

Question Bank

Subject: Chemistry

Chapter 1 Solid States

Objective Type Questions

- Q1 Why does the window glass of the old buildings look milky?
- Q2 'Crystalline solids are anisotropic in nature.' What does this statement mean?
- Q3 What type of interactions hold the molecules together in a polar molecular solid?
- Q4 Give an example each of a molecular solid and an ionic solid.
- Q5 What is the two-dimensional coordination number of a molecule in a square close-packed layer?
- Q6 Express the relationship between atomic radius (r) and the edge length (a) in the bcc unit cell.
- Q7 Which crystal defect lowers the density of a solid and which does not alter the density of a relevant solid?
- Q8 What type of stoichiometric defect is shown by AgCl and ZnS ?
- Q9 What is the formula of a compound in which the element P forms *hcp* lattice and atoms of Q occupy $\frac{2}{3}$ rd of octahedral voids?
- Q10 metallic element crystallises into a lattice having a pattern of AB AB..... and packing of spheres leaves out voids in the lattice. What type of structure is formed by this arrangement?
- Q11 Zinc oxide is white but it turns yellow on heating. Explain.

Chapter 2 Solutions

Objective Type Questions

Q1 State Raoult's law for a solution containing non-volatile solute. What type of deviation from Raoult's law is shown by a solution of chloroform and acetone and why?

Q2 Why is an increase in temperature observed on mixing chloroform and acetone?

Q3 Why does sodium chloride solution freeze at a lower temperature than water?

Q4 Define an ideal solution and write one of its characteristics.

Q5 Differentiate between molarity and molality of a solution. Explain how molarity value of a solution can be converted into its molality.

Q6 Define the term osmotic pressure. Describe how the molecular mass of a substance can be determined by a method based on measurement of osmotic pressure.

Q7 A solution prepared by dissolving 8.95 mg of a gene fragment in 35.0 mL of water has an osmotic pressure of 0.335 torr at 25°C. Assuming that the gene fragment is a non-electrolyte, calculate its molar mass.

Q8 Derive the relationship between relative lowering of vapour pressure and molar mass of the solute.

Q9 Calculate the freezing point depression expected for 0.0711 m aqueous solution of Na₂SO₄. If this solution actually freezes at – 0.320°C, what would be the value of van't Hoff factor?

(K_f for water is 1.86 K kg mol⁻¹).

Q10 When 1.5 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point of benzene raised from 353.23 K to 353.93 K. Calculate the molar mass of the solute.

(K_b for benzene = 2.52 K kg mol⁻¹)

Chapter 3 Electrochemistry

Objective Type Questions

Q1 Define:

Molar conductivity (Λ_m) , Limiting molar conductivity

Q2 Express the relation among cell constant, resistance of the solution in the cell and conductivity of the solution. How is molar conductivity of a solution related to its conductivity?

Q3 State Kohlrausch law of independent migration of ions. Why does the conductivity of a solution decrease with dilution?

Q 4 Following reactions occur at cathode during the electrolysis of aqueous silver chloride solution:



On the basis of their standard reduction electrode potential (E°) values, which reaction is feasible at the cathode and why?

Q5 Define limiting molar conductivity. Why conductivity of an electrolyte solution decreases with the decrease in concentration?

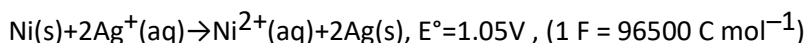
Q6 Following reactions occur at cathode during the electrolysis of aqueous sodium chloride solution:



On the basis of their standard reduction electrode potential (E^0) values, which reaction is feasible at the cathode and why?

Q7 Why does the cell potential of mercury cell remain constant throughout its life?

Q8 Determine the values of equilibrium constant (K_C) and ΔG° for the following reaction:



Q9 The molar conductivity of a 1.5 M solution of an electrolyte is found to be $138.9 \text{ S cm}^2 \text{ mol}^{-1}$. Calculate the conductivity of this solution.

Q10 The conductivity of 0.20 M solution of KCl at 298 K is 0.025 S cm^{-1} . Calculate its molar conductivity.

Chapter 4 Chemical Kinetics

Objective Type Questions

Q1 Define the following:

- i. Elementary step in a reaction
- ii. Rate of reaction
- iii. Pseudo first order reaction
- iv. Half life period of reaction ($t_{1/2}$)
- v.

Q2 Write two differences between 'order of reaction' and 'molecularity of reaction'.

Q3

For a reaction: $2\text{NH}_3(g) \xrightarrow{\text{Pt}} \text{N}_2(g) + 3\text{H}_2(g)$

Rate = k

- i. Write the order and molecularity of this reaction.
- ii. Write the unit of k .

Q4

For a reaction $A + B \rightarrow P$, the rate law is given by,

$$r = k[A]^{1/2}[B]^2.$$

What is the order of this reaction?

Q5 A first order reaction is found to have a rate constant $k = 5.5 \times 10^{-14} \text{ s}^{-1}$. Find the half life of the reaction.

Q6 A reaction is of second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is reduced to half? What is the unit of rate constant for such a reaction?

Q7. Answer the following questions:

Q8 Explain why H_2 and O_2 do not react at room temperature.

Q9 Write the rate equation for the reaction $\text{A}_2 + 3\text{B}_2 \rightarrow 2\text{C}$, if the overall order of the reaction is zero.

Q10 Show that in a first order reaction, time required for completion of 99.9% is 10 times that of half-life ($t_{1/2}$) of the reaction.

Chapter 5 Surface Chemistry

Objective Type Questions

Q1 What happens when a freshly precipitated $\text{Fe}(\text{OH})_3$ is shaken with water containing a small quantity of FeCl_3 ?

Q2 Why is a finely divided substance more effective as an adsorbent?

Q3 How are the following colloidal solutions prepared?

- i. Sulphur in water
- ii. Gold in water

Q4 Write the differences between physisorption and chemisorption with respect to the following:

- i. Specificity
- ii. Temperature dependence
- iii. Reversibility and
- iv. Enthalpy change

Q5 What is meant by coagulation of a colloidal solution? Describe briefly any three methods by which coagulation of lyophobic sols can be carried out.

Q6 Give an example where physisorption changes to chemisorption with rise in temperature. Explain the reason for change.

Q7 How does BF_3 act as a catalyst in industrial process?

Q8 In which of the following does adsorption take place and why?

- i. Silica gel placed in the atmosphere saturated with water.
- ii. Anhydrous CaCl_2 placed in the atmosphere saturated with water.

Q9 Which one of the following electrolytes is the most effective for the coagulation of $\text{Fe}(\text{OH})_3$ sol and why?

NaCl , Na_2SO_4 , Na_3PO_4

Q10 Give reasons:

Physisorption decrease with increase of temperature

Gelatin which is a peptide is added in ice-creams.

Chapter 7 p Block elements

Objective Type Questions

Q1 Complete the following equations:

- i. $P_4 + H_2O \rightarrow$
- ii. $XeF_4 + O_2F_2 \rightarrow$

Q2 Complete the following chemical equations:

- i. $Ca_3P_2 + H_2O \rightarrow$
- ii. $Cu + H_2SO_4 \text{ (conc.)} \rightarrow$

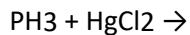
Q3 Complete the following equations:

- i. $2Ag + PCl_5 \rightarrow$
- ii. $CaF_2 + H_2SO_4 \rightarrow$

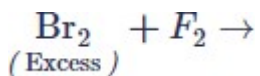
Q4 Complete the following equations:

- i. $C + \text{conc. } H_2SO_4 \rightarrow$
- ii. $XeF_2 + H_2O \rightarrow$

Q5 Complete the following chemical reaction equations:



Q6



Q7 Complete the following reactions:

- i. $NH_3 + 3Cl_2 \text{ (excess)} \rightarrow$
- ii. $XeF_6 + 2H_2O \rightarrow$

Q8 Complete the following reactions:

- i. $Cl_2 + H_2O \rightarrow$
- ii. $XeF_6 + 3H_2O \rightarrow$

Q9 What happens when

- i. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ is heated
- ii. H_3PO_3 is heated?

Write the equation.

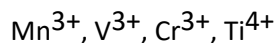
Q10 Draw the structures of the following:

- i. $\text{H}_2\text{S}_2\text{O}_8$
- ii. XeOF_4
- iii. XeF_2
- iv. XeO_3
- v. $\text{H}_2\text{S}_2\text{O}_7$
- vi. H_3PO_2
- vii. XeF_4
- viii. H_2SO_3
- ix. HClO_3
- x. XeF_4

Chapter 8 d and f Block elements

Objective Type Questions

Q1 In the following ions:

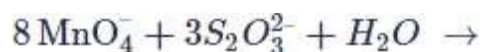


(Atomic no. : Mn = 25, V = 23, Cr = 24, Ti = 22)

- Which ion is most stable in an aqueous solution?
- Which ion is the strongest oxidizing agent?
- Which ion is colourless?
- Which ion has the highest number of unpaired electrons?
-

Q2 Complete the following chemical equations.

Q3 Actinoids exhibit a much larger number of oxidation states than the lanthanoids.



Q4 There is hardly any increase in atomic size with increasing atomic numbers in a series of transition metals.

Q5 Write one similarity and one difference between the chemistry of lanthanoids and that of actinoids.

Q6 Why Mn^{2+} is much more resistant than Fe^{2+} towards oxidation.

Q7 Among lanthanoids, Ln(III) compounds are predominant. However, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained. Explain why

Q8 On what basis can you say that scandium ($Z = 21$) is a transition element but zinc ($Z = 30$) is not?

Q9 Silver atom has completely filled d -orbitals ($4d^{10}$) in its ground state yet silver is a transition element.

Q10 Highest oxidation state of a metal exhibited in its oxide or fluoride only.

Q11 Give reasons for the following:

- The halides of transition elements become more covalent with increasing oxidation state of the metal.
- Ionisation enthalpies of Ce, Pr and Nd are higher than Th, Pa and U.

Chapter 9 Coordination Compounds

Objective Type Questions

Q1 Give the formula of each of the following coordination entities:

- Co^{3+} ion is bound to one Cl^- , one NH_3 molecule and two bidentate ethylene diamine (en) molecules.
- Ni^{2+} ion is bound to two water molecules and two oxalate ions.

Write the name and magnetic behaviour of each of the above coordination entities. (At. nos. Co = 27, Ni = 28)

Q2 Write the IUPAC name of the isomer of the following complex: $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$

Q3. Write the formula for the following:

Tetraammineaquachloridocobalt (III) nitrate

Q4 Using IUPAC norms write the formulae for the following:

- Tris(ethane-1, 2-diamine) chromium (III) chloride
- Potassium tetrahydrozincate(II)

Q5 When a coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 , 2 moles of AgCl are precipitated per mole of the compound. Write:

- structural formula of the complex.
- IUPAC name of the complex.
-

Q6 When a coordination compound $\text{PtCl}_4 \cdot 6\text{NH}_3$ is mixed with AgNO_3 , 4 moles of AgCl are precipitated per mole of the compound. Write:

- structural formula of the complex.
- IUPAC name of the complex.

Q7 For the complex $[\text{Fe}(\text{CN})_6]^{3-}$, write the hybridisation type, magnetic character and spin nature of the complex. (At. Number : Fe = 26).

Q8 Write the state of hybridisation, shape and IUPAC name of the complex $[\text{CoF}_6]^{3-}$.

Q9 For the complex $[\text{Fe}(\text{CO})_5]$, write the hybridization, magnetic character and spin of the complex.

(At. number: Fe = 26)

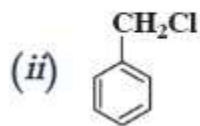
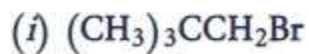
Q10 What is meant by crystal field splitting energy? On the basis of crystal field theory, write the electronic configuration of d^4 in terms of t_{2g} and e_g in an octahedral field when

- $\Delta_0 > P$
- $\Delta_0 < P$

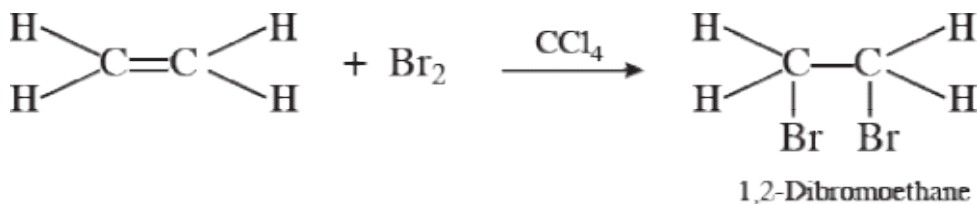
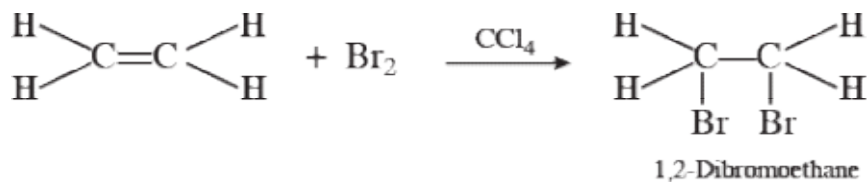
Chapter 10 Haloalkenes and Haloarenes

Objective Type Questions

Q1 Write the IUPAC names of the following compounds:

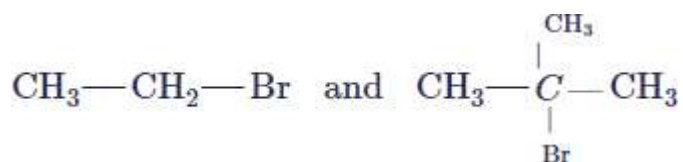


Q2 Complete the following reaction equations:



Q3 Which is a better nucleophile, a bromide ion or an iodide ion?

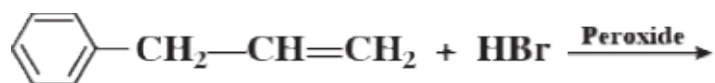
Q4 Which would undergo $\text{S}_{\text{N}}1$ reaction faster in the following pair?



Q5 C—Cl bond length in chlorobenzene is shorter than C—Cl bond length in $\text{CH}_3\text{—Cl}$. Why?

Q6 $\text{S}_{\text{N}}1$ reactions are accompanied by racemisation in optically active alkyl halides.

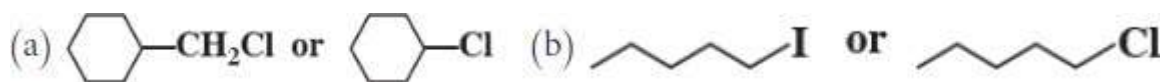
Q7 Draw the structure of major monohalo product in each of the following reactions:



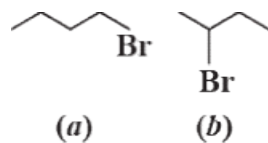
Q8 . Which will have a higher boiling point?

1-Chloropentane or 2-methyl-2-chlorobutane

Q9. Which ones in the following pairs of substances undergoes $\text{S}_\text{N}2$ substitution reaction faster and why?



Q10 Which alkyl halide from the following pair is chiral and undergoes faster $\text{S}_\text{N}2$ reaction?



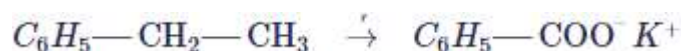
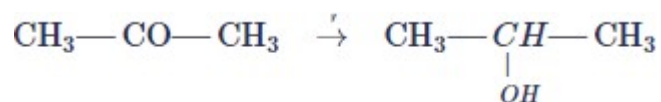
Chapter 11 Aldehyde, Ketone and carboxylic acid

Objective Type Questions

Q1 Write the reagents required in the following reactions:



Q2 Name the reagents used in the following reactions:



Q3 Do the following conversions in not more than two steps:

- Propene to Acetone
- Propanoic acid to 2-hydroxypropanoic acid

Q4 Write Wolff-Kishner reduction reaction and Etard reaction .

Q5 Write the reagents used in the following reactions:



Q6 Arrange the following compounds in increasing order of their property as indicated:

CH_3COCH_3 , $\text{C}_6\text{H}_5-\text{CO}-\text{C}_6\text{H}_5$, CH_3CHO (reactivity towards nucleophilic addition reaction)

Q7



Q8 Oxidation of aldehydes is easier than ketones. Why?

Q9. $\text{CH}_2=\text{CH}-\text{COOH}$ is more acidic than $\text{CH}_3\text{CH}_2-\text{COOH}$. Why?

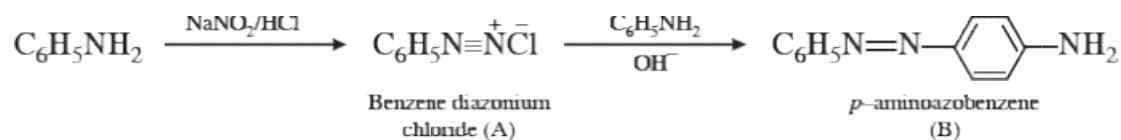
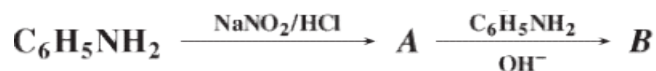
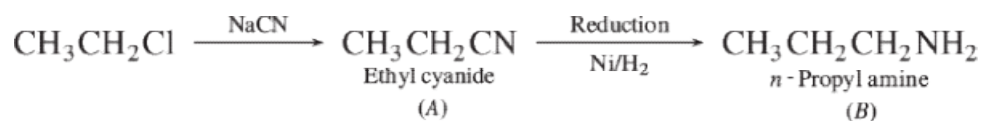
Q10 Illustrate the following reactions giving a suitable example for each:

- i. Cross aldol condensation
- ii. Decarboxylation

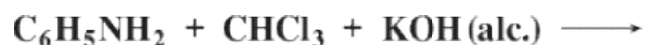
Chapter 12 Amines

Objective Type Questions

Q.1 Identify *A* and *B* in each of the following processes:



Q2 Complete the following reaction equations:



Q3 How are the Ethanamine to N-ethylethanamide conversion carried out?

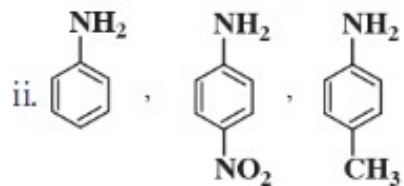
Q4. How are Chloroethane to propan-1-amine conversions carried out?

Q5. Why is an alkylamine more basic than ammonia?

Q6 Why do primary amines have higher boiling points than the tertiary amines?

Q7 Arrange the following in increasing order of their basic strength:

i. $\text{C}_6\text{H}_5\text{—NH}_2$, $\text{C}_6\text{H}_5\text{—CH}_2\text{—NH}_2$, $\text{C}_6\text{H}_5\text{—NH—CH}_3$



Q8. In increasing order of their basic strength

$\text{C}_6\text{H}_5\text{—NH}_2$, $\text{CH}_3\text{—CH}_2\text{—NH}_2$, $\text{CH}_3\text{—NH—CH}_3$

Q9. In increasing order of solubility in water

$\text{CH}_3\text{—NH}_2$, $(\text{CH}_3)_3\text{N}$, $\text{CH}_3\text{—NH—CH}_3$

Q10 Give chemical test to distinguish between $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$ and $\text{C}_6\text{H}_5\text{NH}_2$.

Chapter 13 Biomolecules

Objective Type Questions

Q1 Write the reactions involved when D-glucose is treated with the following reagents:

(i) HCN (ii) Br₂ water

Q2 Explain what is meant by the peptide linkage

Q3. Explain what is meant by the pyranose structure of glucose.

Q4 Name the four bases present in DNA. Which one of these is not present in RNA?

Q5 Name the bases present in RNA. Which one of these is not present in DNA?

Q6 Describe what you understand by primary structure and secondary structure of proteins.

Q7. Write one difference between α -helix and β -pleated sheet structures of protein.

Q8. Write the name of the disease caused by the deficiency of vitamin B₁₂.

Q9. What type of linkage is present in nucleic acids?

Q10. Give one example each for fibrous protein and globular protein.

Q11 Explain difference between RNA and DNA.