PGIMER BSc Nursing Chemistry

Sample Paper – 6

Duration: 23 Minutes **Maximum Marks: 25**

Instructions

- This paper contains **25** Multiple Choice Questions (Single Correct Answer), modelled on the Chemistry portion of the **PGIMER BSc Nursing** entrance exam.
- Each correct answer carries **+1 mark**. **0.25 mark** is deducted for every incorrect answer. Unattempted questions carry **0 marks**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 and 12 (NCERT) Chemistry**.
- The exam is conducted as a computer-based test. Personal calculators, mobile phones, log tables, and other electronic gadgets are strictly prohibited.

Q1. The number of moles present in 11.2 L of a gas measured at STP (molar volume $= 22.4$ L mol^{-1}) is:

(A) 1.0 mol

(B) 0.25 mol

(C) 0.5 mol

(D) 2.0 mol

Q2. Using the Rydberg formula, the wavelength of the spectral line emitted when the electron in a hydrogen atom falls from $n = 2$ to $n = 1$ ($R_\text{H} = 1.1 \times 10^7$ m^{-1}) is approximately:

(A) 656 nm

(B) 365 nm

(C) 91 nm

(D) 122 nm

Q3. The correct order of decreasing metallic character among the period-3 elements Na, Mg, Al and Si is:

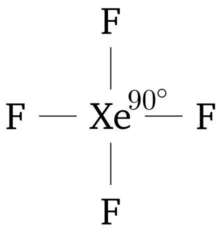
(A) Si $>$ Al $>$ Mg $>$ Na

(B) Al $>$ Mg $>$ Na $>$ Si

(C) Mg $>$ Na $>$ Al $>$ Si

(D) Na $>$ Mg $>$ Al $>$ Si

Q4. The shape of the xenon tetrafluoride (XeF_4) molecule, whose skeleton is shown below, is:



(A) tetrahedral

(B) square planar

(C) octahedral

(D) see-saw

Q5. Which one of the following compounds contains *both* ionic and covalent bonds?

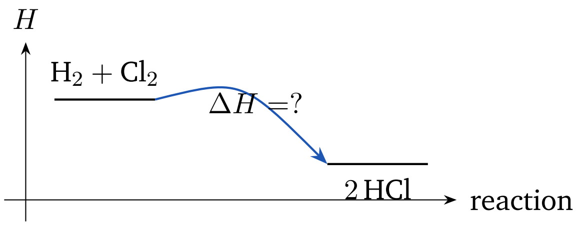
(A) NaCl

(B) NaCN

(C) CH_4

(D) Cl_2

Q6. For the reaction $H_2(g) + Cl_2(g) \rightarrow 2\,HCl(g)$, use the bond enthalpies H–H $= 436$, Cl–Cl $= 242$ and H–Cl $= 431$ kJ mol^{-1}. The enthalpy of the reaction is:



(A) -862 kJ

(B) $+184$ kJ

(C) -184 kJ

(D) -678 kJ

Q7. For the equilibrium $N_2(g) + 3\,H_2(g) \rightleftharpoons 2\,NH_3(g)$, the relation between K_p and K_c is:

(A) $K_p = K_c(RT)^{-2}$

(B) $K_p = K_c(RT)^2$

(C) $K_p = K_c(RT)$

(D) $K_p = K_c$

Q8. In the reduction of the permanganate ion to Mn^{2+} in acidic medium ($MnO_4^- \rightarrow Mn^{2+}$), the change in the oxidation state of manganese is:

(A) 2

(B) 5

(C) 3

(D) 7

Q9. The correct relationship between the standard Gibbs energy change and the standard cell potential of an electrochemical cell is:

(A) $\Delta G^\circ = -nFE^\circ_{\text{cell}}$

(B) $\Delta G^\circ = +nFE^\circ_{\text{cell}}$

(C) $\Delta G^\circ = -\dfrac{nE^\circ_{\text{cell}}}{F}$

(D) $\Delta G^\circ = \dfrac{nF}{E^\circ_{\text{cell}}}$

Q10. The rate of a certain reaction doubles for every 10°C rise in temperature. By what factor does the rate increase when the temperature is raised from 20°C to 50°C?

(A) 8 times

(B) 2 times

(C) 4 times

(D) 6 times

Q11. The depression in freezing point when 0.1 mol of a non-volatile, non-electrolyte solute is dissolved in 1 kg of water ($K_f = 1.86$ K kg mol^{-1}) is:

(A) 1.86 K

(B) 0.93 K

(C) 0.372 K

(D) 0.186 K

Q12. The high-spin complex $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ has the central Fe^{2+} ion ($3d^6$) with four unpaired electrons. Its spin-only magnetic moment is:

(A) 1.73 BM

(B) 3.87 BM

(C) 4.90 BM

(D) 5.92 BM

Q13. Which of the following statements about interhalogen compounds is correct?

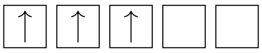
(A) They do not exist and cannot be prepared in the laboratory.

(B) They are always purely ionic compounds.

(C) They are less reactive than the halogens from which they are formed.

(D) They are generally more reactive than the halogens (except fluorine).

Q14. The correct ground-state electronic configuration of the chromium(III) ion, Cr^{3+} ($Z = 24$), whose $3d$ sub-shell is shown below, is:



three unpaired electrons ($3d^3$)

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

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

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

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

Q15. Which of the following alkali metals burns in excess oxygen to form a stable superoxide of the type MO_2?

(A) Potassium

(B) Lithium

(C) Sodium

(D) Beryllium

Q16. The correct order of decreasing stability of the following free radicals is:

(A) $(CH_3)_3C^{\bullet} > (CH_3)_2CH^{\bullet} > CH_3CH_2^{\bullet} > CH_3^{\bullet}$

(B) $CH_3^{\bullet} > CH_3CH_2^{\bullet} > (CH_3)_2CH^{\bullet} > (CH_3)_3C^{\bullet}$

(C) $CH_3CH_2^{\bullet} > (CH_3)_3C^{\bullet} > CH_3^{\bullet} > (CH_3)_2CH^{\bullet}$

(D) all four radicals are equally stable

Q17. The addition of HBr to propene in the presence of an organic peroxide (Kharasch effect), shown below, gives mainly:

$$CH_3\text{-}CH{=}CH_2 \xrightarrow[\text{peroxide}]{\text{HBr}} \text{product}$$

(A) 2-bromopropane

(B) 1-bromopropane

(C) 1,2-dibromopropane

(D) propan-1-ol

Q18. When an optically active alkyl halide undergoes an S_N2 reaction, the product shows:

(A) complete retention of configuration

(B) complete racemisation

(C) no change in spatial arrangement

(D) inversion of configuration (Walden inversion)

Q19. In the Lucas test (using concentrated HCl and anhydrous $ZnCl_2$), which type of alcohol produces immediate turbidity at room temperature?

(A) a primary alcohol

(B) methanol

(C) a secondary alcohol

(D) a tertiary alcohol

Q20. The reduction of propanone (acetone) with sodium borohydride ($NaBH_4$) gives:

(A) propane

(B) propanal

(C) propan-2-ol

(D) propan-1-ol

Q21. The correct order of decreasing acidic strength among acetic acid, phenol, water and ethanol is:

(A) ethanol $>$ water $>$ phenol $>$ acetic acid

(B) phenol $>$ acetic acid $>$ water $>$ ethanol

(C) acetic acid $>$ phenol $>$ water $>$ ethanol

(D) water $>$ acetic acid $>$ phenol $>$ ethanol

Q22. A primary aliphatic amine ($R\text{-}NH_2$) reacts with nitrous acid (HNO_2) at room temperature to give mainly:

(A) a stable diazonium salt

(B) an alcohol with brisk evolution of nitrogen gas

(C) a secondary amine

(D) an amide

Q23. Enzymes, which speed up biochemical reactions in living systems, are best described as:

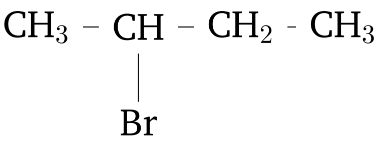
(A) proteins that act as biological catalysts

(B) carbohydrates that store chemical energy

(C) lipids that form cell membranes

(D) nucleic acids that carry genetic information

Q24. The IUPAC name of the haloalkane whose structure is shown below is:



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

(A) 1-bromobutane

(B) 2-bromobutane

(C) 2-bromopropane

(D) 3-bromobutane

Q25. In a paper chromatography experiment, a solute spot moves 4 cm from the base line while the solvent front moves 8 cm in the same time. The R_f value of the solute is:

(A) 2.0

(B) 0.25

(C) 0.5

(D) 1.0

Detailed Solutions

Q1.

Solution

Concept — Molar gas volume: At STP one mole of any ideal gas occupies 22.4 L, so the number of moles equals the gas volume divided by 22.4 L mol^{-1}.

Step 1 — List the data: Volume of gas $V = 11.2$ L.

Molar volume at STP $= 22.4$ L mol^{-1}.

Step 2 — Apply the relation:

$$n = \frac{V}{22.4} = \frac{11.2}{22.4}.$$

Step 3 — Simplify:

$$n = 0.5 \text{ mol}.$$

Why other options are wrong:

- Option A $(1.0$ mol$)$: would require 22.4 L of gas.
- Option B $(0.25$ mol$)$: would require 5.6 L.
- Option D $(2.0$ mol$)$: would require 44.8 L.

Final Answer: Number of moles $= 0.5$ mol $\Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q1**

Q2.

Solution

Concept — Rydberg formula: For a hydrogen spectral line, $\dfrac{1}{\lambda} = R_{\text{H}}\left(\dfrac{1}{n_1^2} - \dfrac{1}{n_2^2}\right)$, where $n_1 < n_2$.

Step 1 — Insert the levels ($n_1 = 1,\ n_2 = 2$):

$$\frac{1}{\lambda} = R_{\text{H}}\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = R_{\text{H}}\left(1 - \frac{1}{4}\right).$$

Step 2 — Evaluate the bracket:

$$\frac{1}{\lambda} = R_{\text{H}} \times \frac{3}{4} = (1.1 \times 10^7) \times 0.75.$$

Step 3 — Compute:

$$\frac{1}{\lambda} = 8.25 \times 10^6 \text{ m}^{-1}.$$

$$\lambda = \frac{1}{8.25 \times 10^6} \approx 1.21 \times 10^{-7} \text{ m} = 121\text{–}122 \text{ nm}.$$

Why other options are wrong:

- Option A (656 nm): the $n = 3 \to 2$ line (Balmer), not Lyman.
- Option B (365 nm): the Balmer series limit.
- Option C (91 nm): the Lyman series limit ($n = \infty \to 1$).

Final Answer: $\lambda \approx 122$ nm $\Rightarrow \boxed{\text{D}}$

$\boxed{\text{Answer: (D)}}$ **Go Back to Q2**

Q3.

Solution

Concept — Metallic character across a period: Metallic character decreases from left to right across a period as the nuclear charge rises and the tendency to lose electrons falls.

Step 1 — Place the elements: Na, Mg, Al and Si lie in period 3 in that left-to-right order.

Step 2 — Apply the trend: Sodium loses electrons most easily (most metallic); silicon is a metalloid (least metallic of these).

Step 3 — Write the order: Na $>$ Mg $>$ Al $>$ Si.

Why other options are wrong:

- Option A: exactly reversed (this is the non-metallic order).
- Option B and Option C: jumble the period sequence incorrectly.

Final Answer: The order is Na $>$ Mg $>$ Al $>$ Si $\Rightarrow \boxed{\text{D}}$

$\boxed{\text{Answer: (D)}}$ **Go Back to Q3**

Q4.

Solution

Concept — VSEPR for XeF_4: The shape is fixed by counting the bond pairs and lone pairs on the central atom and minimising their repulsions.

Step 1 — Count electron pairs on xenon: Xe has 8 valence electrons; four are shared with four F atoms, leaving two lone pairs.

So there are 4 bond pairs $+ 2$ lone pairs $= 6$ electron pairs.

Step 2 — Arrange the six pairs: Six pairs take an octahedral arrangement; the two lone pairs occupy opposite (axial) positions to minimise repulsion.

Step 3 — Read off the molecular shape: The four F atoms left in one plane give a *square planar* molecule with 90° angles, as shown.

Why other options are wrong:

- Option A (tetrahedral): would need four bond pairs and no lone pairs.
- Option C (octahedral): describes the electron-pair geometry, not the molecular shape.
- Option D (see-saw): the shape of SF_4 (one lone pair).

Final Answer: XeF_4 is square planar $\Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q4**

Q5.

Solution

Concept — Mixed bonding: A compound contains both ionic and covalent bonds when an ion is itself held together by covalent bonds, e.g. a polyatomic ion paired with a metal cation.

Step 1 — Examine sodium cyanide (NaCN): NaCN is made of Na^+ and the cyanide ion CN^-.

Step 2 — Identify the two bond types: The $Na^+ - CN^-$ attraction is ionic; the carbon and nitrogen inside CN^- are joined by a covalent (triple) bond.

Why other options are wrong:

- Option A (NaCl): purely ionic.
- Option C (CH_4): purely covalent.
- Option D (Cl_2): a single non-polar covalent bond only.

Final Answer: NaCN has both ionic and covalent bonds $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ Go Back to Q5

Q6.

Solution

Concept — Bond-enthalpy method: $\Delta H_{\text{reaction}} = \sum(\text{bond enthalpies of bonds broken}) - \sum(\text{bond enthalpies of bonds formed})$.

Step 1 — Bonds broken (reactants): One H–H bond and one Cl–Cl bond:

$$436 + 242 = 678 \text{ kJ}.$$

Step 2 — Bonds formed (products): Two H–Cl bonds:

$$2 \times 431 = 862 \text{ kJ}.$$

Step 3 — Combine:

$$\Delta H = 678 - 862 = -184 \text{ kJ}.$$

Why other options are wrong:

- Option A (-862 kJ): uses only the bonds-formed term.
- Option B ($+184$ kJ): correct magnitude but wrong sign.
- Option D (-678 kJ): uses only the bonds-broken term.

Final Answer: $\Delta H = -184 \text{ kJ} \Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q6

Q7.

Solution

Concept — Relating K_p and K_c: $K_p = K_c(RT)^{\Delta n}$, where Δn is the change in the number of moles of gas (products minus reactants).

Step 1 — Count gas moles: Products: 2 mol NH_3. Reactants: 1 mol N_2 + 3 mol H_2 = 4 mol.

Step 2 — Find Δn:

$$\Delta n = 2 - 4 = -2.$$

Step 3 — Write the relation:

$$K_p = K_c(RT)^{-2}.$$

Why other options are wrong:

- Option B ($(RT)^2$): uses the wrong sign of Δn.
- Option C ($(RT)^1$): would need $\Delta n = +1$.
- Option D ($K_p = K_c$): only true when $\Delta n = 0$.

Final Answer: $K_p = K_c(RT)^{-2} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q7

Q8.

Solution

Concept — Change in oxidation state: Find the oxidation number of the element before and after the reaction; the change is the difference between the two.

Step 1 — Oxidation state in MnO_4^-: Let Mn be x: $x + 4(-2) = -1 \Rightarrow x = +7$.

Step 2 — Oxidation state in Mn^{2+}: The ion charge gives $+2$ directly.

Step 3 — Compute the change:

$$\Delta = (+7) - (+2) = 5.$$

The oxidation state falls by 5 units (gain of 5 electrons).

Why other options are wrong:

- Option A (2): just the final state, not the change.
- Option C (3): the change for $MnO_4^- \rightarrow MnO_2$ ($+7 \rightarrow +4$).
- Option D (7): just the initial state, not the change.

Final Answer: The oxidation state changes by $5 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q8

Q9.

Solution

Concept — Gibbs energy and cell potential: The maximum electrical work a cell can do equals the decrease in Gibbs energy, giving $\Delta G^\circ = -nFE^\circ_{\text{cell}}$.

Step 1 — Identify the symbols: n is the number of electrons transferred, F is the Faraday constant, and E°_{cell} is the standard cell potential.

Step 2 — Check the sign logic: A spontaneous cell has a positive E°_{cell} and must have a negative ΔG°, which the minus sign in $\Delta G^\circ = -nFE^\circ_{\text{cell}}$ provides.

Why other options are wrong:

- Option B ($+nFE^\circ$): wrong sign; would make spontaneous cells have positive ΔG°.
- Option C and Option D: have F in the wrong place and are dimensionally incorrect.

Final Answer: $\Delta G^\circ = -nFE^\circ_{\text{cell}} \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q9**

Q10.

Solution

Concept — Temperature coefficient: If the rate doubles for every 10°C rise, then over a temperature rise ΔT the rate is multiplied by $2^{(\Delta T/10)}$.

Step 1 — Find the temperature rise:

$$\Delta T = 50^\circ\text{C} - 20^\circ\text{C} = 30^\circ\text{C}.$$

Step 2 — Count the 10°C intervals:

$$\frac{30}{10} = 3 \text{ intervals}.$$

Step 3 — Multiply the factor of two:

$$\text{Factor} = 2^3 = 8.$$

Why other options are wrong:

- Option B (2 times): a single 10°C rise only.

- Option C (4 times): a 20°C rise (2^2).
- Option D (6 times): wrongly multiplies 2×3 instead of using a power.

Final Answer: The rate increases 8 times $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q10

Q11.

Solution

Concept — Depression in freezing point: $\Delta T_f = K_f \times m$, where m is the molality and K_f the cryoscopic constant.

Step 1 — Find the molality:

$$m = \frac{\text{moles of solute}}{\text{kg of solvent}} = \frac{0.1}{1} = 0.1 \text{ mol kg}^{-1}.$$

Step 2 — Apply the formula:

$$\Delta T_f = K_f \times m = 1.86 \times 0.1.$$

Step 3 — Compute:

$$\Delta T_f = 0.186 \text{ K}.$$

Why other options are wrong:

- Option A (1.86 K): uses $m = 1$ instead of 0.1.
- Option B (0.93 K): uses $m = 0.5$.
- Option C (0.372 K): wrongly doubles the result (as for an electrolyte).

Final Answer: $\Delta T_f = 0.186 \text{ K} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Spin-only magnetic moment: $\mu = \sqrt{n(n+2)}$ BM, where n is the number of unpaired electrons.

Step 1 — Unpaired electrons in high-spin Fe^{2+}: Fe^{2+} is $3d^6$; in the high-spin water complex it has 4 unpaired electrons, so $n = 4$.

Step 2 — Substitute into the formula:

$$\mu = \sqrt{4(4+2)} = \sqrt{4 \times 6} = \sqrt{24}.$$

Step 3 — Evaluate:

$$\mu \approx 4.90 \text{ BM}.$$

Why other options are wrong:

- Option A (1.73 BM): for 1 unpaired electron.
- Option B (3.87 BM): for 3 unpaired electrons.
- Option D (5.92 BM): for 5 unpaired electrons.

Final Answer: $\mu \approx 4.90 \text{ BM} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q12

Q13.

Solution

Concept — Interhalogen compounds: These are formed between two different halogens (e.g. ClF_3, ICl). Their bonds are weaker and more polar than the X–X bonds in the parent halogens, making them more reactive.

Step 1 — Judge their reactivity: Because the X–X′ bond is weaker than the average of the two X–X bonds, interhalogens react readily (often more vigorously than the halogens), except that fluorine itself is the most reactive element.

Step 2 — Select the correct statement: They are generally more reactive than the halogens, except fluorine.

Why other options are wrong:

- Option A: many interhalogens are well known and easily prepared.
- Option B: they are covalent, not ionic.

- Option C: they are more, not less, reactive than the parent halogens.

Final Answer: Interhalogens are generally more reactive than halogens $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q13**

Q14.

Solution

Concept — Configuration of a transition-metal ion: Write the neutral atom configuration, then remove electrons first from the $4s$ orbital and then from $3d$ to form the cation.

Step 1 — Neutral chromium ($Z = 24$): $\text{Cr} = [\text{Ar}]\,3d^5\,4s^1$ (a stable half-filled arrangement).

Step 2 — Remove three electrons for Cr^{3+}: Remove the one $4s$ electron first, then two $3d$ electrons:

$$[\text{Ar}]\,3d^5\,4s^1 \xrightarrow{-3e^-} [\text{Ar}]\,3d^3.$$

Step 3 — Match the diagram: $3d^3$ has three singly occupied boxes (three unpaired electrons), as drawn.

Why other options are wrong:

- Option A ($3d^6$): too many electrons for Cr^{3+}.
- Option B ($3d^5\,4s^1$): that is neutral chromium, not the $+3$ ion.
- Option C ($3d^4$): only two electrons removed.

Final Answer: $\text{Cr}^{3+} = [\text{Ar}]\,3d^3 \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q14**

Q15.

Solution

Concept — Oxides of alkali metals: On burning in oxygen, lithium gives the normal oxide, sodium gives the peroxide, and the larger metals potassium, rubidium and caesium give superoxides (MO_2). The large cation stabilises the large O_2^- ion.

Step 1 — Apply the trend: Of the choices given, only potassium is large enough to form a stable superoxide, KO_2.

Step 2 — Confirm: $K + O_2 \rightarrow KO_2$ (potassium superoxide).

Why other options are wrong:

- Option B (lithium): forms only the normal oxide Li_2O.
- Option C (sodium): forms the peroxide Na_2O_2.
- Option D (beryllium): an alkaline-earth metal, not an alkali metal, and does not form a superoxide.

Final Answer: Potassium forms a superoxide ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — Stability of free radicals: Alkyl groups donate electron density (hyperconjugation and the inductive effect) and stabilise the electron-deficient radical centre, so stability rises with the degree of substitution.

Step 1 — Classify the radicals: $(CH_3)_3C^\bullet$ tertiary, $(CH_3)_2CH^\bullet$ secondary, $CH_3CH_2^\bullet$ primary, $CH_3^\bullet$ methyl.

Step 2 — Order by number of stabilising alkyl groups: Tertiary $>$ secondary $>$ primary $>$ methyl.

Why other options are wrong:

- Option B: exactly reversed.
- Option C: jumbles the correct order.
- Option D: the radicals are not equally stable.

Final Answer: $3^\circ > 2^\circ > 1^\circ >$ methyl ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Peroxide (Kharasch) effect: In the presence of an organic peroxide, HBr adds to an unsymmetrical alkene by a free-radical mechanism that gives the *anti*-Markovnikov product.

Step 1 — Identify the alkene: Propene is $CH_3\text{-}CH{=}CH_2$.

Step 2 — Place the bromine: The radical chain forms the more stable secondary carbon radical, so the bromine ends up on the terminal carbon (C-1), opposite to Markovnikov.

Step 3 — Name the product: Br on C-1 gives 1-bromopropane.

Why other options are wrong:

- Option A (2-bromopropane): the Markovnikov product, formed *without* peroxide.
- Option C (1,2-dibromopropane): the product of Br_2 addition.
- Option D (propan-1-ol): an addition of water, not HBr.

Final Answer: The major product is 1-bromopropane $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q17

Q18.

Solution

Concept — Stereochemistry of S_N2: The S_N2 reaction is a one-step, back-side attack of the nucleophile, so the three remaining groups flip through, giving inversion of configuration (Walden inversion).

Step 1 — Picture the attack: The nucleophile approaches from the side opposite the leaving group.

Step 2 — See the consequence: As the leaving group departs, the carbon centre turns inside out, like an umbrella in the wind.

Step 3 — State the result: An optically active substrate gives a product of opposite (inverted) configuration.

Why other options are wrong:

- Option A (retention): would require front-side attack, which S_N2 does not use.
- Option B (racemisation): characteristic of S_N1, not S_N2.
- Option C (no change): contradicts the back-side attack mechanism.

Final Answer: S_N2 proceeds with inversion of configuration $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q18

Q19.

Solution

Concept — Lucas test: The reagent (conc. HCl + anhydrous $ZnCl_2$) converts alcohols to alkyl chlorides; the rate of turbidity (cloudiness) follows the ease of carbocation formation: tertiary $>$ secondary $>$ primary.

Step 1 — Recall the observation: Tertiary alcohols give turbidity *immediately*; secondary alcohols take about 5 minutes; primary alcohols show no turbidity at room temperature.

Step 2 — Select the alcohol: Immediate turbidity means a tertiary alcohol.

Why other options are wrong:

- Option A (primary) and Option B (methanol): no reaction at room temperature.
- Option C (secondary): reacts only after about 5 minutes, not immediately.

Final Answer: A tertiary alcohol gives immediate turbidity $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q19**

Q20.

Solution

Concept — Reduction of carbonyl compounds: $NaBH_4$ (and $LiAlH_4$) reduce the C=O group to an alcohol; a ketone gives a secondary alcohol.

Step 1 — Identify the carbonyl: Propanone (acetone) is CH_3-CO-CH_3, a ketone.

Step 2 — Add hydrogen across C=O:

$$CH_3\text{-CO-}CH_3 \xrightarrow{NaBH_4} CH_3\text{-CH(OH)-}CH_3.$$

Step 3 — Name the product: The OH on the middle carbon gives propan-2-ol (a secondary alcohol).

Why other options are wrong:

- Option A (propane): would require complete deoxygenation (Clemmensen/Wolff–Kishner), not $NaBH_4$.
- Option B (propanal): an aldehyde, an oxidation-level partner, not a reduction product of acetone.

- Option D (propan-1-ol): a primary alcohol, which would come from a different carbonyl.

Final Answer: Acetone is reduced to propan-2-ol $\Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q20**

Q21.

Solution

Concept — Acidity ranking: An acid is stronger when its conjugate base is more stabilised. Carboxylate ions are stabilised by resonance over two oxygens; phenoxide by ring resonance; hydroxide and alkoxide are not resonance-stabilised, and the electron-donating alkyl group makes ethoxide the least stable.

Step 1 — Compare the conjugate bases: Carboxylate (two equivalent oxygens) $>$ phenoxide (ring delocalisation) $>$ hydroxide $>$ ethoxide.

Step 2 — Translate to acidity (approximate pK_a): Acetic acid (≈ 4.8) $>$ phenol (≈ 10) $>$ water (≈ 15.7) $>$ ethanol (≈ 16).

Step 3 — Write the order: acetic acid $>$ phenol $>$ water $>$ ethanol.

Why other options are wrong:

- Option A: completely reversed.
- Option B: puts phenol above acetic acid, which is wrong.
- Option D: puts water above acetic acid and phenol, which is wrong.

Final Answer: acetic acid $>$ phenol $>$ water $>$ ethanol $\Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q21**

Q22.

Solution

Concept — Amines with nitrous acid: Primary aliphatic amines form a very unstable diazonium salt that decomposes at once, releasing nitrogen gas and giving an alcohol (and other products).

Step 1 — Form the diazonium ion: $\text{R-NH}_2 + \text{HNO}_2 \rightarrow [\text{R-N}_2]^+$, which is unstable for an aliphatic R.

Step 2 — Decompose it:

$$[\text{R-N}_2]^+ + \text{H}_2\text{O} \rightarrow \text{R-OH} + \text{N}_2 \uparrow + \text{H}^+.$$

The brisk evolution of N_2 gas is the key observation.

Why other options are wrong:

- Option A (stable diazonium salt): only aromatic primary amines give stable (cold) diazonium salts; aliphatic ones do not.
- Option C (secondary amine): secondary amines give N-nitrosamines, not this reaction.
- Option D (an amide): not formed with nitrous acid.

Final Answer: A primary aliphatic amine gives an alcohol with N_2 gas $\Rightarrow \boxed{\text{B}}$

$\boxed{\text{Answer: (B)}}$ **Go Back to Q22**

Q23.

Solution

Concept — Nature of enzymes: Enzymes are globular proteins that act as highly specific biological catalysts, lowering the activation energy of biochemical reactions.

Step 1 — Recall their composition: Enzymes are made of polypeptide (protein) chains folded into a specific shape with an active site.

Step 2 — Recall their function: They speed up reactions without being consumed, i.e. they are catalysts.

Why other options are wrong:

- Option B (carbohydrates): these store energy (e.g. starch, glycogen), they are not the catalysts.
- Option C (lipids): form membranes and store energy, not catalysts.
- Option D (nucleic acids): DNA/RNA carry genetic information; they are not the general protein catalysts.

Final Answer: Enzymes are proteins acting as biological catalysts $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ **Go Back to Q23**

Q24.

Solution

Concept — IUPAC naming of haloalkanes: Choose the longest chain as the parent, number it to give the substituent the lowest locant, and add the halogen as a prefix with its locant.

Step 1 — Read the structure: CH_3-CHBr-CH_2-CH_3 is a continuous four-carbon (butane) chain carrying a bromine.

Step 2 — Number for the lowest locant: Counting from the left end places the Br on C-2 (from the right it would be C-3); $2 < 3$, so we use C-2.

Step 3 — Assemble the name: A butane chain with Br on C-2 is 2-bromobutane.

Why other options are wrong:

- Option A (1-bromobutane): Br is on C-2, not C-1.
- Option C (2-bromopropane): only three carbons; the chain here has four.
- Option D (3-bromobutane): not the lowest locant; numbering should give C-2.

Final Answer: The compound is 2-bromobutane $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q24

Q25.

Solution

Concept — Retention factor: In chromatography, $R_f = \dfrac{\text{distance moved by the solute}}{\text{distance moved by the solvent front}}$; it always lies between 0 and 1.

Step 1 — List the distances: Distance moved by solute $= 4$ cm; distance moved by solvent front $= 8$ cm.

Step 2 — Apply the formula:

$$R_f = \frac{4}{8}.$$

Step 3 — Simplify:

$$R_f = 0.5.$$

Why other options are wrong:

- Option A (2.0): inverts the ratio; R_f can never exceed 1.

- Option B (0.25): uses the wrong numbers.
- Option D (1.0): would mean the solute travelled with the solvent front.

Final Answer: $R_f = 0.5 \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q25**

Answer Key

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