

- 121 A Ethanol and dimethyl ether share the molecular formula  $C_2H_6OC_2H_6OC_2H_6O$  but have different functional groups.
- 122 B A nucleophile donates an electron pair to form a new bond.
- 123 A HBr adds across the carbon–carbon double bond of ethene, a typical electrophilic addition reaction.
- 124 A Tollens' reagent is generally reduced by aldehydes, producing a silver mirror under suitable conditions; most ketones do not respond.
- 125 A Esterification commonly combines an alcohol and a carboxylic acid to form an ester and water.
- 126 B Proteins are polymers formed from amino acid monomers linked by peptide bonds.
- 127 A Saponification is alkaline hydrolysis of fats or oils, producing soap and glycerol.
- 128 A Chromatography separates mixture components through their different interactions with stationary and mobile phases.
- 129 B At the equivalence point, reactants have been mixed in their stoichiometric proportions.
- 130 A Acid–base titration determines an acid's concentration by reaction with a standard base.

## Physics

**Answers + Explanations****Q. Answer Explanation**

- 131 B Speed  $= 150/10 = 15 = 150/10 = 15 = 150/10 = 15$  m/s.
- 132 B The slope of a velocity–time graph is change in velocity divided by time, which is acceleration.
- 133 B Circular motion involves continuously changing velocity direction, so centripetal acceleration exists even at constant speed.
- 134 C Newton's second law gives  $F = ma = 4 \times 3 = 12$  N.
- 135 D  $\Delta PE = mgh = 2 \times 10 \times 5 = 100$  J.
- 136 B Kinetic energy is  $KE = \frac{1}{2}mv^2$ , so it is proportional to  $v^2$  for fixed mass.
- 137 C Power  $= W/t = 600/20 = 30$  W.
- 138 B Total linear momentum remains constant when the net external force on the system is zero.

## Q. Answer Explanation

- 139 B      Moment (torque) equals force multiplied by the perpendicular distance from the pivot.
- 140 A      Pascal's principle states that pressure applied to an enclosed fluid is transmitted throughout the fluid.
- 141 A      Specific heat capacity is energy per unit mass per unit temperature change:  
 $\text{J kg}^{-1} \text{K}^{-1}$
- 142 A      Conduction transfers thermal energy through a metal mainly via particle interactions and mobile electrons.
- 143 B      During melting, heat breaks or weakens the solid structure rather than increasing temperature.
- 144 B      At constant volume, the ideal gas law gives  $P \propto T$  when temperature is measured in kelvin.
- 145 B      The first law expresses conservation of energy, relating heat transfer, work, and internal energy.
- 146 B      Heat-engine efficiency is useful work output divided by heat absorbed from the hot source.
- 147 B      Sound in air travels mainly through longitudinal pressure variations and requires a material medium.
- 148 B      Since  $v = f\lambda$ , doubling frequency at constant wave speed halves wavelength.
- 149 B      The Doppler effect is the apparent change in frequency caused by relative motion between source and observer.
- 150 B      Resonance occurs when a driving frequency matches a system's natural frequency.
- 151 B      Refractive index  $n = c/v$ , the speed of light in vacuum divided by its speed in the medium.
- 152 B      Light moving from glass to air can undergo total internal reflection if the incidence angle exceeds the critical angle.
- 153 B      A real image forms where rays actually converge and can therefore be projected onto a screen.
- 154 B      Fringe spacing is  $\beta = \lambda D/d$ ; increasing screen distance  $D$  increases spacing.
- 155 A      Diffraction is a characteristic wave phenomenon in which waves spread around obstacles or through apertures.
- 156 B      Electric field is defined as force per unit positive test charge:  $E = F/q$ .
- 157 B      Like electric charges repel each other.
- 158 B      The SI unit of potential difference is the volt.

## Q. Answer Explanation

- 159 B A capacitor stores energy in the electric field between its conductors.
- 160 B For a parallel-plate capacitor,  $C = \epsilon A/d$ ; doubling  $d$  halves capacitance.
- 161 C Ohm's law gives  $V = IR = 3 \times 4 = 12 \text{ V}$ .
- 162 A Two equal resistors in parallel have half the resistance of either resistor:  $6/2 = 3 \, \Omega$ .
- 163 B Electrical power dissipated in a resistor is  $P = I^2 R$ .
- 164 A An applied electric field causes charge carriers to drift, producing electric current.
- 165 B Magnetic force magnitude is  $F = |q|vB \sin \theta$ ; it is zero when velocity is parallel or antiparallel to the field.
- 166 B Magnetic flux density is measured in tesla (T).
- 167 A Faraday's law states that changing magnetic flux through a circuit induces an emf.
- 168 A A transformer works by mutual induction between its primary and secondary windings.
- 169 B For an ideal transformer,  
 $V_s/V_p = N_s/N_p = 100/500$ , so  $V_s = 220/5 = 44 \text{ V}$ .
- 170 B Photon energy is  $E = hf$ , directly proportional to frequency.
- 171 B The photoelectric effect supports the quantized transfer of light energy in photons.
- 172 A The de Broglie relation is  $\lambda = h/p$ , so wavelength is inversely proportional to momentum.
- 173 B An alpha particle contains two protons and two neutrons, equivalent to a helium-4 nucleus.
- 174 A In beta-minus decay, a neutron becomes a proton while an electron and an antineutrino are emitted.
- 175 B Half-life is the time for half of the radioactive nuclei in a sample to decay.
- 176 B Nuclear fission splits a heavy nucleus into smaller nuclei and releases energy.
- 177 A Doping changes the concentration and type of charge carriers in a semiconductor.
- 178 B A trivalent impurity creates a p-type semiconductor with holes as the majority carriers.
- 179 B The photon is the gauge boson that mediates the electromagnetic interaction.
- 180 B The Sun produces most of its energy by nuclear fusion, primarily converting hydrogen into helium.

# MAT

## Answers + Explanations

| Q.  | Answer                     | Explanation                                                                                                                                                              |
|-----|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 181 | C                          | "Abundant" means plentiful and is the opposite of "scarce."                                                                                                              |
| 182 | B                          | A thermometer measures temperature; a barometer measures atmospheric pressure.                                                                                           |
| 183 | C                          | "All surgeons are doctors" is explicitly given and must be true. The other conclusions do not necessarily follow.                                                        |
| 184 | C                          | Each term is multiplied by 2 and then increased by 1:<br>$79 \times 2 + 1 = 159$                                                                                         |
| 185 | D                          | The letter positions increase by 3, 4, 5, and 6; the next increase is 7. T (20) + 7 wraps around to A.                                                                   |
| 186 | A                          | The 8 m east and 8 m west movements cancel. The student remains 6 m north of the starting point.                                                                         |
| 187 | Correction: C should be 77 | The letter values are N=14, U=21, R=18, S=19, E=5. Their sum is $14+21+18+19+5=77$ . The original options for Question 187 did not include 77; the correct answer is 77. |
| 188 | D                          | Triangle, square, and pentagon are two-dimensional polygons; a sphere is a three-dimensional object.                                                                     |
| 189 | B                          | S must be before P, P before Q, and Q before R. The order S, P, Q, R, T satisfies all three conditions.                                                                  |
| 190 | C                          | If yesterday was Thursday, today is Friday and tomorrow is Saturday. Ten days after Saturday is Tuesday.                                                                 |
| 191 | C                          | Discount = $0.15 \times 800 = 120$ . Selling price = $800 - 120 = \text{Tk } 680$ .                                                                                      |
| 192 | B                          | Total ratio parts = $5+2=7$ . Water = $(\frac{2}{7}) \times 28 = 8$ L.                                                                                                   |
| 193 | B                          | The total of five numbers is $5 \times 18 = 90$ . The four known numbers sum to 72, so the fifth is $90 - 72 = 18$ .                                                     |
| 194 | C                          | Production rate = $240/6 = 40$ items/hour. In 9 hours: $40 \times 9 = 360$ .                                                                                             |
| 195 | B                          | Total work is $3 \times 12 = 36$ worker-days. With 6 workers, time = $36/6 = 6$ days.                                                                                    |
| 196 | B                          | Outcomes greater than 4 are 5 and 6, so probability = $2/6 = 1/3$ .                                                                                                      |

| Q.  | Answer | Explanation                                                                                                                      |
|-----|--------|----------------------------------------------------------------------------------------------------------------------------------|
| 197 | C      | Each row doubles from left to right: $5 \rightarrow 10 \rightarrow 20 \rightarrow 40 \rightarrow 80$ .                           |
| 198 | B      | A $3 \times 3 \times 3$ cube has 12 edge-centre cubes with exactly two painted faces. The corner cubes have three painted faces. |
| 199 | C      | At 3:00, the minute hand is at 12 and the hour hand at 3, making a $90^\circ$ angle.                                             |
| 200 | B      | Studying at least one subject: $22+18-10=30$ . Neither: $40-30=10$ .                                                             |

\_\_Best Wishes\_\_