AIIMS Paramedical Chemistry

Sample Paper – 8

Duration: 30 Minutes **Maximum Marks: 30**

Instructions

- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Chemistry portion of **AIIMS Paramedical** entrance.
- Each correct answer carries **+1 marks**. There is **a penalty of $-\frac{1}{3}$ mark** for an incorrect answer. Unattempted questions carry **0 marks**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 & 12 NCERT Chemistry**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. The percentage by mass of nitrogen in ammonium nitrate (NH_4NO_3, molar mass $= 80$ g mol^{-1}) is:

(A) 17.5%

(B) 25.0%

(C) 35.0%

(D) 46.7%

Q2. The correct ground-state electronic configuration of the chromium atom ($Z = 24$) is:

(A) $[Ar]\,3d^4\,4s^2$

(B) $[Ar]\,3d^5\,4s^1$

(C) $[Ar]\,3d^6\,4s^0$

(D) $[Ar]\,3d^3\,4s^2\,4p^1$

Q3. The density of carbon dioxide gas (molar mass 44 g mol^{-1}) at STP, where the molar volume is 22.4 L, is closest to:

(A) 1.96 g L^{-1}

(B) 0.51 g L^{-1}

(C) 4.40 g L^{-1}

(D) 2.24 g L^{-1}

Q4. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, the relation between ΔH and ΔU at temperature T is:

(A) $\Delta H = \Delta U$

(B) $\Delta H = \Delta U + RT$

(C) $\Delta H = \Delta U - RT$

(D) $\Delta H = \Delta U - 2RT$

Q5. Adding a catalyst to a gaseous reaction already at equilibrium will:

(A) shift the equilibrium towards the products

(B) shift the equilibrium towards the reactants

(C) change neither the position nor the value of K_c, but speed up the attainment of equilibrium

(D) increase the value of K_c

Q6. A 0.10 M solution of a weak monoacidic base has $K_b = 1.0 \times 10^{-5}$. The pH of the solution (take $\log 10 = 1$) is approximately:

(A) 3

(B) 11

(C) 9

(D) 5

Q7. In acidic medium, MnO_4^- is reduced to Mn^{2+}. The number of moles of Fe^{2+} oxidised to Fe^{3+} by one mole of MnO_4^- is:

(A) 5

(B) 3

(C) 2

(D) 1

Q8. During the electrolysis of an aqueous solution of sodium sulphate using inert platinum electrodes, the gases liberated at the cathode and anode respectively are:

(A) O_2 and H_2

(B) SO_2 and H_2

(C) Na metal and O_2

(D) H_2 and O_2

Q9. Which of the following statements about molecularity and order of a reaction is correct?

(A) Molecularity can be zero or fractional

(B) Order is always equal to the sum of stoichiometric coefficients

(C) Molecularity is always a whole number for an elementary step, while order may be zero or fractional

(D) Order is always a whole number

Q10. The mole fraction of the solute in a 1.0 molal aqueous solution (water molar mass $= 18$ g mol^{-1}) is approximately:

(A) 0.018

(B) 0.180

(C) 0.056

(D) 0.500

Q11. Among the halogens, the order of decreasing oxidising power (reactivity towards electron gain) is:

(A) $I_2 > Br_2 > Cl_2 > F_2$

(B) $F_2 > Cl_2 > Br_2 > I_2$

(C) $Cl_2 > F_2 > Br_2 > I_2$

(D) $Br_2 > Cl_2 > F_2 > I_2$

Q12. Across period 3, the element with the highest melting point is:

(A) Sodium (Na)

(B) Aluminium (Al)

(C) Silicon (Si)

(D) Argon (Ar)

Q13. In which of the following species is a coordinate (dative) bond present?

(A) CH_4

(B) H_2O

(C) Cl_2

(D) NH_4^+

Q14. According to Fajans' rules, among $LiCl$, $NaCl$, KCl and $RbCl$, the compound with the greatest covalent character is:

(A) $LiCl$

(B) $NaCl$

(C) KCl

(D) $RbCl$

Q15. Temporary hardness of water, caused by dissolved $Ca(HCO_3)_2$ and $Mg(HCO_3)_2$, can be removed by:

(A) adding common salt

(B) simply boiling the water

(C) adding dilute hydrochloric acid

(D) adding glucose

Q16. The correct order of increasing acid strength of the oxoacids of chlorine is:

(A) $HClO_4 < HClO_3 < HClO_2 < HClO$

(B) $HClO_2 < HClO < HClO_3 < HClO_4$

(C) $HClO < HClO_2 < HClO_3 < HClO_4$

(D) $HClO_3 < HClO_4 < HClO < HClO_2$

Q17. In hypophosphorous acid, H_3PO_2, the number of P–H bonds and ionisable (replaceable) hydrogen atoms are respectively:

(A) 0 and 3

(B) 1 and 2

(C) 0 and 1

(D) 2 and 1

Q18. The ground-state electronic configuration of the Fe^{3+} ion (Z of Fe $= 26$) is:

(A) $[Ar]\,3d^5$

(B) $[Ar]\,3d^6$

(C) $[Ar]\,3d^3\,4s^2$

(D) $[Ar]\,3d^6\,4s^2$

Q19. In the spectrochemical series, which of the following ligands produces the largest crystal-field splitting (strongest field)?

(A) Cl^-

(B) CN^-

(C) H_2O

(D) F^-

Q20. The self-ionisation (autoprotolysis) of water is best represented by which equilibrium?

(A) $H_2O \rightleftharpoons H_2 + \frac{1}{2}O_2$

(B) $2H_2O \rightleftharpoons H_2O_2 + H_2$

(C) $2H_2O \rightleftharpoons H_3O^+ + OH^-$

(D) $H_2O \rightleftharpoons H^+ + OH_2^-$

Q21. Which of the following groups, when attached to a benzene ring, shows a $+M$ (electron-releasing mesomeric) effect?

(A) $-NO_2$

(B) $-CN$

(C) $-COOH$

(D) $-OCH_3$

Q22. Which of the following compounds is optically inactive because it is a meso form (internally compensated)?

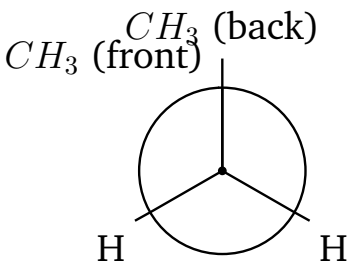
(A) meso-tartaric acid

(B) (R)-lactic acid

(C) (S)-2-chlorobutane

(D) (R)-butan-2-ol

Q23. The Newman projection below (sighting along the C_2–C_3 bond of n-butane) places the two methyl groups directly behind one another. This least-stable, highest-energy conformation is the:



(A) anti (staggered) conformation

(B) fully eclipsed (syn-periplanar) conformation

(C) gauche conformation

(D) skew-boat conformation

Q24. When benzene is treated with fuming sulphuric acid (oleum), the major organic product formed by electrophilic aromatic substitution is:

(A) chlorobenzene

(B) nitrobenzene

(C) benzenesulphonic acid

(D) phenol

Q25. The reaction of bromoethane (CH_3CH_2Br) with aqueous potassium hydroxide (KOH) chiefly gives:

(A) ethene

(B) ethoxyethane

(C) ethyl cyanide

(D) ethanol

Q26. Acid-catalysed hydration (addition of water in the presence of dilute H_2SO_4) of propene chiefly yields, following Markovnikov's rule:

(A) propan-2-ol

(B) propan-1-ol

(C) propane-1,2-diol

(D) propanal

Q27. Which of the following carboxylic acids is the strongest acid?

(A) acetic acid (CH_3COOH)

(B) trichloroacetic acid (CCl_3COOH)

(C) chloroacetic acid ($CH_2ClCOOH$)

(D) dichloroacetic acid ($CHCl_2COOH$)

Q28. When acetone reacts with hydroxylamine (NH_2OH), the carbonyl group is converted into a $> C = N - OH$ group. The product formed is:

(A) an acetal

(B) a semicarbazone

(C) an oxime

(D) a cyanohydrin

Q29. In the Hofmann bromamide degradation, an aliphatic amide ($R{-}CONH_2$) is treated with bromine and aqueous KOH to give:

(A) a nitrile with the same number of carbons

(B) a carboxylic acid with one more carbon

(C) an amide with one more carbon

(D) a primary amine ($R - NH_2$) with one fewer carbon

Q30. Acid-catalysed (or enzymatic) hydrolysis of sucrose gives an equimolar mixture of:

(A) glucose and fructose

(B) two molecules of glucose

(C) glucose and galactose

(D) two molecules of fructose

Detailed Solutions

Q1.

Solution

Concept — Percentage composition by mass: The mass percent of an element is the total mass of that element in one formula unit divided by the molar mass, multiplied by 100.

Step 1 — Count the nitrogen atoms: In NH_4NO_3 there are 2 nitrogen atoms.

Step 2 — Find the mass of nitrogen: Mass of N $= 2 \times 14 = 28$ g.

Step 3 — Compute the percentage:

$$\%\, N = \frac{28}{80} \times 100 = 35.0\%$$

Why other options are wrong:

- 17.5%: this counts only one nitrogen atom $(14/80)$.
- 25.0% and 46.7%: these do not match the correct ratio.

Final Answer: 35.0% nitrogen $\Rightarrow$ C

Answer: (C) Go Back to Q 1

Q2.

Solution

Concept — Anomalous configuration of chromium: A half-filled $3d^5$ subshell gives extra exchange-energy stability, so one $4s$ electron shifts into $3d$.

Step 1 — Expected versus actual: The naive filling would give $[Ar]\,3d^4\,4s^2$, but the stable arrangement is $[Ar]\,3d^5\,4s^1$.

Step 2 — Reason: The half-filled $3d^5$ and half-filled $4s^1$ together maximise exchange energy and symmetry, lowering the total energy.

Why other options are wrong:

- $[Ar]\,3d^4\,4s^2$: the expected but not the actual configuration.
- $[Ar]\,3d^6\,4s^0$ and the $4p^1$ option: incorrect electron counts.

Final Answer: $[Ar]\,3d^5\,4s^1 \Rightarrow$ B

Answer: (B) Go Back to Q 2

Q3.

Solution

Concept — Density of an ideal gas: At STP, one mole of gas occupies 22.4 L, so density $=$ molar mass $/$ molar volume.

Step 1 — Substitute the values:

$$d = \frac{M}{V_m} = \frac{44}{22.4}$$

Step 2 — Evaluate:

$$d = 1.96 \text{ g L}^{-1}$$

Why other options are wrong:

- 0.51 g L^{-1}: this is the reciprocal ($22.4/44$).
- 4.40 and 2.24 g L^{-1}: arise from misplacing the factor of 10 or wrong arithmetic.

Final Answer: 1.96 g L^{-1} $\Rightarrow$ A

Answer: (A) Go Back to Q 3

Q4.

Solution

Concept — Relation between ΔH and ΔU: For gaseous reactions, $\Delta H = \Delta U + \Delta n_g RT$, where Δn_g is the change in moles of gas.

Step 1 — Find Δn_g: Products have 2 moles of gas; reactants have $1+3=4$ moles. So $\Delta n_g = 2 - 4 = -2$.

Step 2 — Substitute:

$$\Delta H = \Delta U + (-2)RT = \Delta U - 2RT$$

Why other options are wrong:

- $\Delta H = \Delta U$: would require $\Delta n_g = 0$.
- $\Delta U \pm RT$: would require $\Delta n_g = \pm 1$, not -2.

Final Answer: $\Delta H = \Delta U - 2RT$ $\Rightarrow$ D

Answer: (D) Go Back to Q 4

Q5.

Solution

Concept — Effect of a catalyst on equilibrium: A catalyst lowers the activation energy of both forward and backward reactions equally.

Step 1 — Equilibrium position: Since both rates are raised by the same factor, the equilibrium position and K_c are unchanged.

Step 2 — Kinetic effect: The catalyst only allows the system to reach equilibrium faster.

Why other options are wrong:

- Shifting towards products or reactants: a catalyst causes no shift.
- Increasing K_c: K_c depends only on temperature.

Final Answer: No shift, no change in K_c, only faster attainment $\Rightarrow$ C

Answer: (C) Go Back to Q 5

Q6.

Solution

Concept — pH of a weak base: For a weak base, $[OH^-] = \sqrt{K_b\, C}$, then $pOH = -\log[OH^-]$ and $pH = 14 - pOH$.

Step 1 — Hydroxide concentration:

$$[OH^-] = \sqrt{(1.0 \times 10^{-5})(0.10)} = \sqrt{1.0 \times 10^{-6}} = 1.0 \times 10^{-3}\ \text{M}$$

Step 2 — pOH and pH:

$$pOH = -\log(10^{-3}) = 3, \qquad pH = 14 - 3 = 11$$

Why other options are wrong:

- 3: that is the pOH, not the pH.
- 9 and 5: arise from arithmetic slips in the square root or in $14 - pOH$.

Final Answer: $pH \approx 11 \Rightarrow$ B

Answer: (B) Go Back to Q 6

Q7.

Solution

Concept — Permanganate–iron redox stoichiometry: In acid, MnO_4^- gains 5 electrons ($Mn^{+7} \rightarrow Mn^{+2}$); each Fe^{2+} loses 1 electron.

Step 1 — Balance electrons: One MnO_4^- accepts 5 electrons, so it must oxidise 5 moles of Fe^{2+}.

Step 2 — Net ionic equation:

$$MnO_4^- + 5Fe^{2+} + 8H^+ \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$$

Why other options are wrong:

- 3, 2, 1: none of these balance the 5-electron change of permanganate.

Final Answer: 5 moles of $Fe^{2+} \Rightarrow$ A

Answer: (A) Go Back to Q 7

Q8.

Solution

Concept — Electrolysis of aqueous Na_2SO_4: Both Na^+ and SO_4^{2-} are hard to discharge, so water is preferentially electrolysed at both electrodes.

Step 1 — Cathode: Water is reduced, liberating hydrogen gas: $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$.

Step 2 — Anode: Water is oxidised, liberating oxygen gas: $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$.

Why other options are wrong:

- Na metal: Na^+ is not discharged from aqueous solution.
- SO_2 and swapped O_2/H_2 pairs: do not match the actual electrode reactions.

Final Answer: H_2 at cathode, O_2 at anode $\Rightarrow$ D

Answer: (D) Go Back to Q 8

Q9.

Solution

Concept — Molecularity versus order: Molecularity is the number of species in an elementary step and is a small whole number; order is found experimentally and can be zero, fractional or whole.

Step 1 — Molecularity: It applies only to elementary reactions and is always 1, 2 or rarely 3.

Step 2 — Order: It is determined from the rate law and need not equal the stoichiometric coefficients; it can be 0 or fractional.

Why other options are wrong:

- Molecularity cannot be zero or fractional.
- Order is not always the sum of coefficients, nor always a whole number.

Final Answer: Molecularity is a whole number; order may be zero or fractional $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 9

Q10.

Solution

Concept — Mole fraction from molality: A 1.0 molal solution contains 1 mole of solute per 1000 g of water.

Step 1 — Moles of water:

$$n_{water} = \frac{1000}{18} = 55.6 \text{ mol}$$

Step 2 — Mole fraction of solute:

$$x_{solute} = \frac{1}{1 + 55.6} = \frac{1}{56.6} \approx 0.018$$

Why other options are wrong:

- 0.180: off by a factor of 10.
- 0.056 and 0.500: do not follow from the correct mole counts.

Final Answer: $x_{solute} \approx 0.018 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 10

Q11.

Solution

Concept — Oxidising power of halogens: Down group 17, oxidising power decreases because the tendency to gain an electron falls. Fluorine is the strongest oxidiser.

Step 1 — Order of E° (reduction): $F_2 > Cl_2 > Br_2 > I_2$ in oxidising strength.

Step 2 — Interpretation: F_2 most readily accepts electrons; I_2 least readily.

Why other options are wrong:

- $I_2 > Br_2 > Cl_2 > F_2$: this is the reverse (reducing) order.
- The mixed orders place Cl_2 or Br_2 above F_2, which is wrong.

Final Answer: $F_2 > Cl_2 > Br_2 > I_2 \Rightarrow$ B

Answer: (B) Go Back to Q 11

Q12.

Solution

Concept — Melting points across period 3: The giant covalent network of silicon has the strongest bonding, giving the highest melting point of the period.

Step 1 — Compare bonding types: Na and Al are metals; Si is a covalent network solid; Ar is a monatomic gas held only by weak dispersion forces.

Step 2 — Conclusion: Breaking the strong covalent network of silicon needs the most energy, so Si melts highest.

Why other options are wrong:

- Na and Al: metallic bonding is weaker than the silicon network here.
- Ar: has an extremely low melting point.

Final Answer: Silicon $\Rightarrow$ C

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept — Coordinate (dative) bond: A coordinate bond forms when both shared electrons come from the same atom.

Step 1 — Examine the ammonium ion: In NH_4^+, three $N-H$ bonds are normal covalent; the fourth forms when the nitrogen lone pair is donated to H^+.

Step 2 — Identify the dative bond: That fourth $N \rightarrow H$ bond is a coordinate bond.

Why other options are wrong:

- CH_4, H_2O, Cl_2: contain only ordinary covalent bonds where each atom contributes one electron.

Final Answer: NH_4^+ contains a coordinate bond $\Rightarrow$ D

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept — Fajans' rules: A small, highly charged cation polarises the anion strongly, giving greater covalent character.

Step 1 — Compare cation sizes: Li^+ is the smallest of Li^+, Na^+, K^+, Rb^+.

Step 2 — Conclusion: The small Li^+ has the highest polarising power, so $LiCl$ is the most covalent.

Why other options are wrong:

- $NaCl$, KCl, $RbCl$: the cations are larger, less polarising, so these are more ionic.

Final Answer: $LiCl$ is the most covalent $\Rightarrow$ A

Answer: (A) Go Back to Q 14

Q15.

Solution

Concept — Temporary hardness: It is due to dissolved bicarbonates of calcium and magnesium and is removed by boiling.

Step 1 — On boiling: The bicarbonates decompose to insoluble carbonates, for example $Ca(HCO_3)_2 \rightarrow CaCO_3\downarrow + H_2O + CO_2$.

Step 2 — Result: The insoluble carbonate precipitates out and the water is softened.

Why other options are wrong:

- Common salt or glucose: do not remove the hardness ions.
- Dilute HCl: would keep the calcium and magnesium ions in solution.

Final Answer: Boiling removes temporary hardness $\Rightarrow$ B

Answer: (B) Go Back to Q 15

Q16.

Solution

Concept — Strength of chlorine oxoacids: As the oxidation state of chlorine and the number of oxygen atoms increase, the conjugate base is more stabilised, so acid strength rises.

Step 1 — List oxidation states: $HClO$ $(+1)$ $<$ $HClO_2$ $(+3)$ $<$ $HClO_3$ $(+5)$ $<$ $HClO_4$ $(+7)$.

Step 2 — Conclusion: Acid strength increases in the same order, so $HClO_4$ is the strongest.

Why other options are wrong:

- Any order that places $HClO_4$ as weak, or jumbles the sequence, contradicts the oxidation-state trend.

Final Answer: $HClO < HClO_2 < HClO_3 < HClO_4 \Rightarrow$ C

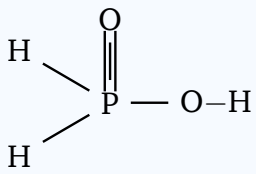
Answer: (C) Go Back to Q 16

Q17.

Solution

Concept — Structure of H_3PO_2: Only hydrogen atoms bonded to oxygen (as $O-H$) are ionisable; hydrogen directly bonded to phosphorus is not.

Step 1 — Draw the bonding: In hypophosphorous acid, phosphorus is bonded to two H atoms (P–H), one $O-H$ group and one $P=O$.



Step 2 — Count: There are 2 P–H bonds and only 1 ionisable $O-H$ hydrogen, so H_3PO_2 is monobasic.

Why other options are wrong:

- 0 and 3, 1 and 2, 0 and 1: misjudge the number of P–H bonds or replaceable hydrogens.

Final Answer: 2 P–H bonds and 1 ionisable H $\Rightarrow$ D

Answer: (D) Go Back to Q 17

Q18.

Solution

Concept — Configuration of a transition-metal ion: For a cation, remove electrons from the $4s$ orbital first, then from $3d$.

Step 1 — Neutral iron: Fe is $[Ar]\,3d^6\,4s^2$.

Step 2 — Form Fe^{3+}: Remove both $4s$ electrons and one $3d$ electron, giving $[Ar]\,3d^5$.

Why other options are wrong:

- $[Ar]\,3d^6$: that is Fe^{2+}.
- Options retaining $4s^2$: $4s$ electrons are removed first on ionisation.

Final Answer: $Fe^{3+} = [Ar]\,3d^5 \Rightarrow$ A

Answer: (A) Go Back to Q 18

Q19.

Solution

Concept — Spectrochemical series: Ligands are ranked by the size of the crystal-field splitting they cause. Strong-field ligands give large splitting.

Step 1 — Recall the order: $I^- < Br^- < Cl^- < F^- < H_2O < NH_3 < en < CN^- < CO$.

Step 2 — Identify the strongest: Of the choices, CN^- lies furthest right, so it produces the largest splitting.

Why other options are wrong:

- Cl^- and F^-: weak-field ligands giving small splitting.
- H_2O: intermediate, weaker than CN^-.

Final Answer: CN^- is the strongest-field ligand $\Rightarrow$ B

Answer: (B) Go Back to Q 19

Q20.

Solution

Concept — Autoprotolysis of water: One water molecule donates a proton to another, generating the hydronium and hydroxide ions.

Step 1 — Write the equilibrium:

$$2H_2O \rightleftharpoons H_3O^+ + OH^-$$

Step 2 — Significance: This self-ionisation defines $K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$ at 298 K.

Why other options are wrong:

- Splitting into H_2 and O_2, or forming H_2O_2: these are decomposition reactions, not autoprotolysis.
- OH_2^- is not a real species.

Final Answer: $2H_2O \rightleftharpoons H_3O^+ + OH^-$ $\Rightarrow$ C

Answer: (C) Go Back to Q 20

Q21.

Solution

Concept — Mesomeric effect: Groups with a lone pair on the atom attached to the ring donate electron density into the ring through resonance ($+M$).

Step 1 — Examine $-OCH_3$: The oxygen lone pair conjugates with the ring, releasing electron density, a $+M$ effect.

Step 2 — Contrast: $-NO_2$, $-CN$ and $-COOH$ all withdraw electron density by resonance ($-M$).

Why other options are wrong:

- $-NO_2$, $-CN$, $-COOH$: these are $-M$ (electron-withdrawing) groups.

Final Answer: $-OCH_3$ shows the $+M$ effect $\Rightarrow$ D

Answer: (D) Go Back to Q 21

Q22.

Solution

Concept — Meso compounds: A meso compound has chiral centres but an internal plane of symmetry, so it is optically inactive overall.

Step 1 — Examine tartaric acid: The meso form has two stereocentres of opposite configuration; their rotations cancel internally.

Step 2 — Conclusion: meso-tartaric acid is achiral and therefore optically inactive.

Why other options are wrong:

- (R)-lactic acid, (S)-2-chlorobutane, (R)-butan-2-ol: each is a single enantiomer and is optically active.

Final Answer: meso-tartaric acid $\Rightarrow$ A

Answer: (A) Go Back to Q 22

Q23.

Solution

Concept — Conformations of butane: Rotating about the central $C_2 - C_3$ bond gives staggered (anti, gauche) and eclipsed conformers of differing energy.

Step 1 — Identify the projection: The two methyl groups lie one directly behind the other (dihedral angle $0°$), so they eclipse each other.

Step 2 — Energy: Methyl–methyl eclipsing gives maximum steric and torsional strain; this fully eclipsed (syn-periplanar) form is the highest-energy conformation.

Why other options are wrong:

- anti (staggered): lowest energy, dihedral $180°$.
- gauche: staggered at $60°$, higher than anti but lower than eclipsed.
- skew-boat: a ring conformation, not relevant to butane.

Final Answer: Fully eclipsed (syn-periplanar) conformation $\Rightarrow$ B

Answer: (B) Go Back to Q 23

Q24.

Solution

Concept — Sulphonation of benzene: Oleum supplies the electrophile SO_3 (or HSO_3^+), which substitutes a ring hydrogen.

Step 1 — Electrophilic attack: SO_3 attacks the benzene ring to give benzenesulphonic acid, $C_6H_5SO_3H$.

Step 2 — Note: Sulphonation is reversible, unlike most aromatic substitutions.

Why other options are wrong:

- Chlorobenzene and nitrobenzene: need $Cl_2/FeCl_3$ and HNO_3/H_2SO_4 respectively.
- Phenol: not formed by direct sulphonation.

Final Answer: Benzenesulphonic acid $\Rightarrow$ C

Answer: (C) Go Back to Q 24

Q25.

Solution

Concept — Substitution versus elimination: Aqueous KOH favours nucleophilic substitution by hydroxide ion, while alcoholic KOH favours elimination.

Step 1 — Reaction: With aqueous KOH, OH^- replaces bromide: $CH_3CH_2Br + OH^- \rightarrow CH_3CH_2OH + Br^-$.

Step 2 — Product: The chief product is ethanol.

Why other options are wrong:

- Ethene: would form with alcoholic KOH (elimination).
- Ethoxyethane and ethyl cyanide: require different reagents (sodium ethoxide, KCN).

Final Answer: Ethanol $\Rightarrow$ D

Answer: (D) Go Back to Q 25

Q26.

Solution

Concept — Markovnikov addition of water: In acid-catalysed hydration, the $-OH$ adds to the more substituted carbon (the one bearing fewer hydrogens).

Step 1 — Apply the rule to propene: H adds to the terminal CH_2, and OH adds to the central carbon.

Step 2 — Product: The major product is propan-2-ol.

Why other options are wrong:

- propan-1-ol: the anti-Markovnikov product.
- propane-1,2-diol and propanal: require different reactions (oxidation, etc.).

Final Answer: Propan-2-ol $\Rightarrow$ A

Answer: (A) Go Back to Q 26

Q27.

Solution

Concept — Inductive effect on acid strength: Electron-withdrawing chlorine atoms stabilise the carboxylate anion; more chlorines means a stronger acid.

Step 1 — Compare the acids: Number of Cl atoms: acetic (0) $<$ chloroacetic (1) $<$ dichloroacetic (2) $<$ trichloroacetic (3).

Step 2 — Conclusion: Trichloroacetic acid, with three chlorines, has the strongest $-I$ effect and is the strongest acid.

Why other options are wrong:

- Acetic acid: weakest, no withdrawing group.
- Mono- and dichloroacetic acid: stronger than acetic but weaker than trichloroacetic.

Final Answer: Trichloroacetic acid $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q 27

Q28.

Solution

Concept — Reactions of carbonyl with nitrogen nucleophiles: Hydroxylamine adds to the carbonyl and loses water to form a $> C = N - OH$ linkage, called an oxime.

Step 1 — Reaction: $(CH_3)_2C = O + NH_2OH \rightarrow (CH_3)_2C = N - OH + H_2O$.

Step 2 — Name the product: The product is acetone oxime.

Why other options are wrong:

- Acetal: forms with alcohols.
- Semicarbazone: forms with semicarbazide, not hydroxylamine.
- Cyanohydrin: forms with HCN.

Final Answer: An oxime $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q 28

Q29.

Solution

Concept — Hofmann bromamide degradation: An amide treated with Br_2 and aqueous KOH gives a primary amine having one carbon fewer than the amide.

Step 1 — Reaction: $R-CONH_2+Br_2+4KOH \rightarrow R-NH_2+K_2CO_3+2KBr+2H_2O$.

Step 2 — Carbon count: The carbonyl carbon is lost as carbonate, so the amine has one fewer carbon than the starting amide.

Why other options are wrong:

- A nitrile: that is dehydration of the amide, a different reaction.
- A carboxylic acid or amide with one more carbon: do not match Hofmann degradation.

Final Answer: A primary amine with one fewer carbon $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 29

Q30.

Solution

Concept — Hydrolysis of sucrose: Sucrose is a disaccharide made of one glucose and one fructose unit linked by a glycosidic bond.

Step 1 — Hydrolysis: Acid or the enzyme invertase cleaves the glycosidic linkage.

Step 2 — Products: An equimolar mixture of glucose and fructose (invert sugar) is obtained.

Why other options are wrong:

- Two glucose units: that describes maltose.
- Glucose and galactose: that describes lactose.
- Two fructose units: is not a natural disaccharide hydrolysis product here.

Final Answer: Glucose and fructose $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q 30

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	B	3	A	4	D	5	C
6	B	7	A	8	D	9	C	10	A
11	B	12	C	13	D	14	A	15	B
16	C	17	D	18	A	19	B	20	C
21	D	22	A	23	B	24	C	25	D
26	A	27	B	28	C	29	D	30	A