NEST Chemistry Sample Paper – 3

Duration: 45 Minutes **Maximum Marks: 60**

Instructions

- This paper contains **20 Multiple Choice Questions (single correct answer)**, modelled on the Chemistry section of **NEST 2026**.
- Each correct answer carries **+3 marks**. There is a deduction of -1 **mark** for each incorrect answer; **no marks** are deducted for an unattempted question.
- Every question has exactly **four options**, of which only **one** is correct. Choose carefully.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited in the examination hall.
- A simple on-screen (virtual) calculator is provided in the computer-based test interface and may be used; blank sheets for rough work are supplied at the exam centre.

Q1. Aluminium reacts with chlorine to form aluminium chloride: $2Al + 3Cl_2 \rightarrow 2AlCl_3$. If 5.4 g of aluminium is allowed to react with 21.3 g of chlorine gas, the mass of $AlCl_3$ formed is (atomic masses: $Al = 27$, $Cl = 35.5$)

(A) 13.35 g

(B) 26.7 g

(C) 40.05 g

(D) 53.4 g

Q2. An electron is accelerated so that it moves with a speed of 7.3×10^{6} m s^{-1}. Taking the electron mass as 9.1×10^{-31} kg and $h = 6.63 \times 10^{-34}$ J s, its de Broglie wavelength is closest to

(A) 1.0×10^{-10} m

(B) 1.0×10^{-8} m

(C) 1.0×10^{-12} m

(D) 0.5×10^{-10} m

Q3. An element in its ground state has the electronic configuration $[Ar]\,3d^{10}\,4s^2\,4p^3$. The period, group and block to which this element belongs are, respectively,

(A) Period 4, Group 13, p-block

(B) Period 3, Group 15, p-block

(C) Period 4, Group 15, p-block

(D) Period 4, Group 5, d-block

Q4. Consider the molecules CH_4, NH_3 and H_2O. The correct order of the number of lone pairs on the central atom, and the correct order of their bond angles, are

(A) lone pairs: $CH_4 > NH_3 > H_2O$; bond angle: $CH_4 > NH_3 > H_2O$

(B) lone pairs: $H_2O > NH_3 > CH_4$; bond angle: $H_2O > NH_3 > CH_4$

(C) lone pairs: $CH_4 = NH_3 = H_2O$; bond angle: all equal

(D) lone pairs: $H_2O > NH_3 > CH_4$; bond angle: $CH_4 > NH_3 > H_2O$

Q5. For the reaction $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, the bond enthalpies are $H{-}H = 436$ kJ mol^{-1}, $Cl{-}Cl = 242$ kJ mol^{-1} and $H{-}Cl = 431$ kJ mol^{-1}. The enthalpy of the reaction is

(A) -184 kJ mol^{-1}

(B) $+184$ kJ mol^{-1}

(C) -247 kJ mol^{-1}

(D) -92 kJ mol^{-1}

Q6. For the equilibrium $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, $\Delta H = -92$ kJ mol^{-1}. Which one of the following changes shifts the equilibrium so as to increase the yield of NH_3?

(A) Increasing the temperature at constant pressure

(B) Increasing the total pressure by reducing the volume

(C) Adding an inert gas at constant volume

(D) Removing N_2 from the system

Q7. In the reaction $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$, the oxidizing agent and the reducing agent are, respectively,

(A) HCl and MnO_2

(B) Cl_2 and H_2O

(C) MnO_2 and HCl

(D) $MnCl_2$ and Cl_2

Q8. A 5.0 L vessel contains 4.0 g of helium ($M = 4$ g mol^{-1}) and 14.0 g of nitrogen ($M = 28$ g mol^{-1}) at 300 K. Taking $R = 0.082$ L atm K^{-1} mol^{-1}, the partial pressure of helium in the mixture is approximately

(A) 2.46 atm

(B) 7.38 atm

(C) 9.84 atm

(D) 4.92 atm

Q9. When 18 g of a non-volatile, non-electrolyte solute is dissolved in 180 g of water, the relative lowering of vapour pressure is found to be 0.02. The molar mass of the solute is (molar mass of water $= 18$ g mol^{-1})

(A) 90 g mol^{-1}

(B) 180 g mol^{-1}

(C) 45 g mol^{-1}

(D) 60 g mol^{-1}

Q10. The limiting molar conductivities of $NaCl$, HCl and CH_3COONa are 126.4, 426.1 and 91.0 S cm^2 mol^{-1} respectively. The limiting molar conductivity of acetic acid (CH_3COOH) is

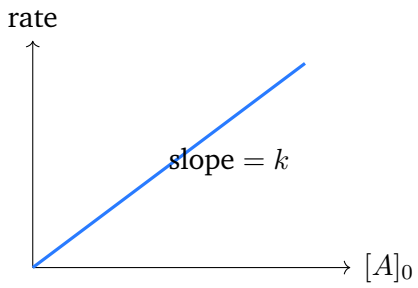
(A) $261.5\ \text{S cm}^2\ \text{mol}^{-1}$

(B) $390.7\ \text{S cm}^2\ \text{mol}^{-1}$

(C) $516.1\ \text{S cm}^2\ \text{mol}^{-1}$

(D) $208.6\ \text{S cm}^2\ \text{mol}^{-1}$

Q11. For a reaction $A \rightarrow$ products, the initial rate was measured at several initial concentrations $[A]_0$ and found to vary linearly with $[A]_0$ through the origin, as sketched below. The order of the reaction with respect to A is



(A) zero order

(B) half order

(C) first order

(D) second order

Q12. The electronic configuration of the Fe^{3+} ion (atomic number of Fe $= 26$) in its ground state is

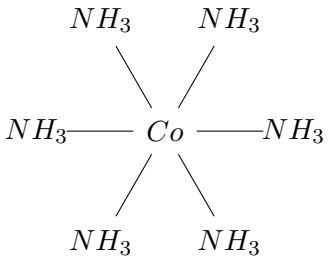
(A) $[Ar]\,3d^6$

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

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

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

Q13. Consider the complex ion shown below, in which a central cobalt atom is bonded to six ammonia ligands. For $[Co(NH_3)_6]^{3+}$, the oxidation state of cobalt and its coordination number are, respectively,



(A) $+3$ and 6

(B) $+2$ and 6

(C) $+3$ and 3

(D) $+6$ and 3

Q14. Three carbocations are shown below. Considering inductive and hyperconjugative (electron-releasing) effects of alkyl groups, the correct order of their stability is

CH_3^+ (I) $\qquad$ $CH_3\text{–}\overset{+}{C}H_2$ (II) $\qquad$ $(CH_3)_3C^+$ (III)

(A) I $>$ II $>$ III

(B) III $>$ II $>$ I

(C) II $>$ III $>$ I

(D) I $>$ III $>$ II

Q15. The number of distinct monochlorination products (structural isomers, ignoring stereoisomers) obtained when 2-methylbutane undergoes free-radical chlorination is

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3$$

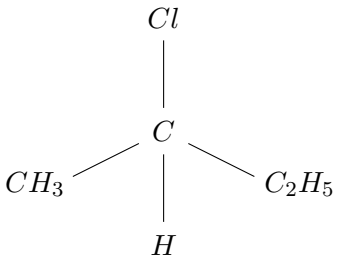
(A) 2

(B) 3

(C) 4

(D) 5

Q16. The tetrahedral carbon shown below carries four different groups: H, Cl, CH_3 and C_2H_5. Such a molecule (2-chlorobutane) is



(A) achiral, because it has a plane of symmetry

(B) achiral, because the central carbon is sp^3 hybridised

(C) optically inactive, being a meso compound

(D) chiral, because the central carbon bears four different groups

Q17. When butan-2-ol ($CH_3CH(OH)CH_2CH_3$) is heated with concentrated H_2SO_4, acid-catalysed dehydration occurs. According to Saytzeff's rule, the major alkene product is

(A) but-1-ene

(B) but-2-ene

(C) buta-1,3-diene

(D) 2-methylpropene

Q18. Consider the acids: acetic acid (CH_3COOH), chloroacetic acid ($ClCH_2COOH$), dichloroacetic acid ($Cl_2CHCOOH$) and trichloroacetic acid (Cl_3CCOOH). The correct order of acid strength (strongest first) is

(A) $CH_3COOH > ClCH_2COOH > Cl_2CHCOOH > Cl_3CCOOH$

(B) $ClCH_2COOH > CH_3COOH > Cl_2CHCOOH > Cl_3CCOOH$

(C) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$

(D) $Cl_2CHCOOH > Cl_3CCOOH > ClCH_2COOH > CH_3COOH$

Q19. Benzene diazonium chloride ($C_6H_5N_2^+Cl^-$), prepared by diazotization of aniline at 0–$5\,^\circ$C, is treated with phenol in a mildly alkaline medium. The principal organic product of this coupling reaction is

(A) p-hydroxyazobenzene (an orange azo dye)

(B) chlorobenzene

(C) phenyl benzoate

(D) nitrobenzene

Q20. Which one of the following statements about proteins is *correct*?

(A) The primary structure refers to the coiling of the chain into an α-helix held by hydrogen bonds

(B) Denaturation destroys the secondary and tertiary structure but leaves the primary structure (sequence) intact

(C) A linear pentapeptide contains five peptide (amide) bonds

(D) Denaturation breaks the peptide bonds of the protein backbone

Detailed Solutions

Q1.

Solution

Concept — Limiting reagent: The reactant that runs out first fixes the amount of product; convert each reactant to moles and compare against the stoichiometric ratio.

Step 1 — Moles of each reactant: $n_{Al} = \dfrac{5.4}{27} = 0.20$ mol; $n_{Cl_2} = \dfrac{21.3}{71} = 0.30$ mol.

Step 2 — Find the limiting reagent: The ratio required is $Al : Cl_2 = 2 : 3$. For 0.20 mol Al we need 0.30 mol Cl_2, which is exactly available. Both are consumed completely (stoichiometric mix), and Al gives 0.20 mol $AlCl_3$.

Step 3 — Mass of product: $M(AlCl_3) = 27 + 3(35.5) = 133.5$ g mol^{-1}. Mass $= 0.20 \times 133.5 = 26.7$ g.

Why other options are wrong:

- (A) 13.35 g uses only 0.10 mol of product.
- (C) 40.05 g assumes 0.30 mol $AlCl_3$ (wrongly tied to Cl_2 moles directly).
- (D) 53.4 g doubles the correct amount.

Final Answer: 26.7 g of $AlCl_3 \Rightarrow$ B

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — de Broglie wavelength: A particle of mass m moving with speed v has an associated wavelength $\lambda = \dfrac{h}{mv}$.

Step 1 — Compute the momentum: $mv = (9.1 \times 10^{-31})(7.3 \times 10^{6}) = 6.64 \times 10^{-24}$ kg m s^{-1}.

Step 2 — Wavelength: $\lambda = \dfrac{6.63 \times 10^{-34}}{6.64 \times 10^{-24}} \approx 1.0 \times 10^{-10}$ m (= 1 Å).

Why other options are wrong:

- (B) 1.0×10^{-8} m is off by $100\times$ (a power-of-ten slip).
- (C) 1.0×10^{-12} m is too small by $100\times$.
- (D) 0.5×10^{-10} m halves the correct value (uses $2mv$).

Final Answer: $\lambda \approx 1.0 \times 10^{-10}$ m $\Rightarrow$ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Reading the configuration: The highest principal quantum number gives the period; the block is set by the subshell being filled last; the group (for p-block) is $10+$ (number of s and p electrons in the valence shell).

Step 1 — Period: Highest n is 4 (the $4s$ and $4p$ electrons) $\Rightarrow$ Period 4.

Step 2 — Block: The last electrons enter the $4p$ subshell $\Rightarrow$ p-block.

Step 3 — Group: Valence electrons $= 4s^2\,4p^3$, i.e. 5 electrons. For a p-block element, group $= 10 + 5 = 15$. (This is arsenic, $Z = 33$.)

Why other options are wrong:

- (A) Group 13 would need $4s^2\,4p^1$.
- (B) Period 3 ignores the $n = 4$ valence shell.
- (D) The $3d$ is completely filled, so the element is not in the d-block; Group 5 is wrong.

Final Answer: Period 4, Group 15, p-block $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — VSEPR and lone-pair repulsion: Lone pairs repel more strongly than bond pairs, so as the number of lone pairs on the central atom increases, the bond angle decreases.

Step 1 — Count lone pairs: CH_4 (C): 0 lone pairs; NH_3 (N): 1 lone pair; H_2O (O): 2 lone pairs. Hence lone pairs: $H_2O > NH_3 > CH_4$.

Step 2 — Compare bond angles: $CH_4 = 109.5°$, $NH_3 = 107°$, $H_2O = 104.5°$. More lone pairs $\Rightarrow$ smaller angle, so $CH_4 > NH_3 > H_2O$.

Why other options are wrong:

- (A) Reverses the lone-pair order.
- (B) Claims more lone pairs give a larger angle (opposite of VSEPR).
- (C) Treats all three as identical.

Final Answer: lone pairs $H_2O > NH_3 > CH_4$; angles $CH_4 > NH_3 > H_2O \Rightarrow$ D

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Reaction enthalpy from bond enthalpies: $\Delta H_{\text{rxn}} = \sum(\text{bonds broken in reactants}) - \sum(\text{bonds formed in products})$.

Step 1 — Bonds broken: One $H-H$ and one $Cl-Cl$: $436 + 242 = 678$ kJ mol^{-1}.

Step 2 — Bonds formed: Two $H-Cl$ bonds: $2 \times 431 = 862$ kJ mol^{-1}.

Step 3 — Enthalpy: $\Delta H = 678 - 862 = -184$ kJ mol^{-1} (exothermic).

Why other options are wrong:

- (B) $+184$ reverses the sign (treats it as bonds formed minus bonds broken).
- (C) -247 uses only one $H-Cl$ bond.
- (D) -92 halves the result.

Final Answer: $\Delta H = -184$ kJ mol$^{-1} \Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Le Chatelier's principle: A system at equilibrium shifts to oppose an imposed change. The forward reaction here is exothermic and proceeds with a decrease in the number of gas moles ($4 \rightarrow 2$).

Step 1 — Effect of pressure: Increasing the total pressure (by reducing volume) shifts the equilibrium towards the side with fewer gas moles, i.e. towards NH_3. Yield increases.

Step 2 — Check the rest: Increasing temperature favours the endothermic (reverse) direction, lowering NH_3. Adding inert gas at constant volume changes no partial pressure, so no shift. Removing N_2 shifts the equilibrium backwards, lowering NH_3.

Why other options are wrong:

- (A) Higher T decreases yield for an exothermic forward reaction.

- (C) Inert gas at constant volume does not change concentrations.
- (D) Removing a reactant shifts equilibrium backward.

Final Answer: Increasing total pressure by reducing volume $\Rightarrow$ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Oxidizing and reducing agents: The oxidizing agent is itself reduced (oxidation number falls); the reducing agent is itself oxidized (oxidation number rises).

Step 1 — Track manganese: In MnO_2, Mn is $+4$; in $MnCl_2$, Mn is $+2$. Mn is reduced, so MnO_2 is the oxidizing agent.

Step 2 — Track chlorine: In HCl, Cl is -1; in Cl_2, Cl is 0. Cl is oxidized, so HCl is the reducing agent.

Why other options are wrong:

- (A) Swaps the two roles.
- (B) Cl_2 and H_2O are products, not the agents driving the redox change.
- (D) $MnCl_2$ and Cl_2 are products.

Final Answer: Oxidizing agent MnO_2, reducing agent $HCl \Rightarrow$ C

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Dalton's law of partial pressures: Each gas exerts the pressure it would if it alone occupied the vessel; the partial pressure of helium is $p_{He} = \dfrac{n_{He}RT}{V}$.

Step 1 — Moles of helium: $n_{He} = \dfrac{4.0}{4} = 1.0$ mol. (Nitrogen: $n_{N_2} = \dfrac{14.0}{28} = 0.5$ mol, not needed for p_{He}.)

Step 2 — Partial pressure of He: $p_{He} = \dfrac{(1.0)(0.082)(300)}{5.0} = \dfrac{24.6}{5.0} = 4.92$ atm.

Why other options are wrong:

- (A) 2.46 atm uses $n = 0.5$ mol (the nitrogen amount).
- (B) 7.38 atm is the *total* pressure (1.5 mol).
- (C) 9.84 atm doubles the He partial pressure.

Final Answer: $p_{He} \approx 4.92$ atm $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Raoult's law (relative lowering): For a dilute solution of a non-volatile solute, $\frac{p^\circ - p}{p^\circ} = x_{\text{solute}} \approx \frac{n_{\text{solute}}}{n_{\text{solvent}}}$.

Step 1 — Set up: $n_{\text{water}} = \frac{180}{18} = 10$ mol. Let solute molar mass be M, so $n_{\text{solute}} = \frac{18}{M}$.

Step 2 — Apply the relation: $0.02 = \frac{18/M}{10} = \frac{1.8}{M}$.

Step 3 — Solve: $M = \frac{1.8}{0.02} = 90\ \text{g mol}^{-1}$.

Why other options are wrong:

- (B) $180\ \text{g mol}^{-1}$ omits dividing the solute moles by the solvent moles.
- (C) $45\ \text{g mol}^{-1}$ halves the correct mass.
- (D) $60\ \text{g mol}^{-1}$ comes from an arithmetic slip in $1.8/0.02$.

Final Answer: $M = 90\ \text{g mol}^{-1} \Rightarrow$ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Kohlrausch's law of independent migration: The limiting molar conductivity is the sum of independent ionic contributions, so combinations of strong-electrolyte values can build a weak electrolyte's value.

Step 1 — Construct CH_3COOH: $\Lambda^\circ(CH_3COOH) = \Lambda^\circ(CH_3COONa) + \Lambda^\circ(HCl) - \Lambda^\circ(NaCl)$, since this combination cancels Na^+ and Cl^- and leaves CH_3COO^- and H^+.

Step 2 — Substitute: $\Lambda^\circ = 91.0 + 426.1 - 126.4 = 390.7$ S cm^2 mol^{-1}.

Why other options are wrong:

- (A) 261.5 uses a wrong combination ($NaCl + CH_3COONa - ...$).
- (C) 516.1 adds all three instead of subtracting $NaCl$.
- (D) 208.6 subtracts HCl rather than adding it.

Final Answer: $\Lambda^\circ = 390.7$ S cm^2 mol^{-1} $\Rightarrow$ B

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Order from rate dependence: For rate $= k[A]^n$, a plot of rate against $[A]_0$ is a straight line through the origin only when $n = 1$.

Step 1 — Interpret the graph: The sketch shows rate $\propto [A]_0$ (linear, passing through the origin), so rate $= k[A]_0^1$.

Step 2 — Read off the order: The exponent is 1, so the reaction is first order in A; the slope of the line is the rate constant k.

Why other options are wrong:

- (A) Zero order would give a horizontal line (rate independent of $[A]_0$).
- (B) Half order would give a curve (rate $\propto \sqrt{[A]_0}$), not a straight line.
- (D) Second order would give an upward-bending parabola (rate $\propto [A]_0^2$).

Final Answer: First order in A $\Rightarrow$ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Configuration of a transition-metal ion: Write the neutral atom's configuration, then remove electrons from the $4s$ orbital *before* the $3d$ orbital when forming the cation.

Step 1 — Neutral Fe: $Z = 26 \Rightarrow [Ar]\, 3d^6\, 4s^2$.

Step 2 — Form Fe^{3+}: Remove 3 electrons: first the two $4s$ electrons, then one $3d$ electron. This leaves $[Ar]\, 3d^5$ (a stable, half-filled d-subshell).

Why other options are wrong:

- (A) $3d^6$ is Fe^{2+}, not Fe^{3+}.
- (B) Retains $4s$ electrons, which are removed first.
- (C) Wrong electron count and keeps a $4s$ electron.

Final Answer: $[Ar]\,3d^5 \Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Oxidation state and coordination number: The coordination number is the count of donor atoms (sigma bonds) attached to the metal; the oxidation state is found by balancing ligand charges against the overall charge.

Step 1 — Coordination number: Six NH_3 ligands are bonded to Co, so the coordination number is 6.

Step 2 — Oxidation state: NH_3 is neutral. Let Co be x: $x + 6(0) = +3 \Rightarrow x = +3$.

Why other options are wrong:

- (B) $+2$ ignores the overall $+3$ charge.
- (C) and (D) take the coordination number as 3, but six ligands are bonded.

Final Answer: Oxidation state $+3$, coordination number $6 \Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Carbocation stability: Alkyl groups release electron density (inductive $+I$ and hyperconjugation), stabilising the positive carbon. More alkyl substituents $\Rightarrow$ more stable cation.

Step 1 — Classify each cation: (I) CH_3^+ is a methyl cation (no alkyl groups); (II) $CH_3CH_2^+$ is primary (one alkyl group); (III) $(CH_3)_3C^+$ is tertiary (three alkyl groups).

Step 2 — Rank stability: Tertiary $>$ primary $>$ methyl, i.e. III $>$ II $>$ I.

Why other options are wrong:

- (A) Reverses the order entirely.
- (C) Wrongly places primary above tertiary.
- (D) Puts methyl as most stable.

Final Answer: III $>$ II $>$ I $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Monochlorination products: Each chemically distinct (non-equivalent) type of hydrogen gives one structural monochloride. Count the sets of equivalent H atoms.

Step 1 — Label the carbons of 2-methylbutane $(CH_3)_2CH–CH_2–CH_3$: the two equivalent methyls on C2, the lone C2–H, the C3 methylene, and the terminal C4 methyl.

Step 2 — Count distinct H environments: (1) the $(CH_3)_2$ methyl H's, (2) the tertiary C2–H, (3) the C3 CH_2 H's, (4) the C4 CH_3 H's. That is 4 distinct positions $\Rightarrow$ 4 structural monochlorides.

Why other options are wrong:

- (A) 2 and (B) 3 under-count the equivalent sets.
- (D) 5 over-counts, e.g. by treating the two equivalent methyls as different.

Final Answer: 4 monochlorination products $\Rightarrow$ C

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Chirality: A carbon bonded to four *different* groups is a stereocentre; a molecule with one such centre and no internal symmetry is chiral and optically active.

Step 1 — Examine the central carbon: It bears H, Cl, CH_3 and C_2H_5 — four different groups.

Step 2 — Conclude: With four different substituents and no plane of symmetry, the molecule is chiral and exists as two non-superimposable mirror images

(enantiomers); it is optically active.

Why other options are wrong:

- (A) There is no plane of symmetry.
- (B) sp^3 hybridisation alone does not make a carbon achiral.
- (C) A meso compound requires more than one stereocentre with internal symmetry.

Final Answer: Chiral, four different groups on the carbon $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Saytzeff's rule: In acid-catalysed dehydration, the major alkene is the more substituted (more stable) one, formed by losing the hydrogen from the carbon with fewer hydrogens.

Step 1 — Identify the β-hydrogens: Butan-2-ol can lose H from C1 (giving but-1-ene) or from C3 (giving but-2-ene).

Step 2 — Apply Saytzeff: But-2-ene is the disubstituted (internal) alkene, more stable than the terminal but-1-ene, so but-2-ene is the major product.

Why other options are wrong:

- (A) But-1-ene is the minor (Hofmann) product.
- (C) A 1,3-diene would require loss of two molecules of water.
- (D) 2-methylpropene has a different (branched) carbon skeleton, not formed here.

Final Answer: But-2-ene (major) $\Rightarrow$ B

Answer: (B) Go Back to Q17

Q18.

Solution

Concept — Inductive effect on acidity: Electron-withdrawing groups ($-I$) stabilise the carboxylate anion, increasing acidity. More chlorine atoms near the $-COOH$ group means stronger acid.

Step 1 — Rank by number of Cl atoms: Trichloroacetic (3 Cl) $>$ dichloroacetic (2 Cl) $>$ chloroacetic (1 Cl) $>$ acetic (0 Cl, and CH_3 is electron-*releasing*).

Step 2 — Confirm with pK_a trend: pK_a values fall as Cl is added ($\sim 4.76 \rightarrow 2.86 \rightarrow 1.29 \rightarrow 0.65$), confirming the order.

Why other options are wrong:

- (A) Reverses the trend (acetic strongest is wrong).
- (B) and (D) misplace the relative positions of the chlorinated acids.

Final Answer: $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH \Rightarrow$ C

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Azo coupling: A diazonium salt acts as a weak electrophile and couples with electron-rich aromatics (phenols, aromatic amines) at the para position, giving a coloured azo compound.

Step 1 — Coupling with phenol: In mild alkali, $C_6H_5N_2^+$ attacks the para position of phenol, forming the azo linkage $-N=N-$.

Step 2 — Product: The product is p-hydroxyazobenzene, C_6H_5–$N=N$–C_6H_4–OH (an orange azo dye).

Why other options are wrong:

- (B) Chlorobenzene forms only with $CuCl$ (Sandmeyer), not with phenol.
- (C) Phenyl benzoate is an ester, an unrelated product.
- (D) Nitrobenzene is not formed in a coupling reaction.

Final Answer: p-hydroxyazobenzene (orange azo dye) $\Rightarrow$ A

Answer: (A) Go Back to Q19

Q20.

Solution

Concept — Protein structure and denaturation: The primary structure is the amino-acid sequence joined by peptide bonds; secondary/tertiary structures arise from hydrogen bonding and folding. Denaturation disrupts the higher-order structure (H-bonds) but does not cleave peptide bonds.

Step 1 — Evaluate the correct statement: Denaturation (heat, pH, etc.) unfolds the secondary and tertiary structure while the covalent backbone (primary sequence) stays intact. Statement (B) is correct.

Step 2 — Peptide-bond counting (checks C): A peptide of n residues has $(n-1)$ peptide bonds, so a pentapeptide has 4 peptide bonds, not 5.

Why other options are wrong:

- (A) The α-helix is the secondary structure, not the primary structure (which is the sequence).
- (C) A pentapeptide has 4 peptide bonds, not 5.
- (D) Denaturation does not break peptide (covalent) bonds.

Final Answer: Denaturation leaves the primary structure intact $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q20

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	A	3	C	4	D	5	A
6	B	7	C	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	D	17	B	18	C	19	A	20	B