PGIMER BSc Nursing Chemistry

Sample Paper – 1

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 9 g of water (H_2O, molar mass $= 18$ g mol^{-1}) is:

(A) 0.5 mol

(B) 1.0 mol

(C) 0.25 mol

(D) 2.0 mol

Q2. Which of the following sets of quantum numbers $(n,\ l,\ m_l)$ is permissible for an electron in an atom?

(A) $n = 2,\ l = 2,\ m_l = 0$

(B) $n = 3,\ l = 2,\ m_l = -1$

(C) $n = 1,\ l = 1,\ m_l = 0$

(D) $n = 2,\ l = 0,\ m_l = +1$

Q3. Among the following elements, the one with the largest atomic radius is:

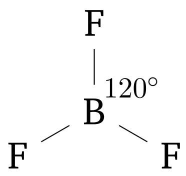
(A) Na

(B) K

(C) Mg

(D) Al

Q4. The hybridization of the central boron atom in boron trifluoride (BF_3), whose planar shape is shown, is:



(A) sp

(B) sp^3

(C) sp^3d

(D) sp^2

Q5. According to molecular orbital theory, the bond order of the oxygen molecule (O_2) is:

(A) 1

(B) 2

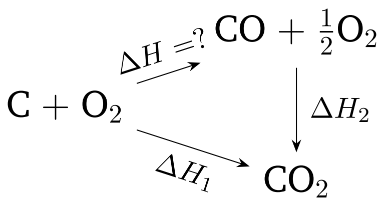
(C) 2.5

(D) 3

Q6. Using the data below and Hess's law, the enthalpy change for the reaction $\mathrm{C}(s) + \frac{1}{2}\mathrm{O}_2(g) \rightarrow \mathrm{CO}(g)$ is:

$$\mathrm{C}(s) + \mathrm{O}_2(g) \rightarrow \mathrm{CO}_2(g), \quad \Delta H_1 = -393 \text{ kJ}$$

$$\mathrm{CO}(g) + \tfrac{1}{2}\mathrm{O}_2(g) \rightarrow \mathrm{CO}_2(g), \quad \Delta H_2 = -283 \text{ kJ}$$



(A) -676 kJ

(B) -110 kJ

(C) $+110$ kJ

(D) -283 kJ

Q7. The pH of a 0.001 M aqueous solution of hydrochloric acid (a strong acid) at $25°$C is:

(A) 1

(B) 2

(C) 3

(D) 11

Q8. The oxidation number of manganese in potassium permanganate ($KMnO_4$) is:

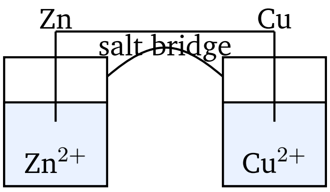
(A) $+2$

(B) $+4$

(C) $+6$

(D) $+7$

Q9. For the Daniell cell shown, $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34$ V and $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76$ V. The standard cell potential E°_{cell} is:



(A) 0.42 V

(B) -1.10 V

(C) 0.76 V

(D) 1.10 V

Q10. For a reaction the experimentally determined rate law is Rate $= k[\text{A}][\text{B}]^2$. The overall order of the reaction is:

(A) 2

(B) 3

(C) 1

(D) 4

Q11. The molarity of a solution prepared by dissolving 4 g of sodium hydroxide (NaOH, molar mass $= 40$ g mol^{-1}) in enough water to make 500 mL of solution is:

(A) 0.1 M

(B) 0.2 M

(C) 0.4 M

(D) 0.05 M

Q12. The IUPAC name of the coordination compound $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ is:

(A) tetraamminecopper(I) sulphate

(B) copper tetraammine sulphate

(C) tetraamminecuprate(II) sulphate

(D) tetraamminecopper(II) sulphate

Q13. Due to the inert pair effect, the stability of the $+1$ oxidation state increases down group 13. The ion in which the $+1$ state is most stable is:

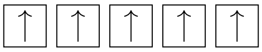
(A) Tl^+

(B) Al^+

(C) Ga^+

(D) B^+

Q14. The spin-only magnetic moment of the Fe^{3+} ion (electronic configuration $3d^5$, shown below) is:



five unpaired electrons ($3d^5$)

(A) 1.73 BM

(B) 3.87 BM

(C) 5.92 BM

(D) 4.90 BM

Q15. The characteristic colour imparted to a Bunsen flame by potassium salts is:

(A) golden yellow

(B) brick red

(C) lilac (violet)

(D) apple green

Q16. Considering the electron-withdrawing inductive effect of chlorine, the strongest acid among the following is:

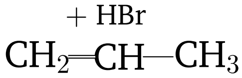
(A) $\text{Cl}_3\text{C-COOH}$ (trichloroacetic acid)

(B) $\text{CH}_3\text{-COOH}$ (acetic acid)

(C) $\text{ClCH}_2\text{-COOH}$ (chloroacetic acid)

(D) $\text{Cl}_2\text{CH-COOH}$ (dichloroacetic acid)

Q17. According to Markovnikov's rule, the addition of HBr to propene (shown) gives mainly:



$$\overset{+\ \mathrm{HBr}}{\mathrm{CH_2{=}CH{-}CH_3}}$$

(A) 2-bromopropane

(B) 1-bromopropane

(C) 1,2-dibromopropane

(D) propan-2-ol

Q18. Which of the following alkyl halides reacts fastest by an S_N1 mechanism?

(A) CH_3Br (methyl bromide)

(B) CH_3CH_2Br (ethyl bromide)

(C) $(CH_3)_3C$-Br (tert-butyl bromide)

(D) $(CH_3)_2CH$-Br (isopropyl bromide)

Q19. Which of the following compounds is the most acidic?

(A) phenol

(B) ethanol

(C) methanol

(D) water

Q20. Aldehydes and ketones characteristically undergo which type of reaction at the carbonyl carbon?

(A) electrophilic addition

(B) electrophilic substitution

(C) nucleophilic substitution

(D) nucleophilic addition

Q21. Among the following carboxylic acids, the strongest acid is:

(A) acetic acid (CH_3COOH)

(B) propanoic acid (CH_3CH_2COOH)

(C) formic acid ($HCOOH$)

(D) pivalic acid ($(CH_3)_3CCOOH$)

Q22. Which of the following is the strongest base in aqueous solution?

(A) methylamine (CH_3NH_2)

(B) aniline ($C_6H_5NH_2$)

(C) ammonia (NH_3)

(D) acetamide (CH_3CONH_2)

Q23. Which of the following carbohydrates is a non-reducing sugar?

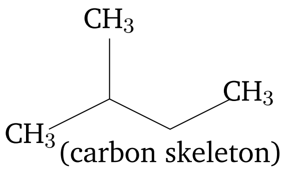
(A) glucose

(B) maltose

(C) sucrose

(D) lactose

Q24. The IUPAC name of the branched alkane shown below is:



(A) pentane

(B) n-butane

(C) 2-methylpropane

(D) 2-methylbutane

Q25. In Lassaigne's test, the presence of nitrogen in an organic compound is confirmed by the formation of:

(A) a black precipitate

(B) a white precipitate

(C) a Prussian blue colour

(D) a blood-red colouration

Detailed Solutions

Q1.

Solution

Concept — Mole concept: The number of moles of a substance equals its mass divided by its molar mass, $n = \frac{m}{M}$.

Step 1 — List the values: Mass of water $m = 9$ g.

Molar mass $M = 18$ g mol^{-1}.

Step 2 — Apply the formula:

$$n = \frac{m}{M} = \frac{9}{18}.$$

Step 3 — Simplify:

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

Why other options are wrong:

- Option B (1.0 mol): would need 18 g of water.
- Option C (0.25 mol): would need 4.5 g.
- Option D (2.0 mol): would need 36 g.

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

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Quantum numbers: For a given n, the azimuthal quantum number l ranges from 0 to $n-1$, and the magnetic quantum number m_l ranges from $-l$ to $+l$.

Step 1 — Test each set against the rules: For $n = 2$, l can be 0 or 1 only.

For $n = 3$, l can be $0, 1, 2$.

Step 2 — Check option B ($n = 3,\ l = 2,\ m_l = -1$): $l = 2$ is allowed for $n = 3$, and $m_l = -1$ lies in the range -2 to $+2$. This set is permissible.

Why other options are wrong:

- Option A: $l = 2$ is not allowed when $n = 2$ (max $l = 1$).

- Option C: $l = 1$ is not allowed when $n = 1$ (max $l = 0$).
- Option D: for $l = 0$, m_l must be 0, not $+1$.

Final Answer: The permissible set is $n = 3,\ l = 2,\ m_l = -1 \Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ **Go Back to Q2**

Q3.

Solution

Concept — Trends in atomic radius: Atomic radius increases down a group (new shells added) and decreases across a period (increasing nuclear charge).

Step 1 — Place the elements: Na and K are in group 1; Mg and Al are in period 3.

Step 2 — Compare: K is below Na in group 1, so K has one more shell and a larger radius than Na.

Across period 3, radius decreases as Na $>$ Mg $>$ Al.

Step 3 — Conclude: K has the largest radius of all four.

Why other options are wrong:

- Option A (Na): smaller than K (one shell fewer).
- Option C (Mg) and Option D (Al): even smaller, being further right in period 3.

Final Answer: Potassium (K) has the largest atomic radius $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ **Go Back to Q3**

Q4.

Solution

Concept — Hybridization: The number of sigma bonds plus lone pairs on the central atom gives the number of hybrid orbitals, which fixes the hybridization.

Step 1 — Count around boron in BF_3: Boron forms three B–F sigma bonds and has no lone pair.

Step 2 — Determine the hybridization: Three regions of electron density $\Rightarrow$ three hybrid orbitals $\Rightarrow sp^2$.

Step 3 — Match the geometry: sp^2 gives a trigonal planar shape with 120° bond angles, as shown.

Why other options are wrong:

- Option A (sp): would give a linear molecule (two regions).
- Option B (sp^3): would give a tetrahedral arrangement (four regions).
- Option C (sp^3d): five regions, as in PCl_5.

Final Answer: Boron in BF_3 is sp^2 hybridized $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Bond order in MO theory: Bond order $= \frac{1}{2}(N_b - N_a)$, where N_b and N_a are the numbers of electrons in bonding and antibonding molecular orbitals.

Step 1 — Electrons in O_2: O_2 has 16 electrons total.

Step 2 — Distribute into MOs: Bonding electrons $N_b = 10$; antibonding electrons $N_a = 6$.

Step 3 — Compute the bond order:

$$\text{Bond order} = \frac{1}{2}(10 - 6) = \frac{4}{2} = 2.$$

Why other options are wrong:

- Option A (1): corresponds to a single bond such as in F_2.
- Option C (2.5): corresponds to the superoxide O_2^-.
- Option D (3): corresponds to N_2.

Final Answer: Bond order of O_2 is $2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Hess's law: The enthalpy change of a reaction is the same whether it occurs in one step or several; reactions can be added or subtracted with their enthalpies.

Step 1 — Write the target reaction: $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$.

Step 2 — Combine the given equations: Reverse the second equation: $CO_2(g) \rightarrow CO(g) + \frac{1}{2}O_2(g)$, $\Delta H = +283$ kJ.

Add it to the first equation $C(s) + O_2(g) \rightarrow CO_2(g)$, $\Delta H_1 = -393$ kJ.

Step 3 — Add the enthalpies:

$$\Delta H = \Delta H_1 - \Delta H_2 = (-393) - (-283).$$

$$\Delta H = -393 + 283 = -110 \text{ kJ}.$$

Why other options are wrong:

- Option A (-676 kJ): adds the two enthalpies instead of subtracting.
- Option C ($+110$ kJ): wrong sign.
- Option D (-283 kJ): just copies ΔH_2.

Final Answer: $\Delta H = -110 \text{ kJ} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — pH of a strong acid: A strong acid dissociates completely, so $[H^+]$ equals its molar concentration, and $pH = -\log[H^+]$.

Step 1 — Find $[H^+]$: For 0.001 M HCl, $[H^+] = 10^{-3}$ M.

Step 2 — Apply the pH formula:

$$pH = -\log(10^{-3}).$$

Step 3 — Simplify:

$$pH = 3.$$

Why other options are wrong:

- Option A (1) and Option B (2): correspond to 0.1 M and 0.01 M acid.
- Option D (11): this is the pOH, or the pH of a corresponding base.

Final Answer: pH $= 3 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept — Oxidation number: The sum of oxidation numbers of all atoms in a neutral compound is zero; K is $+1$ and O is -2 in normal compounds.

Step 1 — Assign known values in $KMnO_4$: K $= +1$; each O $= -2$, and there are four O atoms giving -8.

Step 2 — Set up the equation: Let the oxidation number of Mn be x:

$$(+1) + x + (-8) = 0.$$

Step 3 — Solve:

$$x - 7 = 0 \Rightarrow x = +7.$$

Why other options are wrong:

- Option A ($+2$): the state of Mn in MnO.
- Option B ($+4$): the state in MnO_2.
- Option C ($+6$): the state in the manganate ion MnO_4^{2-}.

Final Answer: Oxidation number of Mn $= +7 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Standard cell potential: $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$, where the cathode is the electrode with the higher (more positive) reduction potential.

Step 1 — Identify the electrodes: Copper has the higher reduction potential, so it is the cathode; zinc is the anode.

Step 2 — Substitute the values:

$$E^\circ_{\text{cell}} = E^\circ_{\text{Cu}^{2+}/\text{Cu}} - E^\circ_{\text{Zn}^{2+}/\text{Zn}} = (+0.34) - (-0.76).$$

Step 3 — Simplify:

$$E^\circ_{\text{cell}} = 0.34 + 0.76 = 1.10\text{ V}.$$

Why other options are wrong:

- Option A (0.42 V): subtracts the magnitudes incorrectly.
- Option B (-1.10 V): reverses anode and cathode.
- Option C (0.76 V): uses only the zinc value.

Final Answer: $E^\circ_{\text{cell}} = 1.10\text{ V} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q9

Q10.

Solution

Concept — Order of a reaction: The overall order is the sum of the powers of the concentration terms in the experimentally determined rate law.

Step 1 — Read the rate law: Rate $= k[\text{A}]^1[\text{B}]^2$.

Step 2 — Add the exponents:

$$\text{Order} = 1 + 2 = 3.$$

Why other options are wrong:

- Option A (2): counts only the power of B.
- Option C (1): counts only the power of A.
- Option D (4): overcounts the exponents.

Final Answer: Overall order $= 3 \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q10**

Q11.

Solution

Concept — Molarity: Molarity is the number of moles of solute per litre of solution, $M = \frac{n}{V(\text{L})}$.

Step 1 — Find the moles of NaOH:

$$n = \frac{m}{M} = \frac{4}{40} = 0.1 \text{ mol.}$$

Step 2 — Convert the volume to litres:

$$V = 500 \text{ mL} = 0.5 \text{ L.}$$

Step 3 — Compute the molarity:

$$M = \frac{0.1}{0.5} = 0.2 \text{ M.}$$

Why other options are wrong:

- Option A (0.1 M): forgets to divide by the volume in litres.
- Option C (0.4 M): uses 250 mL by mistake.
- Option D (0.05 M): inverts the calculation.

Final Answer: Molarity $= 0.2$ M $\Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q11**

Q12.

Solution

Concept — Naming coordination compounds: Name the ligands first (alphabetically) with their counts, then the metal with its oxidation state in Roman numerals; a cationic complex keeps the metal's ordinary name.

Step 1 — Identify the parts of $[Cu(NH_3)_4]SO_4$: The complex cation is $[Cu(NH_3)_4]^{2+}$; the counter-ion is sulphate.

Step 2 — Find the oxidation state of copper: Sulphate is -2, so the complex cation is $+2$; ammonia is neutral, so Cu is $+2$.

Step 3 — Assemble the name: Four ammonia ligands $\Rightarrow$ tetraammine; copper in $+2$ in a cation $\Rightarrow$ copper(II); add sulphate: *tetraamminecopper(II) sulphate*.

Why other options are wrong:

- Option A: wrong oxidation state (I instead of II).
- Option B: ligand count and order not in IUPAC style.
- Option C: "cuprate" is used only for anionic complexes, but this complex is a cation.

Final Answer: tetraamminecopper(II) sulphate $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Inert pair effect: Going down group 13, the ns^2 electrons become increasingly reluctant to take part in bonding, so the lower $(+1)$ oxidation state becomes more stable than the $+3$ state.

Step 1 — Order the group 13 elements: B, Al, Ga, In, Tl from top to bottom.

Step 2 — Apply the trend: The inert pair effect is strongest for the heaviest element, thallium, so Tl^+ is the most stable $+1$ ion.

Why other options are wrong:

- Option B (Al^+) and Option D (B^+): the lighter elements strongly prefer the $+3$ state.
- Option C (Ga^+): less stable in $+1$ than Tl^+ because gallium is higher in the group.

Final Answer: Tl^+ is the most stable $+1$ ion $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q13

Q14.

Solution

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

Step 1 — Find the number of unpaired electrons in Fe^{3+}: Fe^{3+} has the configuration $3d^5$, with all five d electrons unpaired, so $n = 5$.

Step 2 — Substitute into the formula:

$$\mu = \sqrt{5(5+2)} = \sqrt{5 \times 7} = \sqrt{35}.$$

Step 3 — Evaluate:

$$\mu = 5.92 \text{ BM}.$$

Why other options are wrong:

- Option A (1.73 BM): corresponds to 1 unpaired electron.
- Option B (3.87 BM): corresponds to 3 unpaired electrons.
- Option D (4.90 BM): corresponds to 4 unpaired electrons.

Final Answer: $\mu = 5.92$ BM $\Rightarrow \boxed{\text{C}}$

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

Q15.

Solution

Concept — Flame test: Alkali and alkaline earth metals impart characteristic colours to a flame because their valence electrons are easily excited and emit visible light on returning to the ground state.

Step 1 — Recall the colour for potassium: Potassium salts give a lilac (violet) flame.

Step 2 — Match to the option: This is option C.

Why other options are wrong:

- Option A (golden yellow): the colour of sodium.
- Option B (brick red): the colour of calcium.
- Option D (apple green): the colour of barium.

Final Answer: Potassium gives a lilac (violet) flame $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Inductive effect on acidity: Electron-withdrawing groups stabilise the carboxylate anion, increasing acidity; more such groups mean a stronger acid.

Step 1 — Count the chlorine atoms: Trichloroacetic acid has three Cl atoms, dichloroacetic two, chloroacetic one, and acetic none.

Step 2 — Apply the trend: More chlorine atoms withdraw more electron density and stabilise the anion most, so $Cl_3C\text{-}COOH$ is the strongest acid.

Why other options are wrong:

- Option B (acetic acid): no electron-withdrawing groups, the weakest of the four.
- Option C (chloroacetic) and Option D (dichloroacetic): fewer Cl atoms, so weaker than the trichloro acid.

Final Answer: Trichloroacetic acid is the strongest $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Markovnikov's rule: In the addition of HX to an unsymmetrical alkene, the hydrogen adds to the carbon that already has more hydrogen atoms, and the halogen to the more substituted carbon (via the more stable carbocation).

Step 1 — Identify the carbons of propene: $CH_2 = CH\text{-}CH_3$: the terminal $= CH_2$ has more hydrogens than the internal $= CH-$.

Step 2 — Add HBr by the rule: H goes to the terminal carbon; Br goes to the middle carbon (forming the more stable secondary carbocation).

Step 3 — Name the product: Br on C-2 gives 2-bromopropane.

Why other options are wrong:

- Option B (1-bromopropane): the anti-Markovnikov product (only with peroxides).
- Option C (1,2-dibromopropane): the product of Br_2 addition, not HBr.

- Option D (propan-2-ol): the product of acid-catalysed hydration, not HBr.

Final Answer: The major product is 2-bromopropane $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — S_N1 mechanism: The rate-determining step forms a carbocation, so the reaction is fastest for the halide that gives the most stable carbocation, i.e. the tertiary one.

Step 1 — Classify the halides: Methyl and ethyl are primary, isopropyl is secondary, and tert-butyl is tertiary.

Step 2 — Compare carbocation stability: Tertiary $>$ secondary $>$ primary $>$ methyl, because alkyl groups stabilise the positive charge.

Step 3 — Conclude: $(CH_3)_3C\text{-}Br$ forms the most stable (tertiary) carbocation and reacts fastest by S_N1.

Why other options are wrong:

- Options A and B (methyl, ethyl): primary halides favour S_N2, not S_N1.
- Option D (isopropyl): secondary, slower than tertiary by S_N1.

Final Answer: tert-butyl bromide reacts fastest by $S_N1 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Acidity of hydroxy compounds: An acid is stronger when its conjugate base is more stable; the phenoxide ion is resonance-stabilised, unlike alkoxide ions.

Step 1 — Compare the conjugate bases: Phenol gives the phenoxide ion, whose negative charge is delocalised into the benzene ring.

The alkoxide ions from ethanol and methanol, and the hydroxide from water, are not resonance-stabilised in this way.

Step 2 — Rank acidity: Phenol (pKa $\approx$ 10) is more acidic than water (pKa $\approx$

15.7), methanol and ethanol (pKa ≈ 16).

Why other options are wrong:

- Options B and C (ethanol, methanol): alkoxides are not resonance-stabilised, so they are weaker acids.
- Option D (water): less acidic than phenol.

Final Answer: Phenol is the most acidic $\Rightarrow \boxed{A}$

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

Q20.

Solution

Concept — Reactivity of carbonyl compounds: The carbonyl carbon is electron-poor (the C=O is polarised), so it is attacked by nucleophiles, giving nucleophilic addition.

Step 1 — Look at the carbonyl group: In C=O, oxygen pulls electron density away, leaving the carbon partially positive.

Step 2 — Predict the reaction type: A nucleophile attacks this electron-poor carbon and the pi bond opens, which is nucleophilic addition.

Why other options are wrong:

- Options A and B (electrophilic addition/substitution): typical of alkenes and arenes, not carbonyls.
- Option C (nucleophilic substitution): typical of alkyl halides, where a leaving group departs.

Final Answer: Aldehydes and ketones undergo nucleophilic addition $\Rightarrow \boxed{D}$

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

Q21.

Solution

Concept — Acidity of carboxylic acids: Electron-donating alkyl groups destabilise the carboxylate anion and reduce acidity; formic acid, having only an H attached, is the strongest simple carboxylic acid.

Step 1 — Compare the groups attached to -COOH: Formic acid has H; the others have electron-donating alkyl groups of increasing size.

Step 2 — Apply the trend: With no electron-donating alkyl group, formic acid forms the most stable carboxylate and is the strongest acid.

Why other options are wrong:

- Option A (acetic) and Option B (propanoic): the alkyl groups push electron density in, weakening the acid.
- Option D (pivalic): the bulky tert-butyl group makes it the weakest of these acids.

Final Answer: Formic acid is the strongest $\Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q21**

Q22.

Solution

Concept — Basicity of amines: A base is stronger when the lone pair on nitrogen is more available; electron-donating alkyl groups increase basicity, while delocalisation into a ring (as in aniline) decreases it.

Step 1 — Compare the four species: Methylamine has an electron-donating methyl group, raising the electron density on nitrogen.

In aniline the nitrogen lone pair is delocalised into the benzene ring, lowering basicity.

Acetamide's lone pair is delocalised onto the carbonyl, making it essentially non-basic.

Step 2 — Rank basicity: Methylamine > ammonia > aniline > acetamide.

Why other options are wrong:

- Option B (aniline): weaker base than ammonia due to resonance.
- Option C (ammonia): weaker than methylamine (no alkyl group).

- Option D (acetamide): the lone pair is tied up in the amide resonance.

Final Answer: Methylamine is the strongest base $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q22

Q23.

Solution

Concept — Reducing and non-reducing sugars: A reducing sugar has a free aldehyde or ketone group (a free anomeric carbon); if both anomeric carbons are locked in the glycosidic bond, the sugar is non-reducing.

Step 1 — Examine sucrose: In sucrose, the glycosidic bond joins the anomeric carbons of both glucose and fructose, so neither has a free reducing group.

Step 2 — Conclude: Sucrose cannot reduce Tollens' or Fehling's reagent, so it is a non-reducing sugar.

Why other options are wrong:

- Option A (glucose): has a free aldehyde group, a reducing sugar.
- Option B (maltose) and Option D (lactose): each has a free anomeric carbon, so both are reducing.

Final Answer: Sucrose is a non-reducing sugar $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q23

Q24.

Solution

Concept — IUPAC nomenclature: Choose the longest continuous carbon chain as the parent, number it to give substituents the lowest locants, and name the branches as alkyl prefixes.

Step 1 — Find the longest chain: The skeleton shown is a four-carbon chain with a methyl branch, i.e. CH_3-$CH(CH_3)$-CH_2-CH_3.

Step 2 — Number for the lowest locant: Numbering from the end nearer the branch puts the methyl group on C-2.

Step 3 — Assemble the name: A butane chain with a methyl group on C-2 is 2-methylbutane.

Why other options are wrong:

- Option A (pentane): would need an unbranched five-carbon chain.
- Option B (n-butane): ignores the methyl branch.
- Option C (2-methylpropane): has only four carbons total, one fewer than this structure.

Final Answer: The compound is 2-methylbutane $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q24**

Q25.

Solution

Concept — Lassaigne's test: Organic elements are converted to ionic forms by fusion with sodium; nitrogen forms sodium cyanide, which is then detected as Prussian blue.

Step 1 — Formation of the detecting species: Sodium cyanide reacts with ferrous sulphate and then ferric ions to give ferric ferrocyanide.

Step 2 — Observation: Ferric ferrocyanide is a Prussian blue colour, confirming nitrogen.

Why other options are wrong:

- Option A (black precipitate): sulphur is shown by a black precipitate with lead acetate, not nitrogen.
- Option B (white precipitate): a halide gives a white/curdy precipitate with silver nitrate.
- Option D (blood-red colouration): seen when both nitrogen and sulphur are present (sodium thiocyanate).

Final Answer: Nitrogen gives a Prussian blue colour $\Rightarrow \boxed{\text{C}}$

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

Answer Key

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