JCECE Chemistry Sample Paper – 1

Duration: 60 Minutes **Maximum Marks: 50**

Instructions

- This paper contains **50** Multiple Choice Questions (Single Correct Answer), modelled on the Chemistry portion of **JCECE** entrance.
- Each correct answer carries **+1 mark**. There is -0.25 **mark** for each incorrect answer; unattempted questions get 0.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 and Class 12 NCERT Chemistry (Jharkhand JAC / CBSE aligned) – Physical, Organic and Inorganic.**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. The number of moles present in 11.5 g of sodium metal (atomic mass $= 23$ g/mol) is:

(A) 0.25 mol

(B) 0.5 mol

(C) 1.0 mol

(D) 2.0 mol

Q2. In a hydrogen atom, the energy of an electron in the ground state $(n = 1)$ is -13.6 eV. The energy of the electron in the third orbit $(n = 3)$ is:

(A) -4.53 eV

(B) -3.40 eV

(C) -1.51 eV

(D) -0.85 eV

Q3. According to the $(n + l)$ rule, the orbital filled immediately after the $4s$ orbital (whose box is shown) is:

3d subshell

(A) $4p$

(B) $5s$

(C) $4f$

(D) $3d$

Q4. 0.5 mol of an ideal gas is held at 300 K and a pressure of 2.0 atm. Taking $R = 0.0821$ L atm mol^{-1}K^{-1}, the volume occupied by the gas is:

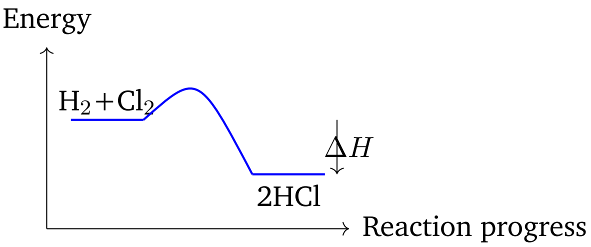
(A) 3.08 L

(B) 6.16 L

(C) 12.3 L

(D) 1.54 L

Q5. For the reaction $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, the bond enthalpies are H–H $= 436$, Cl–Cl $= 242$ and H–Cl $= 431$ kJ/mol. From the energy diagram, the enthalpy of reaction ΔH is:



(A) -862 kJ/mol

(B) -184 kJ/mol

(C) $+184$ kJ/mol

(D) -247 kJ/mol

Q6. Given $C(s) + O_2(g) \rightarrow CO_2(g),\ \Delta H_1 = -393$ kJ and $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g),\ \Delta$
-283 kJ. The enthalpy of formation of CO(g), i.e. $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$, is:

(A) -110 kJ

(B) -676 kJ

(C) $+110$ kJ

(D) -283 kJ

Q7. For the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at equilibrium, $[N_2] = 1$ M, $[H_2] = 2$ M and $[NH_3] = 4$ M. The value of K_c is:

(A) 0.5

(B) 1.0

(C) 4.0

(D) 2.0

Q8. The pH of a 0.01 M aqueous solution of HCl (a strong monobasic acid) at $25°$C is:

(A) 2

(B) 1

(C) 12

(D) 0.01

Q9. The solubility of AgCl in water at $25°$C is 1.0×10^{-5} mol/L. Its solubility product K_{sp} is:

(A) 1.0×10^{-5}

(B) 1.0×10^{-10}

(C) 2.0×10^{-10}

(D) 1.0×10^{-15}

Q10. When 1 mol of a non-volatile, non-electrolyte solute is dissolved in 1000 g of water ($K_b = 0.52$ K kg mol^{-1}), the boiling point of the solution is:

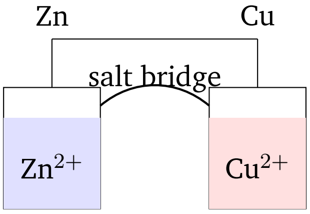
(A) $100.00°$C

(B) $99.48°C$

(C) $100.52°C$

(D) $101.04°C$

Q11. For the Daniell cell shown, $E^\circ_{\mathrm{Zn^{2+}/Zn}} = -0.76$ V and $E^\circ_{\mathrm{Cu^{2+}/Cu}} = +0.34$ V. The standard EMF of the cell is:



(A) -1.10 V

(B) $+0.42$ V

(C) -0.42 V

(D) $+1.10$ V

Q12. A 0.1 M solution of an electrolyte has a specific conductivity (conductivity) of 1.0×10^{-2} S cm^{-1}. Its molar conductivity is:

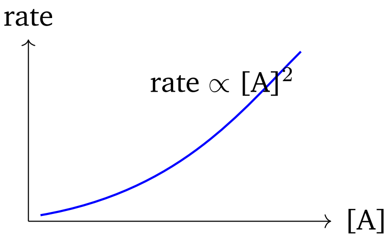
(A) 100 S cm^{2}mol^{-1}

(B) 10 S cm^{2}mol^{-1}

(C) 1000 S cm^{2}mol^{-1}

(D) 1.0 S cm^{2}mol^{-1}

Q13. For a reaction the rate law is rate $= k[\mathrm{A}]^2[\mathrm{B}]$. From the rate-versus-concentration profile shown, the overall order of the reaction is:



(A) 1

(B) 2

(C) 3

(D) 0

Q14. A first-order reaction has a half-life of 20 minutes. The fraction of the reactant remaining after 60 minutes is:

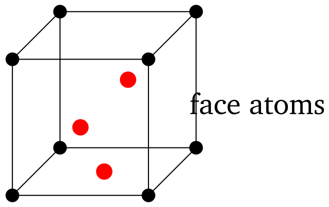
(A) $1/4$

(B) $1/8$

(C) $1/16$

(D) $1/2$

Q15. The number of atoms per unit cell in a face-centred cubic (fcc) lattice, as illustrated by the cube shown, is:



(A) 4

(B) 2

(C) 1

(D) 6

Q16. The oxidation number of manganese (Mn) in the permanganate ion MnO_4^- is:

(A) $+2$

(B) $+4$

(C) $+7$

(D) $+6$

Q17. The normality of a solution containing 4.9 g of H_2SO_4 (molar mass 98 g/mol) dissolved in water to make 500 mL of solution is:

(A) 0.05 N

(B) 0.10 N

(C) 0.40 N

(D) 0.20 N

Q18. The IUPAC name of the compound $(CH_3)_2CH–CH_2–CH_3$ is:

(A) n-pentane

(B) 3-methylbutane

(C) 2-methylbutane

(D) 2,2-dimethylpropane

Q19. The total number of chain (structural) isomers of pentane, C_5H_{12}, is:

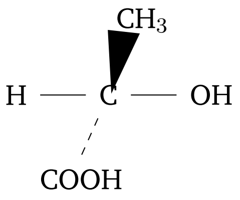
(A) 2

(B) 3

(C) 4

(D) 5

Q20. For the molecule lactic acid, $CH_3–CH(OH)–COOH$, whose central carbon is drawn in wedge–dash form, the number of chiral (asymmetric) carbon centres is:



(A) 1

(B) 0

(C) 2

(D) 3

Q21. Which of the following carboxylic acids is the strongest acid, owing to the electron-withdrawing inductive effect of chlorine?

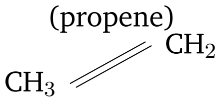
(A) $Cl_3C–COOH$ (trichloroacetic acid)

(B) $ClCH_2–COOH$ (chloroacetic acid)

(C) $CH_3–COOH$ (acetic acid)

(D) $Cl_2CH–COOH$ (dichloroacetic acid)

Q22. When propene (shown) reacts with HBr in the absence of peroxide, the major product formed (Markovnikov addition) is:



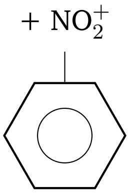
(A) 1-bromopropane

(B) 2-bromopropane

(C) 1,2-dibromopropane

(D) 2,2-dibromopropane

Q23. When benzene (shown) is treated with a mixture of concentrated HNO_3 and concentrated H_2SO_4, the electrophilic substitution product is:



(A) benzenesulphonic acid

(B) chlorobenzene

(C) benzaldehyde

(D) nitrobenzene

Q24. Which of the following alkyl halides will undergo a nucleophilic substitution most readily by the S_N1 mechanism?

(A) CH_3–Br (methyl)

(B) CH_3CH_2–Br (primary)

(C) $(CH_3)_2CH$–Br (secondary)

(D) $(CH_3)_3C$–Br (tertiary)

Q25. The correct order of acidic strength among the following alcohols (most acidic first) is:

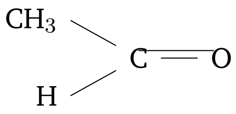
(A) tertiary > secondary > primary

(B) primary > secondary > tertiary

(C) secondary > primary > tertiary

(D) all are equally acidic

Q26. Acetaldehyde (whose carbonyl group is shown) reacts with HCN by nucleophilic addition. The product formed is:



(A) a cyanohydrin ($CH_3CH(OH)CN$)

(B) an acetal

(C) acetic acid

(D) ethanol

Q27. Among formic acid (HCOOH), acetic acid (CH_3COOH) and phenol (C_6H_5OH), the correct order of acidic strength (strongest first) is:

(A) phenol > acetic acid > formic acid

(B) acetic acid > formic acid > phenol

(C) formic acid > acetic acid > phenol

(D) phenol $>$ formic acid $>$ acetic acid

Q28. In the gas phase, the correct order of basic strength of the following amines (most basic first) is:

(A) $NH_3 > CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$

(B) $CH_3NH_2 > NH_3 > (CH_3)_2NH > (CH_3)_3N$

(C) $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N > NH_3$

(D) $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$

Q29. Which of the following carbohydrates is a non-reducing sugar (does not reduce Tollens' or Fehling's reagent)?

(A) sucrose

(B) glucose

(C) fructose

(D) maltose

Q30. Which of the following is an addition polymer (formed by chain addition of unsaturated monomers)?

(A) nylon-6,6

(B) polyethene

(C) terylene (Dacron)

(D) bakelite

Q31. During the acid-catalysed reaction of a primary carbocation, it may rearrange to a more stable species by a hydride or methyl shift. The most stable carbocation among the following is:

(A) $CH_3CH_2^+$ (primary)

(B) CH_3^+ (methyl)

(C) $(CH_3)_3C^+$ (tertiary)

(D) $(CH_3)_2CH^+$ (secondary)

Q32. Benzene reacts with CH_3Cl in the presence of anhydrous $AlCl_3$ to give toluene. This reaction is known as:

(A) Wurtz reaction

(B) Cannizzaro reaction

(C) Kolbe reaction

(D) Friedel–Crafts alkylation

Q33. A compound gives a bright silver mirror when warmed with Tollens' reagent (ammoniacal $AgNO_3$). The functional group present is:

(A) a ketone ($> C{=}O$)

(B) an aldehyde ($-CHO$)

(C) an alcohol ($-OH$)

(D) an ether ($-O-$)

Q34. The reagent best suited to oxidise a primary alcohol selectively to an aldehyde (without further oxidation to the carboxylic acid) is:

(A) pyridinium chlorochromate (PCC)

(B) acidified $KMnO_4$

(C) acidified $K_2Cr_2O_7$

(D) concentrated HNO_3

Q35. The correct order of first ionization energy among the second-period elements Li, B, C and N (increasing order) is:

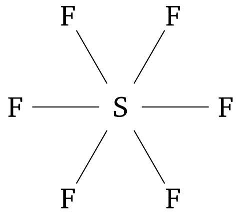
(A) $N < C < B < Li$

(B) $Li < B < C < N$

(C) $Li < C < B < N$

(D) $B < Li < C < N$

Q36. According to VSEPR theory, the molecular shape of sulphur hexafluoride $\mathrm{SF_6}$ (shown) is:



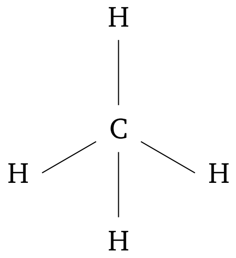
(A) octahedral

(B) tetrahedral

(C) square planar

(D) trigonal bipyramidal

Q37. The hybridization of the central carbon atom in methane $\mathrm{CH_4}$ (tetrahedral geometry shown) is:



(A) sp^3

(B) sp^2

(C) sp

(D) sp^3d

Q38. Which alkali metal imparts a characteristic crimson (brick-red to crimson) colour to the Bunsen flame?

(A) sodium (golden yellow)

(B) potassium (lilac)

(C) lithium (crimson red)

(D) caesium (blue)

Q39. In group 13, thallium shows the $+1$ oxidation state as more stable than $+3$. This is best explained by:

(A) the inert pair effect

(B) the diagonal relationship

(C) back bonding

(D) the lanthanide contraction

Q40. The tendency for catenation (self-linking of like atoms) is greatest for which element of group 14?

(A) silicon

(B) germanium

(C) lead

(D) carbon

Q41. Between ammonia (NH_3) and phosphine (PH_3), the more basic (better proton acceptor) and the reason is:

(A) NH_3, because N is smaller and its lone pair is more available

(B) PH_3, because P is larger

(C) both equally basic

(D) PH_3, because of greater electronegativity of P

Q42. According to molecular orbital theory, the dioxygen molecule O_2 is paramagnetic because:

(A) all its electrons are paired

(B) it has one unpaired electron only

(C) it has a bond order of one

(D) it has two unpaired electrons in its π^* antibonding orbitals

Q43. The correct order of oxidising power of the halogens (strongest oxidant first) is:

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

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

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

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

Q44. Among the noble gases, xenon forms several fluorides. Which set correctly represents three known binary xenon fluorides?

(A) $XeF,\ XeF_3,\ XeF_5$

(B) $XeF_3,\ XeF_5,\ XeF_7$

(C) $XeF_2,\ XeF_4,\ XeF_6$

(D) $XeF_2,\ XeF_3,\ XeF_4$

Q45. Transition (d-block) elements exhibit several variable oxidation states mainly because:

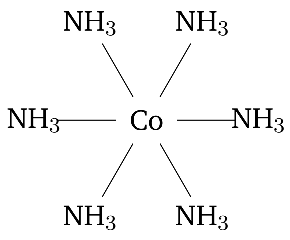
(A) they have completely filled d orbitals

(B) they are all radioactive

(C) their ns and $(n-1)d$ electrons have nearly the same energy and can both take part in bonding

(D) they have only s electrons available

Q46. In the octahedral complex ion $[Co(NH_3)_6]^{3+}$ (shown), the oxidation state of cobalt is:



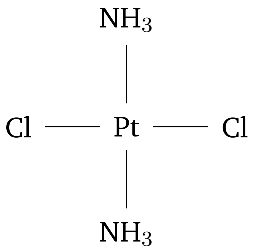
(A) $+2$

(B) $+3$

(C) $+6$

(D) 0

Q47. The square-planar complex $[\mathrm{Pt(NH_3)_2Cl_2}]$ (shown) exhibits geometrical isomerism. The number of geometrical isomers is:



(A) 1

(B) 3

(C) 4

(D) 2 (cis and trans)

Q48. The froth-flotation process is used in metallurgy primarily for the concentration of:

(A) oxide ores

(B) carbonate ores

(C) sulphide ores

(D) chloride ores

Q49. The temporary hardness of water is due to the presence of dissolved:

(A) chlorides of calcium and magnesium

(B) sulphates of calcium and magnesium

(C) bicarbonates of calcium and magnesium

(D) nitrates of calcium and magnesium

Q50. In qualitative inorganic analysis, the group reagent used to precipitate the cations of Group II (e.g. Cu^{2+}, Pb^{2+}) as sulphides in acidic medium is:

(A) dilute HCl

(B) NH_4OH in presence of NH_4Cl

(C) $(NH_4)_2CO_3$

(D) H_2S in presence of dilute HCl

Detailed Solutions

Q1.

Solution

Concept — Mole concept: Number of moles $= \dfrac{\text{given mass}}{\text{molar mass}}$.

Step 1 — List data: Mass $= 11.5$ g, molar mass of Na $= 23$ g/mol.

Step 2 — Write the formula: $n = \dfrac{m}{M}$.

Step 3 — Substitute: $n = \dfrac{11.5}{23}$.

Step 4 — Evaluate: $n = 0.5$ mol.

Why other options are wrong:

- (A) divides by 46 (double the molar mass).
- (C) uses mass $= 23$ g.
- (D) inverts the ratio.

Final Answer: $n = 0.5 \text{ mol} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Bohr energy levels: For hydrogen, $E_n = \dfrac{-13.6}{n^2}$ eV.

Step 1 — Identify n: Third orbit, $n = 3$.

Step 2 — Square n: $n^2 = 9$.

Step 3 — Substitute: $E_3 = \dfrac{-13.6}{9}$.

Step 4 — Evaluate: $E_3 = -1.51$ eV.

Why other options are wrong:

- (A) divides by 3 instead of 9.
- (B) is $E_2 = -13.6/4$.
- (D) is $E_4 = -13.6/16$.

Final Answer: $E_3 = -1.51 \text{ eV} \Rightarrow \boxed{\text{C}}$

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

Q3.

Solution

Concept — $(n+l)$ (Aufbau) rule: Orbitals fill in order of increasing $(n+l)$; for equal $(n+l)$ the one with lower n fills first.

Step 1 — Value for $4s$: $n = 4,\ l = 0 \Rightarrow n + l = 4$.

Step 2 — Compare candidates: $3d$: $n+l = 3+2 = 5$; $4p$: $4+1 = 5$; $5s$: $5+0 = 5$; $4f$: $4+3 = 7$.

Step 3 — Resolve the tie at $(n+l) = 5$: Among $3d$, $4p$, $5s$ the lowest n is $3d$ $(n = 3)$, so $3d$ fills first.

Step 4 — Conclude: Immediately after $4s$, the $3d$ subshell is filled.

Why other options are wrong:

- (A) $4p$ has the same $(n+l) = 5$ but higher n, so fills after $3d$.
- (B) $5s$ also has higher n.
- (C) $4f$ has $(n+l) = 7$, much later.

Final Answer: $3d$ fills next $\Rightarrow \boxed{\text{D}}$

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

Q4.

Solution

Concept — Ideal gas law: $PV = nRT \Rightarrow V = \dfrac{nRT}{P}$.

Step 1 — List data: $n = 0.5$ mol, $R = 0.0821$, $T = 300$ K, $P = 2.0$ atm.

Step 2 — Numerator: $nRT = 0.5 \times 0.0821 \times 300$.

Step 3 — Evaluate numerator: $0.5 \times 0.0821 = 0.04105$; $0.04105 \times 300 = 12.315$.

Step 4 — Divide by P: $V = \dfrac{12.315}{2.0} = 6.16$ L.

Why other options are wrong:

- (A) forgets the factor of 0.5 correctly (used $P = 4$).
- (C) omits dividing by P.

- (D) halves the correct value.

Final Answer: $V = 6.16\text{ L} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q4

Q5.

Solution

Concept — ΔH from bond enthalpies: $\Delta H = \sum(\text{bonds broken}) - \sum(\text{bonds formed})$.

Step 1 — Bonds broken (reactants): one H–H $= 436$ and one Cl–Cl $= 242$.

Step 2 — Sum broken: $436 + 242 = 678$ kJ.

Step 3 — Bonds formed (products): two H–Cl $= 2 \times 431 = 862$ kJ.

Step 4 — Apply the formula: $\Delta H = 678 - 862$.

Step 5 — Evaluate: $\Delta H = -184$ kJ/mol.

Why other options are wrong:

- (A) is only the bonds-formed term.
- (C) has the wrong sign.
- (D) uses one H–Cl bond instead of two.

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

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Hess's law: Target reaction = (reaction 1) − (reaction 2); enthalpies combine the same way.

Step 1 — Write reaction 1: $C + O_2 \rightarrow CO_2,\ \Delta H_1 = -393$ kJ.

Step 2 — Reverse reaction 2: $CO_2 \rightarrow CO + \frac{1}{2}O_2,\ -\Delta H_2 = +283$ kJ.

Step 3 — Add the two: $C + \frac{1}{2}O_2 \rightarrow CO$ with $\Delta H = \Delta H_1 - \Delta H_2$.

Step 4 — Substitute: $\Delta H = -393 - (-283) = -393 + 283$.

Step 5 — Evaluate: $\Delta H = -110$ kJ.

Why other options are wrong:

- (B) adds instead of subtracting.
- (C) has the wrong sign.
- (D) just quotes ΔH_2.

Final Answer: $\Delta H_f(\mathrm{CO}) = -110\ \mathrm{kJ} \Rightarrow \boxed{\mathrm{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Equilibrium constant: $K_c = \dfrac{[\mathrm{NH_3}]^2}{[\mathrm{N_2}][\mathrm{H_2}]^3}$.

Step 1 — List concentrations: $[\mathrm{N_2}] = 1$, $[\mathrm{H_2}] = 2$, $[\mathrm{NH_3}] = 4$.

Step 2 — Numerator: $[\mathrm{NH_3}]^2 = 4^2 = 16$.

Step 3 — Denominator: $[\mathrm{N_2}][\mathrm{H_2}]^3 = 1 \times 2^3 = 1 \times 8 = 8$.

Step 4 — Divide: $K_c = \dfrac{16}{8} = 2.0$.

Why other options are wrong:

- (A) inverts the ratio.
- (B) forgets to cube $[\mathrm{H_2}]$.
- (C) drops the cube and uses $[\mathrm{H_2}] = 2$ linearly with wrong numerator.

Final Answer: $K_c = 2.0 \Rightarrow \boxed{\mathrm{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — pH of a strong acid: HCl is fully ionised, so $[\mathrm{H^+}] =$ acid concentration; $\mathrm{pH} = -\log[\mathrm{H^+}]$.

Step 1 — Find $[\mathrm{H^+}]$: $[\mathrm{H^+}] = 0.01 = 1 \times 10^{-2}$ M.

Step 2 — Apply pH formula: $\mathrm{pH} = -\log(1 \times 10^{-2})$.

Step 3 — Use log: $\log(10^{-2}) = -2$.

Step 4 — Evaluate: $\text{pH} = -(-2) = 2$.

Why other options are wrong:

- (B) uses 0.1 M.
- (C) is the pOH, not the pH.
- (D) quotes the concentration, not the pH.

Final Answer: $\text{pH} = 2 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept — K_{sp} from solubility: For a $1{:}1$ salt $\text{AgCl} \rightleftharpoons \text{Ag}^+ + \text{Cl}^-$, $K_{sp} = s^2$ where s is the molar solubility.

Step 1 — Identify s: $s = 1.0 \times 10^{-5}$ mol/L.

Step 2 — Write K_{sp}: $K_{sp} = [\text{Ag}^+][\text{Cl}^-] = s \times s = s^2$.

Step 3 — Substitute: $K_{sp} = (1.0 \times 10^{-5})^2$.

Step 4 — Evaluate: $K_{sp} = 1.0 \times 10^{-10}$.

Why other options are wrong:

- (A) is s itself, not s^2.
- (C) doubles instead of squaring.
- (D) over-squares to 10^{-15}.

Final Answer: $K_{sp} = 1.0 \times 10^{-10} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — Elevation of boiling point: $\Delta T_b = K_b\,m$, then $T_b = 100°\text{C} + \Delta T_b$.

Step 1 — Find molality: $m = \dfrac{1\ \text{mol}}{1\ \text{kg}} = 1\ \text{mol/kg}$.

Step 2 — Apply formula: $\Delta T_b = 0.52 \times 1$.

Step 3 — Evaluate elevation: $\Delta T_b = 0.52\ \text{K}$.

Step 4 — Add to normal boiling point: $T_b = 100 + 0.52 = 100.52°\text{C}$.

Why other options are wrong:

- (A) ignores the elevation.
- (B) subtracts (that is depression of freezing point logic).
- (D) doubles K_b.

Final Answer: $T_b = 100.52°\text{C} \Rightarrow \boxed{\text{C}}$

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

Q11.

Solution

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

Step 1 — Identify electrodes: $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = +0.34$ V (cathode); $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76$ V (anode).

Step 2 — Write the formula: $E^\circ_{cell} = E^\circ_{cathode} - E^\circ_{anode}$.

Step 3 — Substitute: $E^\circ_{cell} = 0.34 - (-0.76)$.

Step 4 — Evaluate: $E^\circ_{cell} = 0.34 + 0.76 = 1.10\ \text{V}$.

Why other options are wrong:

- (A) has the wrong sign.
- (B) and (C) subtract instead of adding the magnitudes.

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

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

Q12.

Solution

Concept — Molar conductivity: $\Lambda_m = \dfrac{\kappa \times 1000}{C}$ with κ in S cm^{-1} and C in mol/L.

Step 1 — List data: $\kappa = 1.0 \times 10^{-2}$ S cm^{-1}, $C = 0.1$ mol/L.

Step 2 — Numerator: $\kappa \times 1000 = 1.0 \times 10^{-2} \times 1000 = 10$.

Step 3 — Divide by C: $\Lambda_m = \dfrac{10}{0.1}$.

Step 4 — Evaluate: $\Lambda_m = 100$ S cm^{2}mol^{-1}.

Why other options are wrong:

- (B) forgets the factor of 1000.
- (C) divides by 0.01 instead of 0.1.
- (D) omits both the $\times 1000$ and the division.

Final Answer: $\Lambda_m = 100$ S cm^{2}mol^{-1} $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ Go Back to Q12

Q13.

Solution

Concept — Overall order: The overall order is the sum of the exponents of the concentration terms in the rate law.

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

Step 2 — Exponent of A: 2.

Step 3 — Exponent of B: 1.

Step 4 — Add the exponents: order $= 2 + 1 = 3$.

Why other options are wrong:

- (A) counts only B.
- (B) counts only A.
- (D) ignores both concentration terms.

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

$\boxed{\text{Answer: (C)}}$ Go Back to Q13

Q14.

Solution

Concept — Half-life decay: After n half-lives the fraction remaining is $\left(\frac{1}{2}\right)^n$.

Step 1 — Find number of half-lives: $n = \dfrac{60}{20} = 3$.

Step 2 — Apply the fraction formula: fraction $= \left(\frac{1}{2}\right)^3$.

Step 3 — Evaluate: $\left(\frac{1}{2}\right)^3 = \dfrac{1}{8}$.

Why other options are wrong:

- (A) corresponds to 2 half-lives.
- (C) corresponds to 4 half-lives.
- (D) corresponds to 1 half-life.

Final Answer: fraction remaining $= 1/8 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Atoms in an fcc unit cell: Corner atoms contribute $\frac{1}{8}$ each; face-centre atoms contribute $\frac{1}{2}$ each.

Step 1 — Count corner contribution: 8 corners $\times \frac{1}{8} = 1$ atom.

Step 2 — Count face contribution: 6 faces $\times \frac{1}{2} = 3$ atoms.

Step 3 — Add the contributions: $1 + 3 = 4$ atoms.

Why other options are wrong:

- (B) is the count for a body-centred cell.
- (C) is for a simple (primitive) cubic cell.
- (D) miscounts the face atoms.

Final Answer: 4 atoms per fcc cell $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q15

Q16.

Solution

Concept — Oxidation number: The sum of oxidation numbers in an ion equals its charge; oxygen is usually -2.

Step 1 — Let Mn be x: ion is $\mathrm{MnO_4^-}$ with overall charge -1.

Step 2 — Oxygen contribution: $4 \times (-2) = -8$.

Step 3 — Set up the equation: $x + (-8) = -1$.

Step 4 — Solve: $x = -1 + 8 = +7$.

Why other options are wrong:

- (A) is Mn in $\mathrm{Mn^{2+}}$.
- (B) is Mn in $\mathrm{MnO_2}$.
- (D) is Mn in $\mathrm{MnO_4^{2-}}$ (manganate).

Final Answer: oxidation number $= +7 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q16

Q17.

Solution

Concept — Normality: $N = \dfrac{\text{gram-equivalents}}{\text{volume in L}}$; gram-equivalents $= \dfrac{\text{mass}}{\text{equivalent mass}}$, and equivalent mass $= \dfrac{M}{n\text{-factor}}$.

Step 1 — Find equivalent mass: For $\mathrm{H_2SO_4}$, n-factor $= 2$, so equivalent mass $= \dfrac{98}{2} = 49$ g/equiv.

Step 2 — Find gram-equivalents: $\dfrac{4.9}{49} = 0.1$ equiv.

Step 3 — Convert volume: 500 mL $= 0.5$ L.

Step 4 — Apply normality: $N = \dfrac{0.1}{0.5} = 0.2$ N.

Why other options are wrong:

- (A) uses molar mass without the n-factor (gives the molarity 0.05).
- (B) forgets to halve the volume.
- (C) wrongly doubles the n-factor.

Final Answer: $N = 0.20\ \text{N} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q17

Q18.

Solution

Concept — IUPAC naming of alkanes: Find the longest chain, number to give the lowest locant to substituents, and name branches.

Step 1 — Expand the structure: $(CH_3)_2CH–CH_2–CH_3$ has a 4-carbon longest chain (butane) with a methyl branch.

Step 2 — Number the chain: numbering from the end nearer the branch puts the methyl on carbon 2.

Step 3 — Assemble the name: 2-methylbutane.

Why other options are wrong:

- (A) n-pentane is the straight isomer with no branch.
- (B) 3-methylbutane violates the lowest-locant rule (same compound, wrong numbering).
- (D) 2,2-dimethylpropane (neopentane) is a different isomer.

Final Answer: 2-methylbutane $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Chain isomerism: Different carbon-skeleton arrangements of the same molecular formula.

Step 1 — First isomer: n-pentane, $CH_3CH_2CH_2CH_2CH_3$ (straight chain).

Step 2 — Second isomer: isopentane (2-methylbutane), a 4-carbon chain with one methyl branch.

Step 3 — Third isomer: neopentane (2,2-dimethylpropane), a 3-carbon chain with two methyl branches.

Step 4 — Count: total $= 3$ isomers.

Why other options are wrong:

- (A) misses neopentane.
- (C) and (D) count duplicate structures.

Final Answer: 3 chain isomers ⇒ $\boxed{\text{B}}$

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Chiral centre: A carbon attached to four different groups is a chiral (asymmetric) centre.

Step 1 — Examine the central carbon: in CH_3–CH(OH)–COOH it bears H, OH, CH_3 and COOH.

Step 2 — Check the four groups: H, OH, CH_3 and COOH are all different.

Step 3 — Conclude: that carbon is chiral, and it is the only such carbon, so there is 1 chiral centre.

Why other options are wrong:

- (B) wrongly treats the molecule as achiral.
- (C) and (D) over-count; the CH_3 and COOH carbons are not chiral.

Final Answer: 1 chiral centre ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q20

Q21.

Solution

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

Step 1 — Count Cl atoms: Cl_3CCOOH has 3 Cl, $Cl_2CHCOOH$ has 2, $ClCH_2COOH$ has 1, CH_3COOH has none.

Step 2 — Relate to acid strength: more electron-withdrawing Cl atoms ⇒ greater $-I$ effect ⇒ stronger acid.

Step 3 — Rank: $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$.

Step 4 — Select the strongest: trichloroacetic acid.

Why other options are wrong:

- (B) and (D) have fewer Cl atoms, so they are weaker.
- (C) has no electron-withdrawing group, so it is the weakest.

Final Answer: $Cl_3CCOOH \Rightarrow \boxed{A}$

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Markovnikov's rule: In addition of HX to an unsymmetrical alkene, H adds to the carbon with more H atoms; X adds to the more substituted carbon (via the more stable carbocation).

Step 1 — Identify the double-bond carbons: in propene $CH_3–CH{=}CH_2$, the terminal CH_2 has more H than the internal CH.

Step 2 — Place H: H adds to the terminal CH_2.

Step 3 — Place Br: Br adds to the internal (more substituted) carbon, giving the secondary carbocation route.

Step 4 — Name the product: $CH_3–CHBr–CH_3$ is 2-bromopropane.

Why other options are wrong:

- (A) is the anti-Markovnikov product (needs peroxide).
- (C) and (D) are dihalides, not formed by single HBr addition.

Final Answer: 2-bromopropane $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q22

Q23.

Solution

Concept — Aromatic nitration: The HNO_3/H_2SO_4 mixture generates the nitronium ion NO_2^+, which substitutes for a ring hydrogen (electrophilic aromatic substitution).

Step 1 — Identify the electrophile: H_2SO_4 protonates HNO_3 to give NO_2^+.

Step 2 — Substitution: NO_2^+ replaces one H on benzene.

Step 3 — Product: $C_6H_5NO_2$, nitrobenzene.

Why other options are wrong:

- (A) needs H_2SO_4 alone (sulphonation).
- (B) needs $Cl_2/FeCl_3$.
- (C) is from a Gattermann–Koch type reaction, not nitration.

Final Answer: nitrobenzene $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q23

Q24.

Solution

Concept — S_N1 reactivity: S_N1 proceeds through a carbocation; the more stable the carbocation, the faster the reaction. Tertiary carbocations are most stable.

Step 1 — Rank carbocation stability: tertiary > secondary > primary > methyl.

Step 2 — Match to the halides: $(CH_3)_3CBr$ gives a tertiary carbocation.

Step 3 — Conclude: the tertiary halide reacts fastest by S_N1.

Why other options are wrong:

- (A) methyl and (B) primary favour S_N2, not S_N1.
- (C) secondary is intermediate, slower than tertiary in S_N1.

Final Answer: $(CH_3)_3C\text{–}Br \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Acidity of alcohols: Alkyl groups are electron-donating ($+I$), which destabilise the alkoxide ion. More alkyl substitution lowers acidity.

Step 1 — Compare alkyl substitution: primary has fewest alkyl groups on the C–OH carbon, tertiary has most.

Step 2 — Relate to alkoxide stability: less $+I$ donation (primary) gives a more stable alkoxide, hence greater acidity.

Step 3 — Order: primary > secondary > tertiary.

Why other options are wrong:

- (A) reverses the trend.
- (C) misorders secondary and primary.
- (D) ignores the inductive effect.

Final Answer: primary $>$ secondary $>$ tertiary $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

Concept — Nucleophilic addition of HCN: The CN^- adds to the electrophilic carbonyl carbon and H^+ to the oxygen, giving a cyanohydrin (an α-hydroxynitrile).

Step 1 — Attack on carbonyl: CN^- adds to the C of CH_3CHO.

Step 2 — Protonation: the resulting alkoxide picks up H^+.

Step 3 — Product: $CH_3CH(OH)CN$, a cyanohydrin.

Why other options are wrong:

- (B) acetals form with alcohols, not HCN.
- (C) and (D) are oxidation/reduction products, not HCN addition.

Final Answer: cyanohydrin $CH_3CH(OH)CN \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q26

Q27.

Solution

Concept — Acidity comparison: Carboxylic acids are far stronger acids than phenol; among carboxylic acids, formic acid is stronger than acetic acid because the CH_3 group $(+I)$ in acetic acid destabilises the carboxylate.

Step 1 — Carboxylic acids vs phenol: both formic and acetic acids ionise more than phenol.

Step 2 — Formic vs acetic: formic acid (HCOOH) lacks the electron-donating methyl group, so it is more acidic than acetic acid.

Step 3 — Final order: formic acid $>$ acetic acid $>$ phenol.

Why other options are wrong:

- (A) and (D) wrongly place phenol first.
- (B) reverses formic and acetic acid.

Final Answer: formic $>$ acetic $>$ phenol $\Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q27**

Q28.

Solution

Concept — Basicity of amines in the gas phase: In the gas phase (no solvation), basicity follows the inductive electron-donating effect, so it increases with the number of alkyl groups.

Step 1 — Identify the effect: more alkyl groups $\Rightarrow$ greater $+I$ $\Rightarrow$ more available lone pair $\Rightarrow$ more basic (gas phase).

Step 2 — Rank: $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3$.

Step 3 — Conclude: trimethylamine is the most basic in the gas phase.

Why other options are wrong:

- (A) reverses the trend.
- (B) and (C) place the order out of sequence; they apply to mixed aqueous effects, not the pure gas-phase inductive order.

Final Answer: $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3 \Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ **Go Back to Q28**

Q29.

Solution

Concept — Reducing vs non-reducing sugars: A sugar is reducing if it has a free aldehyde/ketone group (free anomeric carbon). Sucrose has both anomeric carbons locked in its glycosidic bond.

Step 1 — Examine sucrose: the glucose and fructose units are joined through both their anomeric carbons.

Step 2 — Conclude for sucrose: no free reducing group, so it is non-reducing.

Step 3 — Check the others: glucose, fructose and maltose all have a free reducing group, so they reduce Tollens'/Fehling's.

Why other options are wrong:

- (B) glucose is a reducing sugar.
- (C) fructose reduces Tollens' (isomerises).
- (D) maltose has a free anomeric carbon, so it is reducing.

Final Answer: sucrose (non-reducing) $\Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ Go Back to Q29

Q30.

Solution

Concept — Addition vs condensation polymers: Addition polymers form by repeated addition of unsaturated monomers with no loss of small molecules; condensation polymers lose small molecules such as water.

Step 1 — Examine polyethene: it forms from ethene ($CH_2{=}CH_2$) by chain addition, with no by-product.

Step 2 — Conclude: polyethene is an addition polymer.

Why other options are wrong:

- (A) nylon-6,6 is a condensation polymer (loses water).
- (C) terylene is a condensation polyester.
- (D) bakelite is a condensation polymer (phenol + formaldehyde).

Final Answer: polyethene $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ Go Back to Q30

Q31.

Solution

Concept — Carbocation stability: Stability increases with alkyl substitution (hyperconjugation and $+I$): tertiary $>$ secondary $>$ primary $>$ methyl.

Step 1 — Classify each cation: $(CH_3)_3C^+$ tertiary; $(CH_3)_2CH^+$ secondary; $CH_3CH_2^+$ primary; CH_3^+ methyl.

Step 2 — Apply the stability order: tertiary is the most stable.

Step 3 — Select: $(CH_3)_3C^+$.

Why other options are wrong:

- (A) primary and (B) methyl are the least stable.
- (D) secondary is less stable than tertiary.

Final Answer: $(CH_3)_3C^+ \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — Friedel–Crafts alkylation: An alkyl halide with anhydrous $AlCl_3$ introduces an alkyl group onto an aromatic ring.

Step 1 — Identify the reagents: benzene + CH_3Cl with $AlCl_3$.

Step 2 — Recognise the reaction: alkyl group (CH_3) is added to the ring, giving toluene.

Step 3 — Name it: this is Friedel–Crafts alkylation.

Why other options are wrong:

- (A) Wurtz couples two alkyl halides (no arene).
- (B) Cannizzaro is for aldehydes without α-H.
- (C) Kolbe is a phenol carboxylation.

Final Answer: Friedel–Crafts alkylation $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — Tollens' test: Tollens' reagent (ammoniacal $AgNO_3$) is reduced to metallic silver by aldehydes, giving a silver mirror.

Step 1 — Recall what reacts: only aldehydes (and a few easily oxidised species) reduce Tollens'.

Step 2 — Identify the group: the silver mirror indicates a $-CHO$ group.

Step 3 — Conclude: the compound contains an aldehyde group.

Why other options are wrong:

- (A) ketones do not give the silver mirror.
- (C) alcohols and (D) ethers are unreactive with Tollens'.

Final Answer: an aldehyde (−CHO) $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q33

Q34.

Solution

Concept — Selective oxidation: PCC (pyridinium chlorochromate) is a mild oxidant that stops a primary alcohol at the aldehyde stage.

Step 1 — Goal: oxidise 1° alcohol to aldehyde only.

Step 2 — Choose reagent: PCC oxidises without over-oxidising to the acid.

Step 3 — Conclude: PCC is the correct reagent.

Why other options are wrong:

- (B) and (C) are strong oxidants that carry the alcohol all the way to the carboxylic acid.
- (D) concentrated HNO_3 is also a strong, non-selective oxidant.

Final Answer: PCC $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q34

Q35.

Solution

Concept — Ionization energy trend: IE generally increases across a period, but N (half-filled $2p^3$) has anomalously high IE, higher than O; here among Li, B, C, N the order rises Li $<$ B $<$ C $<$ N.

Step 1 — General trend: across period 2, IE increases left to right.

Step 2 — Place B: B ($2s^2 2p^1$) is slightly lower than expected but still above Li.

Step 3 — Order the four: Li $<$ B $<$ C $<$ N (N highest due to stable half-filled $2p^3$).

Why other options are wrong:

- (A) reverses the whole trend.
- (C) misplaces C and B.
- (D) wrongly puts B below Li.

Final Answer: Li $<$ B $<$ C $<$ N $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ **Go Back to Q35**

Q36.

Solution

Concept — VSEPR for AB_6: Six bond pairs and no lone pair on the central atom give an octahedral shape.

Step 1 — Count electron domains: S in SF_6 has 6 bond pairs, 0 lone pairs.

Step 2 — Assign geometry: 6 domains $\Rightarrow$ octahedral.

Step 3 — Conclude: SF_6 is octahedral, bond angles $90°$.

Why other options are wrong:

- (B) tetrahedral is for 4 domains.
- (C) square planar arises with 4 bonds and 2 lone pairs (e.g. XeF_4).
- (D) trigonal bipyramidal is for 5 domains.

Final Answer: octahedral $\Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ **Go Back to Q36**

Q37.

Solution

Concept — Hybridization from geometry: A central atom with four sigma bonds and no lone pair is sp^3 hybridised (tetrahedral).

Step 1 — Count sigma bonds on C: in CH_4 there are 4 C–H bonds.

Step 2 — Count lone pairs: 0 on carbon.

Step 3 — Assign hybridization: 4 electron domains $\Rightarrow sp^3$.

Why other options are wrong:

- (B) sp^2 is for 3 domains.
- (C) sp is for 2 domains.

- (D) sp^3d is for 5 domains.

Final Answer: $sp^3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Flame colours of alkali metals: Each alkali metal gives a characteristic flame colour; lithium gives crimson red.

Step 1 — Recall the colours: Na golden yellow, K lilac, Li crimson red, Cs blue/violet.

Step 2 — Match crimson: crimson red corresponds to lithium.

Step 3 — Conclude: lithium imparts the crimson flame.

Why other options are wrong:

- (A) sodium is golden yellow.
- (B) potassium is lilac.
- (D) caesium is blue.

Final Answer: lithium (crimson) $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q38

Q39.

Solution

Concept — Inert pair effect: Down group 13–15, the ns^2 electrons become reluctant to take part in bonding, stabilising the lower oxidation state.

Step 1 — Identify the trend: for Tl, the $6s^2$ pair is held tightly and stays unshared.

Step 2 — Consequence: the $+1$ state (loss of one $6p$ electron) is more stable than $+3$.

Step 3 — Name the effect: the inert pair effect.

Why other options are wrong:

- (B) diagonal relationship relates Li–Mg, Be–Al, B–Si.
- (C) back bonding explains BF_3 stability, not oxidation states.

- (D) lanthanide contraction is a size effect in the f-block.

Final Answer: inert pair effect ⇒ $\boxed{\text{A}}$

Answer: (A) Go Back to Q39

Q40.

Solution

Concept — Catenation: The ability of like atoms to bond to one another is greatest when the element–element bond is strong; the C–C bond is the strongest in group 14.

Step 1 — Compare bond strengths: C–C $>$ Si–Si $>$ Ge–Ge $>$ Sn–Sn $>$ Pb–Pb.

Step 2 — Relate to catenation: stronger self-bonds mean greater catenation.

Step 3 — Conclude: carbon shows maximum catenation.

Why other options are wrong:

- (A), (B) and (C) silicon, germanium and lead have weaker element–element bonds and far less catenation.

Final Answer: carbon ⇒ $\boxed{\text{D}}$

Answer: (D) Go Back to Q40

Q41.

Solution

Concept — Basicity of group-15 hydrides: Basicity depends on lone-pair availability; the smaller N holds its lone pair in a more compact, available orbital, so NH_3 is more basic than PH_3.

Step 1 — Compare atom size: N is smaller than P.

Step 2 — Lone pair availability: on the smaller N the lone pair is more concentrated and donates more readily.

Step 3 — Conclude: $NH_3 > PH_3$ in basicity.

Why other options are wrong:

- (B) larger size lowers, not raises, basicity.
- (C) they are not equal.

- (D) P is less electronegative than N, and that is not the basicity reason.

Final Answer: NH_3 is more basic $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q41

Q42.

Solution

Concept — MO theory of O_2: Filling MOs gives two unpaired electrons in the degenerate π^*_{2p} orbitals, making O_2 paramagnetic.

Step 1 — Fill the MOs: the last two electrons enter $\pi^*_{2p_x}$ and $\pi^*_{2p_y}$ singly (Hund's rule).

Step 2 — Count unpaired electrons: 2 unpaired electrons.

Step 3 — Conclude: unpaired electrons $\Rightarrow$ paramagnetism.

Why other options are wrong:

- (A) paired electrons would make it diamagnetic.
- (B) there are two, not one, unpaired electrons.
- (C) O_2 has bond order 2, not 1.

Final Answer: two unpaired electrons in $\pi^* \Rightarrow \boxed{D}$

Answer: (D) Go Back to Q42

Q43.

Solution

Concept — Oxidising power of halogens: It decreases down the group; F_2 is the strongest oxidant, I_2 the weakest.

Step 1 — Recall the trend: oxidising power $F_2 > Cl_2 > Br_2 > I_2$.

Step 2 — Reason: highly negative electron-gain/hydration and low bond enthalpy make F_2 the best oxidant.

Step 3 — Conclude: order is $F_2 > Cl_2 > Br_2 > I_2$.

Why other options are wrong:

- (A) reverses the trend.
- (B) and (C) misplace F_2.

Final Answer: $\mathrm{F_2 > Cl_2 > Br_2 > I_2} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q43

Q44.

Solution

Concept — Xenon fluorides: Xenon forms $\mathrm{XeF_2}$, $\mathrm{XeF_4}$ and $\mathrm{XeF_6}$ (even numbers of F, reflecting pairing of electrons).

Step 1 — Recall the known fluorides: $\mathrm{XeF_2}$, $\mathrm{XeF_4}$, $\mathrm{XeF_6}$.

Step 2 — Match the option: the set $\mathrm{XeF_2, XeF_4, XeF_6}$ is correct.

Step 3 — Conclude: option (C).

Why other options are wrong:

- (A), (B) and (D) list odd-numbered fluorides (XeF, $\mathrm{XeF_3}$, $\mathrm{XeF_5}$, $\mathrm{XeF_7}$) which do not exist as stable binary species.

Final Answer: $\mathrm{XeF_2,\ XeF_4,\ XeF_6} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q44

Q45.

Solution

Concept — Variable oxidation states: In d-block elements the $(n-1)d$ and ns orbitals are close in energy, so electrons from both sets can be lost, giving several oxidation states.

Step 1 — Identify the orbitals: $4s$ and $3d$ (for first series) are very close in energy.

Step 2 — Consequence: both can participate in bonding, allowing many oxidation states.

Step 3 — Conclude: this energy closeness is the reason.

Why other options are wrong:

- (A) filled d orbitals would limit, not increase, variability.
- (B) they are not all radioactive.
- (D) they have d as well as s electrons available.

Final Answer: close $ns/(n-1)d$ energies $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q45

Q46.

Solution

Concept — Oxidation state in a complex: Charge on the complex = (oxidation state of metal) + (sum of ligand charges). NH_3 is neutral.

Step 1 — Ligand charge: six NH_3 each 0, total 0.

Step 2 — Set up the equation: let Co be x; $x + 0 = +3$ (charge of the complex ion).

Step 3 — Solve: $x = +3$.

Why other options are wrong:

- (A) $+2$ ignores the overall $+3$ charge.
- (C) $+6$ double counts.
- (D) 0 would require a neutral complex.

Final Answer: Co is $+3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q46

Q47.

Solution

Concept — Geometrical isomerism in MA_2B_2 square-planar complexes: Such complexes exist as cis and trans isomers, so there are two geometrical isomers.

Step 1 — Identify the type: $[Pt(NH_3)_2Cl_2]$ is square planar of type MA_2B_2.

Step 2 — Possible arrangements: the two Cl can be adjacent (cis) or opposite (trans).

Step 3 — Count: 2 geometrical isomers (cis and trans).

Why other options are wrong:

- (A) ignores the cis/trans distinction.
- (B) and (C) over-count; only two arrangements exist.

Final Answer: 2 isomers (cis, trans) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q47

Q48.

Solution

Concept — Froth flotation: This method separates sulphide ores from gangue using the difference in wettability; sulphide particles stick to oil/froth and float.

Step 1 — Recall the principle: sulphide ores are preferentially wetted by oil and float on the froth.

Step 2 — Conclude: froth flotation concentrates sulphide ores.

Why other options are wrong:

- (A), (B) and (D) oxide, carbonate and chloride ores are concentrated by other methods (e.g. gravity, magnetic, leaching), not froth flotation.

Final Answer: sulphide ores $\Rightarrow \boxed{\text{C}}$

Answer: (C)

Go Back to Q48

Q49.

Solution

Concept — Temporary hardness: Caused by dissolved bicarbonates of Ca^{2+} and Mg^{2+}; it is removed by boiling.

Step 1 — Identify the cause: $\mathrm{Ca(HCO_3)_2}$ and $\mathrm{Mg(HCO_3)_2}$ give temporary hardness.

Step 2 — Conclude: temporary hardness is due to bicarbonates of Ca and Mg.

Why other options are wrong:

- (A), (B) and (D) chlorides, sulphates and nitrates of Ca/Mg cause permanent hardness, not temporary.

Final Answer: bicarbonates of Ca and Mg $\Rightarrow \boxed{\text{C}}$

Answer: (C)

Go Back to Q49

Q50.

Solution

Concept — Qualitative analysis group reagent: Group II cations are precipitated as sulphides by passing H_2S in the presence of dilute HCl, which keeps the sulphide-ion concentration low.

Step 1 — Recall Group II reagent: H_2S in acidic (dilute HCl) medium.

Step 2 — Reason for acidity: dilute HCl suppresses S^{2-} via the common-ion effect so only the least-soluble (Group II) sulphides precipitate.

Step 3 — Conclude: the group reagent is H_2S with dilute HCl.

Why other options are wrong:

- (A) dilute HCl alone is the Group I reagent.
- (B) is the Group III reagent.
- (C) is the Group V (carbonate) reagent.

Final Answer: H_2S in dilute HCl $\Rightarrow \boxed{D}$

$\boxed{\textbf{Answer: (D)}}$ **Go Back to Q50**

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	D	4	B	5	B
6	A	7	D	8	A	9	B	10	C
11	D	12	A	13	C	14	B	15	A
16	C	17	D	18	C	19	B	20	A
21	A	22	B	23	D	24	D	25	B
26	A	27	C	28	D	29	A	30	B
31	C	32	D	33	B	34	A	35	B
36	A	37	A	38	C	39	A	40	D
41	A	42	D	43	D	44	C	45	C
46	B	47	D	48	C	49	C	50	D