

CAREERS360

PRACTICE **Series**

Maharashtra HSC

**Chemistry Sample
Paper 2025**

Std : 12 th
CHEMISTRY
SPECIMEN QUESTION BANK
Chapter Number : 1 to 16

Type of questions :

- 1) 1 Mark VSA (difficulty level)**
- 2) 1 Mark VSA (Which can be combined with sections B/C/D)**
- 3) 2 Marks SAI**
- 4) 3 Marks SAII**
- 5) 5 Marks LA**

Sub. : CHEMISTRY
Chapter : 1 to 16
SPECIMEN QUESTION BANK

1. Solid state
2. Solution and colligative properties
3. Chemical thermodynamics and energetics
4. Electrochemistry
5. Chemical kinetics
6. General principles and processes of isolation of elements
7. p - Block elements
8. d and f - block elements
9. Coordination compounds
10. Halogen derivatives of alkanes and arenes
11. Alcohols, phenols and ethers
12. Aldehydes, ketones and carboxylic acids
13. Compounds containing nitrogen
14. Biomolecules
15. Polymers
16. Chemistry in everyday life

Chapter 1 : Solid State

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) Write an example of pair of isomorphous substances.
- Q. 2) What is polymorphic form of Sulphur ?
- Q. 3) Name the semiconductor obtained when Boron is added as an impurity to Silicon.
- Q. 4) What type of semiconductor is obtained when Silicon is doped with Phosphorus ?
- Q. 5) Predict the coordination number of Na^+ ion in NaCl. $r_{\text{Na}^+} = 0.95 \text{ \AA}$; $r_{\text{Cl}^-} = 1.81 \text{ \AA}$
- Q. 6) The radius of cation and anion is $0.95 \text{ \AA}$ and $1.81 \text{ \AA}$. Name the structure of the ionic crystal.
- Q. 7) What is the magnetic property of Cl^- ion. $[Z=17]$?
- Q. 8) What is the magnetic property of Ni atom $[Z= 28]$?
- Q. 9) Name the method to determine magnetic properties.
- Q. 10) Atom C and D form FCC structure. Atom C is present at the corners of the cube and D is at the faces of the cube. What is the formula of the compound ?
- Q. 11) Name the type of solid in S_8 molecule.
- Q. 12) Name the type of solid formed Present in Ammonium phosphate ?
- Q. 13) Write uses of Fullerene.
- Q. 14) Which type of hybridisation is present in carbon atom in fullerene?
- Q. 15) What is the force between the layer of carbon atoms in graphite ?
- Q. 16) How density of solid varies in Schottky defect ?
- Q. 17) How density of solid varies in Frenkel defect ?
- Q. 18) How many kg of carbon does 0.1 mole of Buckminster Fullerene contain ?
- Q. 19) Calculate number of unit cells in 58.5 of a compound which forms BCC. [Molar mass of a compound = 58.5]
- Q. 20) Write an example of element in which atoms occupy the position of lattice points ?

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D)

- Q. 1) Define crystalline solid.

- Q. 2) Define Anisotropy.
- Q. 3) What is an unit cell ?
- Q. 4) What is meant by voids in crystal structure ?
- Q. 5) Write two examples of metallic solids.
- Q. 6) Write two examples of covalent solids.
- Q. 7) Write two examples of molecular solids.
- Q. 8) What is meant by the term coordination number ?
- Q. 9) Define crystal defect.
- Q. 10) Define line defect.
- Q. 11) Write an example of solid in which the forces between the particles having electrostatic force.
- Q. 12) What is the relation between the edge lengths 'a', 'b' and 'c' in body centred orthorhombic crystal ?
- Q. 13) What is the relation between the angles ' α ', ' β ' and ' γ ' in simple hexagonal crystal ?
- Q. 14) Define crystal lattice.
- Q. 15) Which crystal lattice is represented by the following values ? $a = b = c$ and $\alpha = \beta = \gamma \neq 90^\circ$.
- Q. 16) Which crystal lattice has most efficient packing efficiency ?
- Q. 17) What is the packing efficiency of BCC unit cell ?
- Q. 18) What is the void space of SCC unit cell ?
- Q. 19) The coordination number of cation is 4. What will be the limiting value of radius ratio?
- Q. 20) Define Interstitial defect.
- Q. 21) Define Impurity defect.
- Q. 22) What is n-type semiconductor.
- Q. 23) What is p-type semiconductor.
- Q. 24) Name the two types of void space in close packing.

Q. 25) How many tetrahedral and octahedral void spaces are there for each sphere in close packing ?

● **Section B - Questions of 2 Marks SA I**

Q. 1) "Solid ice is lighter than water" - Explain.

Q. 2) Write a note on ionic solid.

Q. 3) Write a note on metallic solid.

Q. 4) Write a note on covalent solid.

Q. 5) Explain why ionic solids are hard and brittle ?

Q. 6) Distinguish between hexagonal close packing and cubic close packing in solids.

Q. 7) Calculate the number of atoms per unit cell of FCC and BCC crystal structure.

Q. 8) Metals are good conductors of heat and electricity. Why ?

Q. 9) Write a note on radius ratio rule for ionic compounds.

Q. 10) Explain Ferromagnetism.

Q. 11) Explain Paramagnetism.

Q. 12) Explain Diamagnetism.

Q. 13) Write a note on impurity defect in solids.

Q. 14) Explain the term Schottky defect.

Q. 15) Explain the term Frenkel defect.

Q. 16) Classify the following species as paramagnetic, diamagnetic or ferromagnetic.

a) Sodium [$Z = 11$]

b) Ca^{2+} cation [$Z = 20$]

c) Iron [$Z = 26$]

d) Cl^- anion [$Z = 17$]

Q. 17) How many tetrahedral voids and octahedral voids are present per atom in a closed packed structure ?

Q. 18) Explain the term crystal lattice with suitable example.

Q. 19) What is meant by the term coordination number of a crystal lattice ?

Q. 20) Explain n-type semiconductors.

Q. 21) Explain p-type semiconductors.

Q. 22) Draw the structures of SCC and FCC indicating lattice points.

Q. 23) Distinguish between BCC unit cell and FCC unit cell.

Q. 24) Distinguish between crystalline solids and amorphous solids.

Q. 25) Complete the following :

Crystal System	Type	Edge length	Angle
i) Tetragonal	Body Centred	----	----
ii) Monoclinic	End Centred	----	----

Q. 26) Sodium metal crystallizes to form BCC structure. The edge length of unit cell is 4.29×10^{-8} cm. Calculate the radius of sodium atom.

Q. 27) In an ionic solid, the radii of cation and anion are $0.9858 \text{ \AA}$ respectively and $1.86 \text{ \AA}$. Predict the type of geometry and coordination number of the solid.

Q. 28) Unit cell of iron crystal has edge length of 288 pm and density of 7.86 g cm^{-3} . Determine the type of crystal lattice. [Atomic mass of Fe = 56]

Q. 29) A compound is formed by two elements M & N. The element N forms CCP and atoms of M occupy $\frac{1}{3}$ rd of tetrahedral voids. What is the formula of the compound?

Q. 30) A compound forms hexagonal close packed structure. What is the number of octahedral voids in 0.5 mole of it ?

Q. 31) A compound forms hexagonal close packed structure. What is the number of tetrahedral voids in 0.25 mole of it ?

Q. 32) Copper crystallizes in FCC structure. The edge length of unit cell is $3.8 \text{ \AA}$. Calculate the radius of copper atom.

Q. 33) Aluminium crystallizes in a CCP structure. Its metallic radius is 125 pm. What is the length of the side of the unit cell ?

Q. 34) The edge length of unit cell is 353.5 pm. Calculate the number of unit cells present in 1 cm^3 of Aluminium.

Q. 35) A compound AmBn with A in the form of cation occupies the octahedral voids where B in the form of anion forms CCP type crystal lattice. What will be the formula of the compound ?

● Questions of 3 Marks SAI

Q. 1) What is imperfection in solid ? Explain two types of imperfection in solids

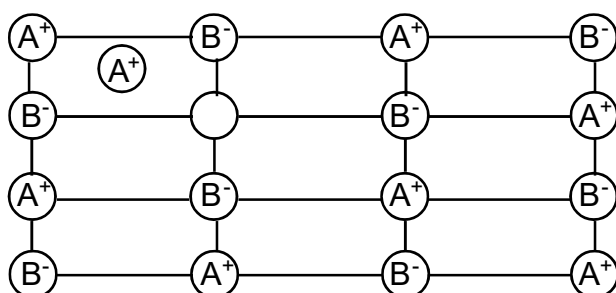
Q. 2) Write the mathematical relation between atomic radius and edge length of cubic unit cell for the following solid structure ?

- a) SCC b) BCC c) FCC

Q. 3) Define semiconductor Describe the two types of semiconductors when silicon is doped with,

- a) group 13 element b) group 15 element

Q. 4) Examine the defective crystal lattice as shown below and answer the following questions.



a) Name the defect present in ionic solid, give reason.

b) Out of AgCl and NaCl, which is most likely to show this type of defect ?

Q. 5) Write the characteristic properties of solid state.

Q. 6) Classify the following solids into different types : Glass, Graphite, Iodine, Sulphur (S_8), Bronze, Ammonium phosphate.

Q. 7) Why substances have magnetic properties ? Explain with suitable example.

Q. 8) Define void.

Tungsten crystallizes in BCC unit cell. If the edge length of unit cell is 320 pm, calculate the radius of tungsten atom.

Q. 9) Determine the structure and coordination number of MgS on the basis of radius ratio in which Mg^{2+} and S^{2-} have ionic radii of 65pm and 184 pm respectively.

Q. 10) Define metallic bond. Iron has a body centred cubic unit cell with cell dimension of 286.65 pm. calculate the density of iron. [Atomic mass of Fe = 56]

- Q. 11) A metal crystallizes into two cubic system FCC and BCC, whose unit cell lengths are $4A^0$ and $3A^0$ respectively. Calculate the ratio of densities of FCC and BCC
- Q. 12) Sodium crystallizes into a BCC unit cell. What is the number of unit cells present in 4.6 g of sodium ? [Atomic mass of Na = 23]
- Q. 13) Thallium (I) chloride crystallizes in either a SCC or FCC of Cl^- ion. The density of the solid is 8.9 g cm^{-3} and edge of the unit cell is $3.95 \times 10^{-8} \text{ cm}^{-3}$. Predict the type of unit cell. [Molar mass of Thallium chloride = 239.8 g mol^{-1}]
- Q.14) An element of atomic mass 98.5 g mol^{-1} occurs in FCC structure. If its density is 5.22 g cm^{-3} , determine the edge length of unit cell.
- Q. 15) A metallic element has BCC lattice. Edge length of unit cell is $2.88 \times 10^{-8} \text{ cm}$. The density of the metal is 7.20 g cm^{-3} . Calculate -
- Volume of unit cell
 - Mass of unit cell
 - Number of atoms in 100 g of metal.
- Q. 16) Molybdenum has atomic mass 96 g mol^{-1} with density 10.3 g cm^{-3} . The edge length of unit cell is 314 pm. Determine its lattice structure.
- Q. 17) An element crystallizes in a cubic closed packed structure having FCC unit of an edge length 200pm. calculate the density if 200 g of this element contains 24×10^{23} atoms.
- Q. 18) Define diamagnetism.
- Copper crystallizes in FCC structure. If the edge length of unit cell is $3.8A^0$. Calculate the radius of copper atom.
- Q. 19) A metal crystallizes in FCC structure. Calculate the atomic mass of metal, if the edge length of the unit cell is 404 pm and its density is 2.7 g cm^{-3} .



Chapter 2 : Solution and Colligative properties

● **Section A - Questions of 1 mark VSA of difficulty level**

- Q. 1) What is the most important condition required for solute and solvent, while preparing a binary solution ?
- Q. 2) Name the physical states of solute and solvent in the solution of iodine in CCl_4 at room temperature.
- Q. 3) Which is the best and flawless way of expressing concentration of solution?
- Q. 4) Write reason, 'concentration of solution in terms of molality is preferred in comparison with molarity'.
- Q. 5) Which is a scientific and useful way of expressing concentration of components of solution ?
- Q. 6) Prove that, "0.5 M ethyl alcohol and 0.1 M magnesium phosphate have same osmotic pressure at 25°C ."
- Q. 7) What is the most important condition, required for separation of solvent and solution in osmosis ?
- Q. 8) Give reason, "oxygen is slightly soluble in water; but highly soluble in blood."
- Q. 9) A person added a table salt in his carbonated soft drink and he was astonished. Write reason on the basis of Henry's law.
- Q. 10) If a non-volatile electrolyte produces four ions after dissociation then what will be the change in its colligative property ?
- Q. 11) What is the most important condition required for any solution to be an ideal or non-ideal?
- Q. 12) Write the mathematical formula for molar mass of non-volatile substance in cryoscopy.
- Q. 13) Give reason, "in Cold countries, the ice frozen on roads and footpaths, is melted by spraying salts like sodium chloride or calcium chloride."
- Q. 14) Fill in the blank.

Using the relation between the molar masses of solute and colligative properties, it is possible to determine the molecular masses of and solutes from dilute solutions.

- Q. 15) Name the law, suggesting the following equations.
 i) $n_1 = n_2$... two solutions at same temperature and pressure.
- Q. 16) What is a cause of abnormal colligative properties ?
- Q. 17) Name the law suggesting equation $\pi = CRT$.
- Q. 18) "Osmotic pressure is more useful to calculate molecular mass than other colligative properties." Why?
- Q. 19) Why is freezing point depression of 0.1 M sodium chloride solution is nearly twice than that of 0.1 M glucose solution?
- Q. 20) What happens when red blood corpuscles are placed in 0.5 % NaCl solution ?
- Q. 21) Complete the sentence. During depression of freezing point in a solution the equilibrium is present in
- Q. 22) Is it possible to calculate molar mass of polymers using boiling point or freezing point method? Why?
- Q. 23) If a grape is placed in water it swells, why ?

● **Section A - Questions of 1 Mark VSA (which can be combined with sections B / C / D)**

- Q. 1) Define the term, solution.
- Q. 2) What is molality and molarity?
- Q. 3) What is solid solution?
- Q. 4) State Henry's law.
- Q. 5) Define colligative properties.
- Q. 6) Write the mathematical expression for lowering of vapour pressure.
- Q. 7) Write the mathematical expression for relative lowering of vapour pressure.
- Q. 8) Define the term lowering of vapour pressure, on the basis of Raoult's law for a solution of non-volatile solute.
- Q. 9) Define boiling point.
- Q. 10) Define freezing point.
- Q. 11) How is lowering of vapour pressure is mathematically related with freezing point?
- Q. 12) Define osmosis.
- Q. 13) State van't Hoff- Boyle's law.

- Q. 14) State van't Hoff-Charles' law.
- Q. 15) Write mathematical expression for van't Hoff general solution equation.
- Q. 16) How is molar mass of non - volatile solute, related with colligative property?
- Q. 17) If a non-volatile solute produces four ions after dissociation, then what will be the change in its molecular mass and colligative property of its solution?
- Q. 18) State van't Hoff-Avogadro's law.
- Q. 19) Write the mathematical expression, showing the relationship between van't Hoff factor and degree of dissociation.
- Q. 20) If an electrolyte HCl is dissolved in water, its value for $\frac{\Delta T_f}{m} = 1.86 \text{ K kg mol}^{-1}$ at 25°C ; then what is its value for K_f ?
- Q. 21) What is theoretical colligative property?
- Q. 22) Define mole fraction.

● **Section B - Questions of 2 Marks SAI**

- Q. 1) Define, i) w/w ii) v/v
- Q. 2) Define the terms, i) concentration of solution ii) concentrated solution.
- Q. 3) Prove that, $P < P_1^0$, with the help of Raoult's law for a solution of non-volatile solute, where P =vapour pressure of solution and P_1^0 = vapour pressure of pure solvent
- Q.4) Derive the relationship between molar mass of solute and solvent and relative lowering of vapour pressure for a solution of non-volatile solute.
- Q. 5) Define freezing point. Write mathematical expression for depression in freezing point.
- Q. 6) State Henry's law. State the relationship between Henry's constant and solubility of gas.
- Q. 7) Write the names of constituents of alloys used for making safes or heavy machinery.
- Q. 8) State Raoult's law. Draw the graph showing variation of vapour pressure of solution with mole fraction of solvent in solution.
- Q. 9) Why is 1 M aqueous solution more concentrated than 1 m aqueous solution ?

Q. 10) Define osmosis. Draw the diagram showing osmosis between solvent and solution.

Q. 11) Match the phenomenon in List I with their equilibriums in List II and write the correct answer using the code assigned to left hand side of each point in the lists.

List I	List II
P. Vapour pressure	1. Rate of dissolution and Rate of crystallization
Q. Freezing point depression and vapour pressure lowering	2. Rate of evaporation and Rate of condensation
R. To stop osmosis	3. Vapour pressure of liquid and atmospheric pressure
S. Process of dissolution	4. Vapour pressure of solid solvent and solvent of the solution
	5. Hydrostatic pressure and osmotic pressure

Q.12. State and derive mathematically van't Hoff - Boyle's law.

Q.13) State and derive mathematically van't Hoff - Charles' law.

Q.14) Derive van't Hoff equation for osmotic pressure of solution.

Q.15) How molar mass of non-volatile solute is determined by osmotic pressure measurements?

Q.16) Show that $\alpha = \frac{i-1}{n'-1}$

Q.17) Define molal depression constant. What are causes of depression in freezing point?

Q. 18) Show that $\alpha = \frac{M_{(theoretical)} - M_{(observed)}}{(n' - 1)M_{(observed)}}$

Q.19) What is lowering of vapour pressure and relative lowering of vapour pressure?

Q.20) Derive the mathematical equation for the relation between depression of freezing point and molar mass of non-volatile solute.

- Q.21) Write the mathematical expression to determine the molar mass of non-volatile solute by ebullioscopy.
- Q.22) State Raoult's law. Prove it mathematically.
- Q.23) Match the designations and formulae in List I with their meaning in List II and write the correct answer using the code assigned to left hand side of each point in the lists.

List I	List II
P. ΔT_f	1. Cryoscopic constant
Q. ΔP	2. Boiling point elevation
R. ΔT_b	3. Relative lowering of vapour pressure
S. $\frac{\Delta T_f}{m}$	4. Freezing point depression
	5. Lowering of vapour pressure

- Q. 24) Write mathematical equation for van't Hoff factor in terms of colligative property. What is theoretical colligative property?
- Q.25) K_f for water is $1.86 \text{ K kg mol}^{-1}$. If the automobile radiator holds 1.0 kg of water, how many gram of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$) must be added to lower the freezing point of the solution to -2.8°C ?
- Q.26) 5.25% solution of a substance is isotonic with 1.5% solution of urea (molar mass = 60) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3} , calculate the molar mass of the substance.
- Q.27) A solution is prepared by dissolving certain amount of solute in 500 g of water. The percentage mass of a solute in solution is 2.38. Calculate mass of solute.
- Q.28) The vapour pressure of 2.1% solution of non-electrolyte in water at 100°C is 755 mm of Hg. Calculate the molar mass of solute.
- Q.29) 2.46 g of NaOH (molar mass = 40) is dissolved in water and the solution is made to 1000 cm^3 . Calculate the molarity of the solution.

- Q.30) The solubility of oxygen in water is $2.43 \times 10^{-3} \text{ mol/dm}^3$ at 25°C and 1 atm pressure. Calculate the concentration of oxygen at 25°C and 0.2 atm pressure.
- Q.31) 18g glucose is dissolved in 1kg of water. At what temperature will the solution boil? ($K_b = 0.52 \text{ K kg mol}^{-1}$)
- Q.32) Calculate the osmotic pressure of 5% solution of cane sugar (molar mass = 342 g mol^{-1}) at 15°C .
- Q.33) If 6.02×10^{20} molecules of urea are present in 100 mL of its solution, then calculate the concentration of urea solution.

● **Section C - Questions of 3 Marks SAI**

- Q. 1) a) Define osmosis.
b) Explain abnormality in colligative property, observed in case of aqueous and non-aqueous solutions.
- Q. 2) State van't Hoff - Avogadro's law. Derive mathematical expression for determination of molar mass from osmotic pressure.
- Q. 3) State Raoult's law. Derive the mathematical expression of Raoult's law for solution containing two volatile components.
- Q. 4) Define vapour pressure. Derive the relationship between molar mass of solute and solvent and relative lowering of vapour pressure for a solution of non-volatile solute.
- Q. 5) What are the different ways of expressing the concentration of the solution?
- Q. 6) State Henry's law. State the relationship between Henry's constant and solubility of gas. Why marine life is observed at the bottom of the sea?
- Q. 7) Define colligative property of solution. What is lowering and relative lowering of vapour pressure of solution?
- Q. 8) a) Show that $\alpha = \frac{i-1}{n'-1}$ b) Show that $\alpha = \frac{M_{(theoretical)} - M_{(observed)}}{(n' - 1)M_{(observed)}}$

- Q.9) Explain graphically, the elevation of boiling point of a liquid when a non-volatile solute is added to it.
- Q.10) Explain graphically, the depression in freezing point of a liquid when a non-volatile solute is added to it.
- Q.11) Derive van't Hoff equation for osmotic pressure of a solution. How is molar mass of solute determined from osmotic pressure measurements?
- Q.12) Explain abnormal osmotic pressure, with suitable example.
- Q. 13) Define osmotic pressure. What are the causes of abnormal osmotic pressure?
- Q. 14) Define : i) isotonic solutions, ii) hypertonic solutions, iii) hypotonic solutions.
- Q. 15) State: i) van't Hoff-Charles' law ii) van't Hoff-Boyle's law iii) van't Hoff-Avogadro's law.
- Q.16) A solution of glucose in water is labeled as 10% (w/w). The density of solution is 1.29g/mL. Calculate i) molarity ii) molality of solution.
- Q.17) A solution containing 1.5 g of $\text{Ba}(\text{NO}_3)_2$ in 0.1 kg of water freezes at 272.720 K. Calculate the degree of dissociation of the salt. ($K_f = 1.86 \text{ K kg mol}^{-1}$, molar mass of $\text{Ba}(\text{NO}_3)_2 = 261 \text{ g/mol}$)
- Q.18) A solution containing 3.10 g of BaCl_2 in 250 g of water, boils at 100.083°C . Calculate molality and van't Hoff factor of BaCl_2 in this solution. ($K_b = 0.52 \text{ K kg mol}^{-1}$, molar mass of $\text{Ba}(\text{NO}_3)_2 = 208.3 \text{ g/mol}$)
- Q.19) 100 g of liquid A (mol. mass of =140 g/mol) was dissolved in 1000 g of liquid B (molar mass of = 180 g/mol). The vapour pressure of pure liquid B was found to be 500 atmosphere. Calculate the vapour pressure of pure liquid A and its vapour pressure in the solution, if the total vapour pressure of the solution is 475 atmosphere.

- Q.20) A solution containing 0.5126 g of naphthalene (molar Mass = 128.17 g/mol) in 50 g of CCl_4 gives boiling point of elevation of 0.402 K. While a solution of 0.6216g of unknown solute in the same mass of same solvent gives a boiling point elevation of 0.647 K. Find the molar mass of the unknown solute.
(K_b for CCl_4 = 5.03 K kg mol^{-1})

● **Section D - Questions of 5 marks LA**

Q. 1) Answer the following :

- i) What happens when red blood corpuscles (RBC) are placed in-
 - a) 0.5% NaCl solution
 - b) 1% NaCl solution?
- ii) A binary solution of two volatile liquids A and B in which mole fraction of A is x_A , is reported to have total vapour pressure equal to P mbar (m atm). P is defined by the relation, $P = 255 - 120 x_A$. What are the values of p_A^0 and p_B^0 ?

Q. 2) Answer the following :

1.22 g of benzoic acid is dissolved in a) 100 g of acetone ($K_b = 2.6 \text{ K kg mol}^{-1}$) and b) 100g of benzene ($K_b = 2.6 \text{ K kg mol}^{-1}$). If the elevation in boiling points ΔT_b is 0.26 °C and 0.13 °C respectively then

- i) What is the molar mass of benzoic acids in two solvents?
- ii) Write molecular structure of benzoic acid in both the solvents.

Q.3) Define, van't Hoff factor. 0.6 mL of glacial acetic acid with density 1.06 g/L is dissolved in 1 kg water and the solution froze at -0.0205°C . Calculate van't Hoff factor.
(K_f for water is $1.86 \text{ K kg mol}^{-1}$)

Q.4) A solution containing 3.10 g of BaCl_2 in 250 g of water, boils at 100.083°C . Calculate molality and van't Hoff factor of BaCl_2 in this solution. ($K_b = 0.52 \text{ K kg mol}^{-1}$, molar mass of $\text{Ba}(\text{NO}_3)_2 = 208.3 \text{ g/mol}$) Derive van't Hoff equation for osmotic pres-

sure of solution.

- Q.5) Explain graphically, the elevation of boiling point of a liquid when a non-volatile solute is added to it. Derive van't Hoff equation for osmotic pressure of solution.



Chapter 3 : Chemical thermodynamics and energetics

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) Write the mathematical equation for the first law of thermodynamics.
- Q. 2) How are the macroscopic properties classified ?
- Q. 3) Write the mathematical expression of enthalpy.
- Q. 4) What is thermodynamic equilibrium ?
- Q. 5) Write the condition for Gibbs' energy for non-spontaneous process.
- Q. 6) One mole of a gas expands by 3 L against a constant pressure of 3 atm. Calculate the work done in Joule.
- Q. 7) For a particular reaction, the system absorbs 5 kJ of heat and does 2kJ of work on its surrounding. What is the change in internal energy ?
- Q. 8) Write the importance of Hess's law of constant heat summation.
- Q. 9) Which of the following has the greater entropy ?
a) $\text{CaCO}_3(\text{s})$ b) $\text{CO}_2(\text{g})$
- Q. 10) In a process, 12.5 L. atm work is obtained. Convert it into $\text{kg m}^2 \text{s}^{-2}$.
- Q. 11) 0.1 L of ethylene gas and 0.1 L of hydrogen chloride gas react to form 0.1 L of ethyl chloride gas at 2 atm. pressure. Calculate the pressure - volume work.
- Q. 12) Calculate the work done in the following reaction at constant pressure and at 423 K
(Given : $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$) $4\text{HCl}_{(\text{g})} + \text{O}_{2(\text{g})} \longrightarrow 2\text{Cl}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{g})}$

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)

- Q. 1) Define isolated system.
- Q. 2) Which of the followings are intensive properties ?
Temperature, Mass, Volume, Boiling point.
- Q. 3) What is a reversible reaction ?
- Q. 4) Define enthalpy of ionisation.
- Q. 5) State first law of thermodynamics.
- Q. 6) Define endothermic reaction.

- Q. 7) What is bond enthalpy ?
- Q. 8) Define standard enthalpy of formation.
- Q. 9) State Hess's law of constant heat summation.
- Q. 10) What is spontaneous process ?
- Q. 11) Write the quantitative relation for entropy change.
- Q. 12) Define entropy.
- Q. 13) What will be change in entropy for the decomposition of CaCO_3 ?
- Q. 14) State second law of thermodynamics.
- Q. 15) State whether ΔS will be positive or negative for the sublimation of Iodine.
- Q. 16) State third law of thermodynamics.
- Q. 17) What is residual entropy ?
- Q. 18) Define an exothermic reaction.
- Q. 19) What is isothermal process ?
- Q. 20) What is use of standard molar entropy ?
- Q. 21) Define enthalpy of fusion.
- Q. 22) What is internal energy ?
- Q. 23) Define enthalpy of vaporization ($\Delta_{\text{vap}} H$).

● **Section B - Questions of 2 Marks SAI**

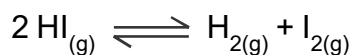
- Q. 1) Distinguish between isothermal and adiabatic processes.
- Q. 2) Derive an expression for maximum work in isothermal reversible expansion of "n" moles of an ideal gas.
- Q. 3) State : (i) Second law of thermodynamics in terms of entropy.
(ii) Third law of thermodynamics.
- Q. 4) Define : (a) Enthalpy of atomization.
(b) Enthalpy of fusion.
- Q. 5) Derive the relation between ΔG° and equilibrium constant, K for the reaction,

$$a A + b B \longrightarrow c C + d D$$

- Q. 6) Distinguish between reversible and irreversible processes.
- Q. 7) Write the mathematical expression for the first law of thermodynamics for the following processes :
- (i) Isothermal (ii) Adiabatic
(iii) Isochoric (iv) Isobaric
- Q. 8) Derive the mathematical relationship between enthalpy change and internal energy change for the gaseous chemical reactions at constant pressure.
- Q. 9) Classify the following reactions, according to work done by the system, work done on the system and no work done, if pressure is constant.
- (a) $\text{H}_{2(g)} + \text{Cl}_{2(g)} \rightarrow 2\text{HCl}_{(g)}$
(b) $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{SO}_{3(g)}$
- Q. 10) Define entropy.
What are the conditions for spontaneous and nonspontaneous reactions in terms of free energy change ?
- Q. 11) In a particular reaction, 1.5 kJ of heat released from the system and 4.5 kJ of work is done on the system. What are the changes in : (i) Internal energy
(ii) Enthalpy of the system ?
- Q. 12) One mole of a gas expands by 5 L against a constant pressure of 4 atm. Calculate the work done in : (i) L. atm (ii) Calories.
- Q. 13) The equilibrium constant, K_p for the reaction; $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightarrow 2\text{SO}_{3(g)}$ is 7.1×10^{24} at 298K. Calculate ΔG° for the reaction.
(Given : $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)
- Q. 14) Calculate the work done during isothermal and reversible expansion of 2 moles of an ideal gas from 10 L to 100 L at 300 K.
(Given : $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)
- Q. 15) Enthalpy of fusion of ice is 6.01 kJ mol^{-1} The enthalpy of vaporisation of water is $45.07 \text{ kJ mol}^{-1}$. What is enthalpy of sublimation of ice ?
- Q. 16) The heat evolved in a reaction of 7.5 g of Fe_2O_3 with enough CO is 1.164 kJ. Calculate ΔH° for the reaction.
 $\text{Fe}_2\text{O}_{3(s)} + 3\text{CO}_{(g)} \rightarrow 2\text{Fe}_{(s)} + 3\text{CO}_{2(g)}$
[Given : At. mass C = 12, O = 16, Fe = 56]

● **Section C - Questions of 3 Marks SAI**

- Q. 1) Derive the relation between ΔH and ΔU for the chemical reactions. Write the conditions for $\Delta H = \Delta U$.
- Q. 2) Define a state function. What are the different types of thermodynamic processes ?
- Q. 3) What is pressure - volume work ? Distinguish between isothermal process and adiabatic process.
- Q. 4) State the first law of thermodynamics. Define and explain the term, enthalpy.
- Q. 5) Define :
 i) Enthalpy of fusion
 ii) Enthalpy of vaporisation.
- How is enthalpy of sublimation related to enthalpy of fusion and enthalpy of vaporisation ?
- Q. 6) Define heat of reaction. Why is second ionisation enthalpy greater than first ionisation enthalpy ?
- Q. 7) Define bond enthalpy. State Hess's law of constant heat summation. Explain the standard state of an element.
- Q. 8) What is a spontaneous process ? Entropy is a measure of disorder, Explain.
- Q. 9) State the second law of thermodynamics in terms of entropy. Derive the relation between ΔG and ΔS_{total} .
- Q. 10) State third law of thermodynamics. Give one application of standard molar entropy. What are the conditions for spontaneous and non-spontaneous reactions in terms of free energy change ?
- Q. 11) Determine whether the reactions with the following ΔH and ΔS values are spontaneous or nonspontaneous. State whether the reactions are endothermic or exothermic.
- (a) $\Delta H = -110 \text{ kJ}$, $\Delta S = 40 \text{ JK}^{-1}$ at 400 K
- (b) $\Delta H = 40 \text{ kJ}$, $\Delta S = -120 \text{ JK}^{-1}$ at 250 K
- Q. 12) The equilibrium constant K for the reaction.
- $\text{H}_{2(g)} + \text{I}_{2(g)} \rightleftharpoons 2\text{HI}_{(g)}$ is 130 at 560 K. Calculate ΔG° for the reaction given below at the same temperature. (Given : $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)



- Q. 13) Calculate ΔH° for the reaction between ethene and water to form ethyl alcohol from the following data :

$$\Delta_c H^\circ \text{ C}_2\text{H}_5\text{OH}_{(g)} = -1368 \text{ kJ mol}^{-1}$$

$$\Delta_c H^\circ \text{ C}_2\text{H}_{4(g)} = -1411 \text{ kJ mol}^{-1}$$

Does the calculated ΔH° represent the enthalpy of formation of liquid ethyl alcohol ?

- Q. 14) Calculate the standard enthalpy of combustion of $\text{CH}_3\text{COOH}_{(l)}$ from the following data :

$$\Delta_f H^\circ (\text{CO}_2) = -393.3 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\circ (\text{H}_2\text{O}) = -285.8 \text{ kJ mol}^{-1}$$

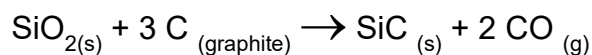
$$\Delta_f H^\circ (\text{CH}_3\text{COOH}) = -483.2 \text{ kJ mol}^{-1}$$

- Q. 15) 300 millimol of perfect gas occupies 13 L at 320 K. Calculate the work done in joules when the gas expands :

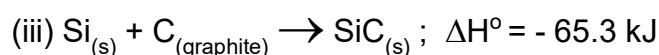
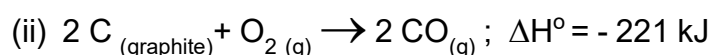
(a) against a constant external pressure of 0.20 atm.

(b) isothermally and reversibly (c) into vacuum, until its volume has increased by 3 L.

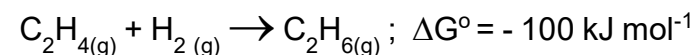
- Q. 16) Calculate ΔH° for the following reaction.



Given :



- Q. 17) Calculate K_p for the reaction :



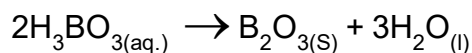
at 25°C [$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$]

● Section D - Questions of 5 marks LA

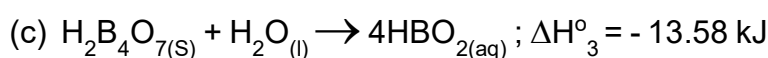
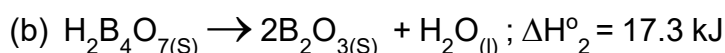
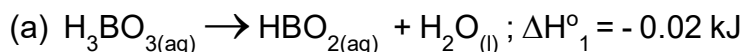
- Q. 1) What are the conditions for spontaneous and non-spontaneous reactions in terms

of free energy change ?

Calculate ΔH° for the following reaction :

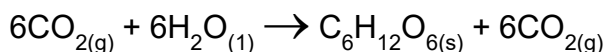


Given that,



Q. 2) Define entropy :

State and explain Hess's law of constant heat summation. What is the value of $\Delta S^\circ_{\text{surr.}}$ for the following reaction at 298 K

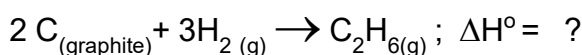


Given :

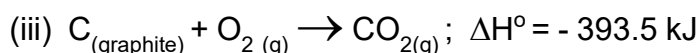
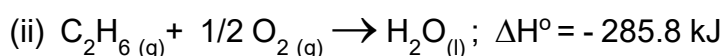
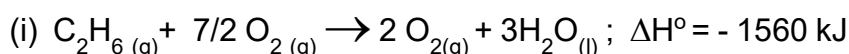
$$\Delta G^\circ = 2879 \text{ kJ mol}^{-1}$$

$$\Delta S^\circ = - 205 \text{ J K}^{-1} \text{ mol}^{-1}$$

Q. 3) Calculate the standard enthalpy of the reaction ;



from the following reactions.



State third law of thermodynamics. Write applications of standard molar entropy.

Q. 4) Calculate the standard enthalpy of formation of $\text{CH}_3\text{COOH}_{(\text{l})}$ from the following data:

$$\Delta_f H^\circ (\text{CO}_2) = -393.3 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\circ (\text{H}_2\text{O}) = -285.8 \text{ kJ mol}^{-1}$$

$$\Delta_c H^\circ (\text{CH}_3\text{COOH}) = -875.0 \text{ kJ mol}^{-1}$$

Distinguish between isothermal and adiabatic process.

- Q. 5) What is an enthalpy ? Derive an expression for maximum work in isothermal reversible expansion of one mole of an ideal gas.

Distinguish between isothermal and adiabatic processes.

- Q. 6) Define : (a) Enthalpy of atomization.
(b) Enthalpy of fusion.

Derive the relation between ΔG and ΔS_{Total} .

State the second law of thermodynamics in terms of entropy.

■■■

Chapter 4 : ELECTROCHEMISTRY

● **Section A - Questions of 1 mark VSA of difficulty level**

- Q. 1) 'Molar conductance of weak electrolyte increases with dilution'. Give reason.
- Q. 2) Specific conductance of 0.01M AB solution is $0.015 \Omega^{-1} \text{ cm}^{-1}$. The resistance of a cell containing the solution was 60Ω calculate cell constant.
- Q. 3) Name the anode and cathode used in Nickel- Cadmium cell
- Q. 4) How is standard electrode potential of $\text{Cu}^{2+} / \text{Cu}_{(s)}$ determined experimentally?
- Q. 5) When cell reaction attains an equilibrium, What will be the EMF of a cell?
- Q. 6) How many moles of Cu is deposited on the cathode by the passage of 965 C of charge ?
- Q. 7) Write IUPAC notation for Daniel cell.
- Q. 8) Write cell representation for cell reaction.
$$\text{Mg}_{(s)} + \text{ZnSO}_{4(aq)} \longrightarrow \text{MgSO}_{4(aq)} + \text{Zn}_{(s)}$$
- Q. 9) How many coulomb of charge is required for deposition of $2/3$ mole of Al in electrolysis of molten Al_2O_3 ?
- Q. 10) Write electrode reaction for following electrode
 $\text{Ag}_{(s)}, \text{AgCl}_{(s)} \mid \text{Cl}^-$
- Q. 11) Following reaction occur at cathode during electrolysis of aqueous solution of AgNO_3
$$\text{Ag}_{(aq)}^+ + e^- \longrightarrow \text{Ag}_{(s)} \quad E^0 = + 0.80 \text{ V}$$
$$\text{H}_{(aq)}^+ + e^- \longrightarrow \frac{1}{2} \text{H}_{2(g)} \quad E^0 = + 0.002 \text{ V}$$

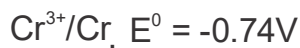
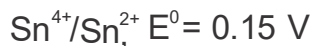
On the basis of their SRP values, which reaction is possible at cathode and why?

Q. 12) What will be the volume of H_2 liberated, when 1 Faraday of electricity is passed through 1 M HCl solution at N.T.P. ?

Q. 13) Write the reaction at anode during rusting.

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D)**

Q. 1) Calculate standard cell potential using following electrodes



Q. 2) Write reaction involved at cathode during the electrolysis of aq NaCl.

Q. 3) Name any two factors which promote corrosion.

Q. 4) Among primary and secondary cells, which can be recharged by passing electric current through it?

Q. 5) What is basic difference in a primary and secondary cell ?

Q. 6) What is the unit of equivalent conductivity ?

Q. 7) Which type of metal is preferably used for cathodic protection of iron against rusting ?

Q. 8) Write Nernst equation for the following cell.



Q. 9) Write relationship between standard free energy change and standard cell potential

Q. 10) How much charge is required for the reduction of 1 mole of $\text{Cu}^{2+}_{(aq)}$ to $\text{Cu}_{(s)}$?

Q. 11) What is electrochemistry ?

Q. 12) What is galvanic cell?

Q. 13) What is an anode ?

Q. 14) Which electrode has positive polarity in a galvanic cell?

Q. 15) What is the volume of 1 Faraday in coulomb?

Q. 16) Write net cell reaction of Daniel cell.

Q. 17) What is standard EMF?

Q. 18) Name the gas evolved at anode in H_2 - O_2 fuel.

Q. 19) What is standard hydrogen electrode?

Q. 20) What is electrolysis?

Q. 21) Define Conductivity.

Q. 22) Define molar conductivity.

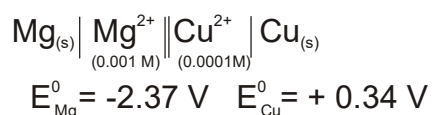
Q. 23) Define corrosion.

Q. 24) Define Fuel cell.

- Q. 25) State Kohlrausch's law of independent migration of ions.
- Q. 26) Why SHE is called reversible electrode?
- Q. 27) What is the source of electrical energy in a galvanic cell?
- Q. 28) Arrange the following metals in the order in which they displace each other from their salt solution
Al, Fe, Mg and Zn.

● **Section B - Questions of 2 Marks SAI**

- Q. 1) Equilibrium Constant (K) is related only to E_{cell}^0 and not to E_{cell} . Explain.
- Q. 2) Write Nernst equation and calculate EMF of the following cell at 298 K.



- Q. 3) Define Faraday's first law of electrolysis. Calculate the amount of Aluminium is deposited by passing 2 Faraday of electricity through 1 mole of fused AlCl_3 .
- Q. 4) How many gram of chlorine can be produced by the electrolysis of molten NaCl with a current of 2 ampere for 20 minutes?
- Q. 5) Standard electrode potentials of some elements are given below

$$\text{K}^+/\text{K} = -2.93 \text{ V}$$

$$\text{Ag}^+/\text{Ag} = 0.80 \text{ V}$$

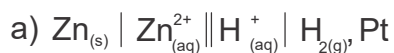
$$\text{Hg}^{2+}/\text{Hg} = 0.79 \text{ V}$$

$$\text{Mg}^{2+}/\text{Mg} = -2.37 \text{ V}$$

Arrange these metals in their increasing order of reducing power.

- Q. 6) $\wedge_0$ For NaCl , HCl and CH_3COONa are 126.4, 425.9 and $91 \text{ S cm}^2 \text{ mol}^{-1}$ respectively calculate $\wedge_0$ for CH_3COOH .
- Q. 7) How is the flow of electric current in a metal wire differs from that in a solution of an electrolyte?
- Q. 8) What is salt bridge? What are its functions in galvanic cell?

Q. 9) Write Nernst equation for the cell reaction of following cells.



Q. 10) What are reduction and oxidation potentials?

Q. 11) What are fuel cells? How are they different from ordinary galvanic cells?

Q. 12) Why Zn does not corrode when exposed to air, though it is more reactive than Fe?

Q. 13) What is molar Conductivity at infinite dilution? How is it determined for strong electrolytes?

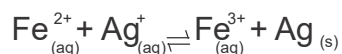
Q. 14) Why it is not possible to determine the molar conductivity at infinite dilution of weak electrolyte, the same way as that of a strong electrolyte?

Q. 15) The specific conductivity of $\frac{M}{50}$ NaOH solution at 298K is $0.002765 \text{ ohm}^{-1} \text{ cm}^{-1}$ and resistance is 200 ohm. Calculate cell constant.

Q. 16) Why a chemical reaction does not get completed in galvanic cell?

Q. 17) Define corrosion. How is it prevented by sacrificial protection?

Q. 18) Calculate standard free energy change for the cell reaction.



$$E_{(\text{Fe})}^0 = 0.77 \text{ V}, E_{(\text{Ag})}^0 = 0.80 \text{ V}$$

Q. 19) Stainless steel is not rusted. Why?

Q. 20) Write Nernst equation and explain the terms involved in it.

Q. 21) The Conductivity of 0.02 M AgNO_3 at 25°C is $2.428 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}$, What is it's Molar conductivity ?

Q. 22) Conductivity of a solution is $6.23 \times 10^{-5} \text{ ohm}^{-1} \text{ cm}^{-1}$ and it's resistance is 13710 ohm. If the electrodes are 0.7 cm apart, calculate cross sectional area of electrode.

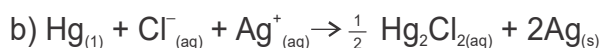
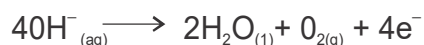
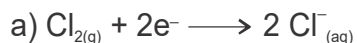
Q. 23) Can copper sulphate solution be stored in an iron vessel? Explain.

Q. 24) Draw neat and labelled diagram of Leclanche' cell.

Q. 25) Arrange the following reducing agents in the order of increasing strength under standard state conditions and Justify your answer __

element	Al(s)	Cu(s)	Cl(aq)	Ni(s)
E^0	-1.66V	0.34 v	1.36 V	- 0.26 V

- Q. 26) With the help of equation $\Delta G^0 = - nFE^0_{\text{cell}}$,
Explain that cell potential is an intensive property.
- Q. 27) Draw neat and labelled diagram of calmoel electrode.
- Q. 28) Resistance and conductivity of a cell containing 0.0001 M KCl solution at 298 K are 1500 ohm and $1.46 \times 10^{-4} \text{ S cm}^{-1}$ respectively. What is the cell constant ?
- Q. 29) Write cell reactions in lead storage battery during discharging.
- Q. 30) In the electrolysis of AgNO_3 solution, 0.7 g of Ag is deposited after a certain period of time. Calculate the quantity of electricity in Coulomb (Molar mass of Ag = 107.9)
- Q. 31) What is electrolytic cell? Write half cell reaction and overall cell reaction during electrolysis of molten NaCl.
- Q. 32) State Faraday's first law of electrolysis. How is it used to calculate the mass of a substance deposited?
- Q. 33) Define a) corrosion, b) galvanization.
- Q. 34) Using IUPAC notations, represent electrochemical cells from given cell reaction.



- Q. 35) Calculate the number of Coulombs required to deposit 40.5 g of aluminium, when electrode reaction is



- Q. 36) How many Coulombs are required to produce 30.0 g of calcium from molten CaCl_2 ?

● **Section C - Questions of 3 Marks SAll**

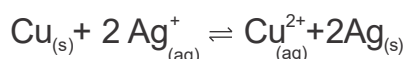
- Q. 1) At 25°C, equivalent conductance of propanoic acid at infinite dilution is 386.6 $\text{ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$.

If its ionisation constant is 1.4×10^{-5} , calculate equivalent conductance of 0.05M propanoic acid solution at 25°C

Q. 2) Explain corrosion of iron on exposure to air. What are different methods of preventing the rusting of iron?

Q. 3) What are fuel cells? Write cathode and anode reactions in H_2 - O_2 fuel cell.

Q. 4) Calculate equilibrium constant of the reaction

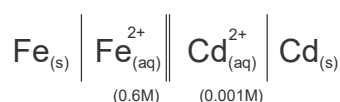


$$E^0_{cell} = 0.46 \text{ V}$$

Q. 5) Why electrolysis of aqueous NaBr and NaI gives Br_2 and I_2 respectively while that of aqueous NaF gives O_2 instead of F_2 ?

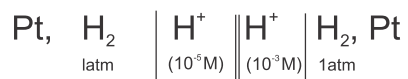
Q. 6) Define Kohlrausch law, give two examples.

Q. 7) Calculate EMF of following cell at 25°C



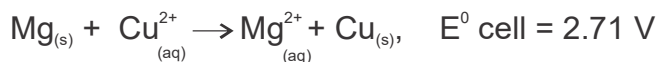
The SRP of Cd and Fe electrodes are -0.403 and -0.441 V respectively?

Q. 8) Calculate EMF of following cell



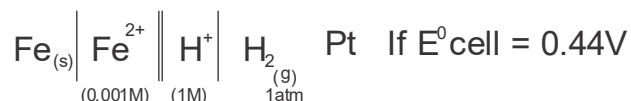
Q. 9) The Molar Conductivity of 0.1M NH_4Cl is $20 \text{ S cm}^2 \text{ mol}^{-1}$. The molar conductivity of NH_4^+ and Cl^- ions at infinite dilution are 74 and $26 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. Calculate degree of dissociation and dissociation constant of NH_4Cl ?

Q. 10) Calculate ΔG^0 for the reaction

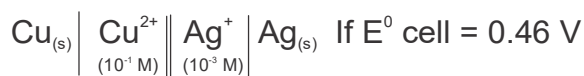


Name the type of cell which was used in apollo space programme for providing electrical power.

Q. 11) Calculate EMF of following cell at 298 K

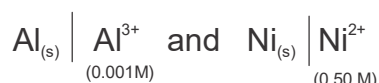


Q. 12) Calculate EMF of following cell at 25°C



Q. 13) The electrical resistance of column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is $5.5 \times 10^3 \text{ Ohm}$. Calculate its resistivity, conductivity and molar conductivity?

Q. 14) A voltaic cell set up at 25°C with the following half cells.

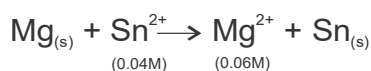


Write an equation for the reaction that occurs when the cell generate an electrical current and determine the standard cell potential.

Q. 15) 0.50 M NaOH solution offered a resistance of 31.6 ohm in a conductivity cell at 298 K. If the cell constant is 0.367 cm^{-1} , calculate molar conductivity of NaOH solution?

Q. 16) Resistance of conductivity cell filled with 0.1 M KCl solution is 100 ohm. If the resistance of same cell when filled with 0.02 M KCl solution is 520 ohm. Calculate conductivity and molar conductivity of 0.02 M KCl solution (Conductivity of 0.1 M KCl solution is 1.29 S cm^{-1})

Q. 17) Calculate E_{cell} and ΔG for the following reaction at 25°C



$$\text{If } E^{\circ}_{\text{cell}} = 2.23 \text{ V}$$

Is the reaction spontaneous?

Q. 18) Write electrode reaction and net cell reaction of fuel cell.

Calculate EMF of following cell at 25°C



$$E^{\circ}_{\text{Zn}} = -0.76 \text{ V}, E^{\circ}_{\text{Cu}} = 0.334 \text{ V}$$

Q.19) Same quantity of electricity was passed through two cells, one containing HCl and other AgNO_3 solution. What volume of H_2 will be liberated at NTP, if $1.08 \times 10^{-4} \text{ kg}$ of Ag got deposited at other electrode? (Molar Mass Ag=108)

Q. 20) An electrochemical cell is composed of Fe and SHE. If emf of cell is 0.445 V, Find $E^{\circ}_{\text{Fe(oxd)}}$ giving half cell reactions?

Q. 21) Write construction and working of Daniel cell?

● **Section D - Questions of 5 marks LA**

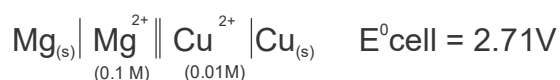
Q. 1) Give the meaning of following terms involved in Nernst equation

- i) n ii) F

Resistance of conductivity cell filled with 0.1 M KCl solution is 100 ohm. If the resistance of same cell filled with 0.02 M KCl solution is 520 ohm. Calculate the conductivity and molar conductivity of 0.02 M KCl solution. The conductivity of 0.1 M KCl solution is $1.29 \times 10^{-2} \text{ ohm}^{-1} \text{ cm}^{-1}$.

Q. 2) State Faraday's second law of electrolysis. How much charge in terms of Faraday is required for the reduction of 1 mole of Cu^{2+} to Cu ?

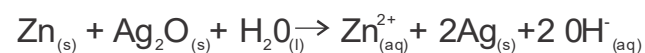
calculate emf of following cell at 298K



Q. 3) What type of battery is lead accumulator?

Write the anode and cathode reactions and the over all reaction occurring in lead storage battery when current is drawn from it.

In the button cell, (widely used in watches) the following reaction takes place.



determine E°_{cell} and ΔG° for the reaction

$$(E^{\circ}_{\text{Ag}} = 0.80 \text{ V}, E^{\circ}_{\text{Zn}} = -0.76 \text{ V})$$

Q. 4) Define molar conductivity of solution Explain how molar conductivity changes with change in concentration of solution for a weak and strong electrolytes.

The resistance of conductivity cell containing 0.001 M KCl solution at 298K is 1500 ohm. What is the cell constant of conductivity of 0.001 M KCl solution at 298 K is $0.146 \times 10^{-3} \text{ S cm}^{-1}$?

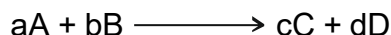
Q. 5) Draw labelled diagram of secondary reversible electrochemical cell Write the reaction during charging of it ?



Chapter 5 : Chemical kinetics

● **Section A - Questions of 1 mark VSA of difficulty level**

Q. 1) Write the average rate of following reaction.



Q. 2) Find the order of reaction having rate law as below

$$C_B^{-2} - \frac{dc}{dt} = k C_A^{1/2} C_B^{-2}$$

Q. 3) For the reaction, $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$, the rate of disappearance of ammonia is $3.6 \times 10^{-3} \text{ mol L}^{-1}\text{s}^{-1}$, what is the rate of formation of water?

Q. 4) The rate law is, $\text{rate} = k [A]^x$. What is effect on rate if x is negative?

Q. 5) What are the importance of knowing the reaction rates?

Q. 6) What is the meaning of positive sign in average rate of the reaction?

Q. 7) What is the meaning of negative sign in average rate of the reaction?

Q. 8) Why reactions of higher order are unknown?

Q. 9) Find the order of the decomposition of gaseous acetaldehyde.

Q. 10) The half life of decomposition of hydrogen peroxide is 0.5 min at a certain temperature. Calculate the rate constant of the reaction.

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)**

Q. 1) What is the mathematical equation for the rate constant of first order reaction?

Q. 2) What is integrated rate law?

Q. 3) Find the order of reaction having rate law, $\text{rate} = k [NO]^2 [H_2]$

Q. 4) What is the unit of rate of a chemical reaction?

Q. 5) Write two factors affecting on the rate of chemical reaction.

Q. 6) What is zero order reaction?

Q. 7) What is reaction intermediate?

Q. 8) Write two applications of integrated rate equation.

- Q. 9) What is initial rate of the reaction?
- Q. 10) Write average rate of the following reaction
- $$2\text{NO}_{(g)} + \text{O}_{2(g)} \longrightarrow 2\text{NO}_{2(g)}$$
- Q. 11) What is the order of thermal decomposition of gaseous ammonia on platinum?
- Q. 12) If $\text{A} \longrightarrow \text{products}$ is a first order reaction then what is the integrated rate equation?
- Q. 13) What is the order of radioactive decay of unstable nuclei?
- Q. 14) What is the mathematical equation for the rate constant for the decomposition of nitrous oxide in presence of platinum catalyst?

Section B - Questions of 2 Marks SAI

- Q. 1) How are the rates of the following reactions expressed.



- Q. 2) What are the applications of rate law?
- Q. 3) Explain the term order of a reaction.
- Q. 4) Write the rate law for the following reactions.
- a) Reaction is zero order in A and second order in B
- b) Reaction is second order in NO (g) and first order in Br₂ (g)
- Q. 5) Define order of reaction. Find order of the following rate laws.
- a) $\text{rate} = k [\text{NO}]^2 [\text{H}_2]$
- b) $\text{rate} = k [\text{CHCl}_3] [\text{Cl}_2]^{1/2}$
- Q. 6) Draw graphical representation for first order reaction of the following variation.
- a) $\log_{10} [\text{A}]_t$ with time
- b) $\log_{10} \frac{[\text{A}]_0}{[\text{A}]_t}$ with time
- Q. 7) Explain the concept of reaction with no order.
- Q. 8) For a reaction, $\text{A} \longrightarrow \text{Product}$, rate is $1.25 \times 10^{-2} \text{ M/s}$, when $[\text{A}]$ is 0.45 M. Determine the rate constant if reaction is (a) first order (b) second order

- Q. 9) Derive the mathematical expression for integrated rate law for a first order reaction.
- Q. 10) Define half life of a reaction. Derive the relationship between half life and rate constant for a first order reaction.
- Q. 11) Derive an expression for integrated rate law for a zero order reaction.
- Q. 12) Inversion of sugar is pseudo first order reaction. Explain.
- Q. 13) Explain the method of initial rates to determine rate law and order of reaction.
- Q. 14) Explain isolation method to determine rate law and order of reaction.
- Q. 15) Explain molecularity of reaction.
- Q. 16) Distinguish between order and molecularity of reaction.
- Q. 17) Define : a) Rate determining step
b) Transition state
- Q. 18) Draw energy profile diagram of potential energy with reaction progress. show the position for the following in the diagram.
a) Activated complex
b) Energy of activation.
- Q. 19) Derive the relationship showing variation in rate constants with temperature.
- Q. 20) Write Arrhenius equation and explain the terms involved in it.
- Q. 21) A reaction is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is (i) doubled (ii) reduced to half?
- Q. 22) $X \longrightarrow Y$ is a second order reaction. If concentration of X is increased by three times, how will it affect the rate of formation of Y?
- Q. 23) Define order of a reaction. Calculate the overall order of reaction which has the rate expressions.
i) $\text{rate} = k [A]^{1/2} [B]^{3/2}$
ii) $\text{rate} = k [A]^{3/2} [B]^{-1}$
- Q. 24) Define zero order reaction. Show that half life of a first order reaction is independent of reactant concentration.
- Q. 25) Define pseudo first order reaction. Show that half life of zero order reaction is directly proportional to concentration of reactant.
- Q. 26) The plot of $\ln k$ against reciprocal of T (in K) for a reaction is linear with a slope

of -1.2×10^4 . What is the activation energy?

- Q. 27) Calculate the energy of activation of a reaction for which rate constant becomes doubles by increase of 10 K temperature from 295 K.

● **Section C - Questions of 3 Marks SAll**

- Q. 1) Define average rate. Derive the relation between half life period and rate constant of zero order reaction. Can decomposition of gaseous HI is zero order reaction?
- Q. 2) Define and explain instantaneous rate of a reaction. How it is determined graphically?
- Q. 3) Define complex reaction. In a reaction, $2A \longrightarrow \text{Products}$, the concentration of A decreases from 0.5 to 0.4 mol L⁻¹ in 10 min. Calculate the rate during this interval?
- Q. 4) Define elementary reaction. For the reaction, $A \longrightarrow \text{products}$, rate is 1.25×10^{-2} M/s when $[A] = 0.45$ M. Determine the rate constant if the reaction is
a) first order in A (b) second order in A
- Q. 5) Define a bimolecular reaction. Explain the conditions of effective collision of a bimolecular reactions.
- Q. 6) Explain, with the help of potential energy diagram, effect of temperature on the rate of reaction.
- Q. 7) Explain effect of catalyst on the following.
a) Activation energy
b) Rate of forward reaction.
c) Rate of backward reaction.
- Q. 8) Define catalyst.
Explain, with the help of potential energy barrier, how does a catalyst increases the speed of a reaction.
- Q. 9) For a substitution reaction, rate constant increases by a factor 10.6 when temperature changes from 25° C to 35° C. Calculate energy of activation of the reaction.

- Q. 10) Consider the reaction $A + B \longrightarrow \text{Products}$. If $[A] = [B] = 1\text{M}$ the rate of reaction is $2 \times 10^{-2} \text{ mol dm}^{-3} \text{ s}^{-1}$. What is the rate of reaction if 90% of each of the reactants are converted into products?
- Q. 11) For a first order reaction, $A \longrightarrow \text{Products}$, the temperature dependent rate constant (k) was found to follow the equation $\log k = -\frac{2000}{T} + 6$ Calculate the pre-exponential factor (A) and activation energy for the reaction.

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Chapter 6 : General principles and processes of isolation of elements

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) Write the name and composition of carbonate mineral of zinc.
- Q. 2) Write the name of the process used for Benefaction of cassiterite ore
- Q. 3) Write the name and composition of ore of zinc which is concentrated by froth floatation method.
- Q. 4) Write the name and formula of depressant used to separate PbS and ZnS from the ores.
- Q. 5) Write the names of chemical substances used for leaching of ore containing silver and Gold.
- Q. 6) Write the reaction involved in the extraction of copper from copper pyrites using sand as a flux to remove impurities during smelting.
- Q. 7) Write the order of relative tendency of following metal to undergo oxidation on the basis of Ellingham diagram Mg, Al, Hg, Ag.
- Q. 8) Write the method used for refining of crude metals like silicon, germanium etc which are used as semiconductor.
- Q. 9) Write the name of processes used for refining of nickel and zirconium by vapour phase technique.
- Q. 10) Write the reduction reaction that takes place in vertical retort process during extraction of zinc.
- Q. 11) Name the alloying element added to alter the mechanical property of steel.
- Q. 12) What is the role of cryolite and fluorspar used during extraction of aluminium from bauxite ore by electrometallurgy?
- Q. 13) What happens when zinc blende is roasted with excess of air? Write chemical reaction involved in it.
- Q. 14) Write the reactions involved in Bessemerisation for extraction of copper from its ore by auto reduction.

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)

- Q. 1) What is Gangue?

- Q. 2) Define Benefaction of the ore.
- Q. 3) Which type of ore is concentrated by froth floatation process?
- Q. 4) Write the equation involved when cyanide compound of silver is treated with zinc.
- Q. 5) What is the difference between Roasting and Calcination?
- Q. 6) Define slag.
- Q. 7) What is smelting?
- Q. 8) What is Ellingham diagram?
- Q. 9) Write name of most abundant ore of zinc.
- Q. 10) Write the composition of Diaspore.
- Q. 11) What is rusting of Iron?
- Q.12) Why magnesium can be used for reducing silicon?
- Q.13) Define flux.
- Q.14) Write the composition of corundum.

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)**

- Q. 1) Define i) Ore ii) Mineral
- Q. 2) What is Leaching? Which of the following metals can be leached during extraction of metal from its ore ?
Copper, Zinc, Aluminium, Iron.
- Q. 3) Write features of Ellingham diagram.
- Q. 4) Write significance of Ellingham diagram.
- Q. 5) Write principles involved in zone refining process for refining of impure metal. Why noble gas atmosphere is provided during the process of zone refining?
- Q. 6) Draw neat and labelled diagram of vertical retort process for extraction of zinc from zinc blende.
- Q. 7) Write cell reactions involved at different electrodes during extraction of impure aluminium from Bauxite ore.

- Q. 8) Define : i) Pyrometallurgy
ii) Hydrometallurgy

● **Section C - Questions of 3 Marks SAll**

- Q. 1) Draw neat and labelled diagram of Blast furnace used for extraction of pig iron from its ore.
Write the name of purest form of Iron.
- Q. 2) Write the reactions involved in the following stages during extraction of cast Iron from Haematite using Blast furnace.
i) Zone of combustion.
ii) Zone of slag formation.
iii) Zone of reduction.
- Q. 3) Explain the following : i) Liquation
ii) Calcination
iii) Electro-refining
- Q. 4) What are the steps involved during extraction of metal from its ore? Draw neat diagram for electromagnetic separator.
- Q. 5) What is Ellingham diagram? How it helps in selection of reducing agents like carbon or carbon monoxide at different temperatures?
- Q. 6) Define Electrometallurgy. Draw neat and labelled diagram of Bessemer converter write the reaction involved in it.

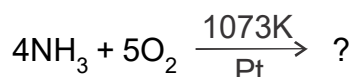
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Chapter 7 : p - Block Elements

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) Name the compounds of nitrogen occurs in earth crust.
- Q. 2) Write the electronic configuration of third element of group 15. ($Z = 33$)
- Q. 3) Name the element of group 15 which does not exhibit allotropy.
- Q. 4) How does the thermal stability of hydrides of group 15 elements vary?
- Q. 5) What is the action of dinitrogen on magnesium?
- Q. 6) What is the action of ammonia on Nessler's reagent?
- Q. 7) What is aqua fortis?
- Q. 8) What is Million's Base?
- Q. 9) What is the action of hot concentrated nitric acid on carbon?
- Q. 10) Draw the structure of laughing gas.
- Q. 11) Draw the structure of N_2O_4 .
- Q. 12) How is Holme's signal obtained?
- Q. 13) What type of halides does phosphorus form?
- Q. 14) Write uses of PCl_5 .
- Q. 15) How is phosphine obtained from aluminium phosphide?
- Q. 16) Write uses of phosphine.
- Q. 17) Which oxyacid of phosphorus has tendency to show higher and lower oxidation state?
- Q. 18) Draw the structure of orthophosphorus acid.
- Q. 19) Name the oxyacid of phosphorus, which contains four P-OH bonds, two P = O bonds and one P - P bond.
- Q. 20) Chromium and Aluminium do not dissolve in hot and concentrated nitric acid. why?
- Q. 21) What happens when phosphine comes in contact with air?
- Q. 22) Name the element of group-16 which forms colourless and odourless hydride.
- Q. 23) Select the most acidic oxide among the following.
 SO_2 , CaO , Al_2O_3 , BaO , NO_2
- Q. 24) How is colloidal sulphur obtained from sodium thiosulphate?

- Q. 25) Write a reaction which shows reducing behaviour of moist sulphur dioxide.
- Q. 26) What is the ideal condition to increase the yield of sulphuric acid by contact process?
- Q. 27) Draw the structure of Dithionic acid.
- Q. 28) Write uses of Sulphuric acid.
- Q. 29) Complete the following reaction.



- Q. 30) What is the action of dioxygen on zinc sulphide.
- Q. 31) Complete the following reaction.
- $$\text{Cl}_2\text{O}_7 + \text{H}_2\text{O} \longrightarrow ?$$
- Q. 32) What is ozone umbrella?
- Q. 33) Give one reaction showing the oxidising power of sulphur dioxide.
- Q. 34) What is oil of vitriol ?
- Q. 35) What is the action of concentrated sulphuric acid on formic acid?
- Q. 36) What is the action of hot and concentrated sulphuric acid on ferrous sulphate?
- Q. 37) Complete the following reaction.
- $$\text{Benzene} + \text{H}_2\text{SO}_{4(\text{conc.})} \longrightarrow ?$$
- Q. 38) Why does ozone act as powerful oxidising agent?
- Q. 39) How is ozone estimated quantitatively?
- Q. 40) Which form of sulphur shows paramagnetic behaviour ?
- Q. 41) What happens when sulphur dioxide is passed through an aqueous solution of Fe (III) salt ?
- Q. 42) Fluorine is a powerful oxidising agent. Why?

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D .)**

- Q. 1) Name the halogen, which is red in colour.
- Q. 2) Write the balanced chemical equation for the reaction of chlorine with hot and concentrated NaOH.
- Q. 3) Draw molecular shape of BrF_3 on the basis of VSEPR theory.

- Q. 4) Why is helium used in diving apparatus?
- Q. 5) Name the poisonous gas which can be prepared from chlorine gas.
- Q. 6) Why do noble gases have comparatively large atomic sizes?
- Q. 7) White phosphorous is used in Holme's signals and smoke screens. Why?
- Q. 8) Give examples for compounds of nitrogen in which nitrogen has a negative oxidation state.
- Q. 9) Arrange group 15 hydrides in the increasing order of their, reducing power.
- Q. 10) How is the presence of Cu^{2+} ions detected by using NH_3 ?
- Q. 11) Nitrogen monoxide becomes brown when exposed to air. why?
- Q. 12) Arrange the following in decreasing order of their acidic character. PH_3 , HCl , H_2S
- Q. 13) How does SO_2 act as bleaching agent?
- Q. 14) How do jet plane emission affect the concentration of ozone in the atmosphere?
- Q. 15) What are the conditions required for the synthesis of ammonia by the Haber process?
- Q. 16) Arrange group 15 hydrides in increasing order of their boiling points.
- Q. 17) Noble gases have a very low boiling points, why?
- Q. 18) Write Bartlett reaction.
- Q. 19) Name the noble gas used in Magnetic Resonance Imaging (MRI) Systems.
- Q. 20) Explain the oxidizing action of $\text{Cl}_2/\text{H}_2\text{O}$ mixture?
- Q. 21) Iodine forms I_3^- but fluorine does not form F_3^- why?
- Q. 22) Why does fluorine form only one oxo-acid?
- Q. 23) PCl_5 is ionic in solid state. Give reason.
- Q. 24) +5 oxidation state of bismuth is less stable than +3. why?
- Q. 25) Bismuth in +5 oxidation state is strong oxidising agent. why?

● **Section B - Questions of 2 Marks SAI**

- Q. 1) Write the reaction to show self ionization of ammonia in liquid state.
- Q. 2) Why does H_3PO_2 behave as reducing agent?.
- Q. 3) What is the action of a) arsenic when fused with NaOH
b) magnesium on nitrogen?

- Q. 4) Draw structures of a) Chlorine trifluoride
b) Chlorine pentafluoride.
- Q. 5) Represent the box type diagram of outer electronic configuration of sulphur ($Z=16$) to justify its oxidation states in each -2, +2, +4 and +6.
- Q. 6) Draw the structures of H_3PO_4 & $\text{H}_4\text{P}_2\text{O}_6$
- Q. 7) What happens when
a) Sulphur is treated with concentrated caustic soda solution
b) Sulphur dioxide gas is passed in water?
- Q. 8) What happens when ozone gas is passed through the neutral solution of KI? Mention two important uses of ozone.
- Q. 9) How is dioxygen prepared in laboratory? Mention two important uses of dioxygen.
- Q. 10) Explain the basicities of orthophosphorus acid and orthophosphoric acid.
- Q. 11) How is dioxygen prepared in laboratory? What happens when dioxygen is passed into ammonia?
- Q. 12) What is the action of following reagents on ammonia?
a) Nessler's reagent
b) Sodium metal
- Q. 13) Write uses of hydrochloric acid.
- Q. 14) Explain brown ring test with the help of chemical equation.
- Q. 15) What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of CO_2 ? Fluorine is a stronger oxidising agent than chlorine. Why?
- Q. 16) When HCl reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride. Why?
- Q. 17) Mention four areas in which H_2SO_4 plays an important role.
- Q. 18) Write two characteristics to show the anomalous behaviour of fluorine.
- Q. 19) Write balanced equation for the following.
a) NaCl is heated with sulphuric acid in the presence of MnO_2

b) Chlorine gas is passed into a solution of NaI in water.

- Q. 20) Why is helium used in diving apparatus?
- Q. 21) Write a note on the acidic strength of hydrogen halides.
- Q. 22) What is the action of water on a) Fluorine b) Chlorine?
- Q. 23) Arrange the following molecules in the increasing order of acidic strength and Thermal stability HClO_4 , HClO_3 , HClO_2 , HClO .
- Q. 24) Explain the variation in metallic and non metallic character of group 15 elements.
- Q. 25) Explain the variation in conductivity of heat & electricity in group 15 elements.
- Q. 26) Why +3 oxidation state is stable in heavier elements of group 15?
- Q. 27) What is the action of sodium hypochlorite solution in the presence of glue or gelatin on excess of ammonia
- Q. 28) Distinguish between white phosphorus and red phosphorus.
- Q. 29) How is dioxygen produced in the atmosphere.?
- Q. 30) What is the action of following on sodium peroxide
i) Water ii) Acidified potassium permanganate ?
- Q. 31) Bromine has the highest negative electron gain enthalpy as compared to other elements of 4th period. Explain.
- Q. 32) What is the action of chlorine on i) cold and dilute alkali ii) hot and conc. alkali?
- Q. 33) Explain the bleaching action of halogens.
- Q. 34) How is chlorine obtained from bleaching powder?
- Q. 35) How is chlorine manufactured by Deacon's process?
- Q. 36) What is the action of chlorine on a) turpentine oil b) sulphur ?
- Q. 37) What are the uses of interhalogen compounds?
- Q. 38) Explain the liquefaction tendency of group 18 elements.
- Q. 39) Why does sulphur in vapour state exhibit paramagnetic behaviour ? In which form of sulphur does it possess an open chain structure?
- Q. 40) The increase in atomic size from As to Bi is smaller as compared to N to P, justify your answer.
- Q. 41) Bismuth is a strong oxidising agent in pentavalent state, Explain

- Q. 6) What is the action of Cl_2 on
 a) Cold and dilute NaOH b) Hot and concentrated NaOH c) Fe ?
- Q. 7) What is the action of concentrated H_2SO_4 on
 a) Zinc b) Phosphorus c) Sulphur?
- Q. 8) What are amphoteric oxides? Explain with suitable reactions.
 Explain one reaction for the preparation of dioxygen by the thermal decomposition of metallic oxide.
- Q. 9) Explain the variation in the following properties in group 15 elements.
 a) Atomic and ionic radii
 b) Electronegativity
 c) Ionisation enthalpy.
- Q. 10) Mention the stable allotropic forms of
 a) most thermodynamically stable form of P
 b) two stable forms of arsenic.
- Q. 11) Explain the oxidation states of group 15 elements.
- Q. 12) What is the action of nitric acid on
 a) P_4 b) As_4 c) Bi
- Q. 13) Why trihalides of group 15 elements are less covalent than pentahalides?
- Q. 14) Explain anomalous behaviour of nitrogen.
- Q. 15) How is dinitrogen obtained from
 a) Ammonium dichromate
 b) Bleaching powder and ammonia
 c) NH_4Cl and NaNO_2 ?
- Q. 16) What is the action of following dinitrogen on
 a) Mg c) Dioxygen at 2000K c) Calcium carbide ?

- Q. 17) Ammonia cannot be dried over regular dehydrating agent like.
 a) H_2SO_4 b) P_2O_5 c) anhydrous CaCl_2
- Q. 18) What is the action of following ammonia
 a) Heat with air b) When heated on Pt at 1100K
 c) When heated with CuO?
- Q. 19) What is the reaction of following with ammonia
 a) Cl_2 b) Br_2 c) I_2 ?
- Q. 20) Write the name and chemical formulae of oxyacids of nitrogen.
- Q. 21) How is nitric acid prepared on a large scale by Ostwald's process?
- Q. 22) Write name and draw the structures of
 a) N_2O b) NO c) NO_2
- Q. 23) What are the chemical properties of phosphine?
- Q. 24) What is the action of following on PCl_3
 a) Moisture b) AgCN c) $\text{C}_2\text{H}_5\text{OH}$?
- Q. 25) What is the action of following on PCl_5
 a) Moisture b) Zn c) CH_3COOH ?
- Q. 26) Describe the properties of phosphonic acid.
- Q. 27) Draw the structure and write the property of pyrophosphoric acid.
- Q. 28) Explain the physical states, volatility and thermal stability of hydrides of group 16 elements.
- Q. 29) Give Reason - a) H_2O is liquid and H_2S is gas. b) H_2S is less acidic than H_2Te .
- Q. 30) What is the action of heat on the following
 a) HgO b) Pb_3O_4 c) Ag_2O ?
- Q. 31) What is the action of dioxygen on
 a) CS_2 b) ZnS c) MgS ?
- Q. 32) Complete the following reactions.
 a) $\text{P}_4\text{O}_{10} + \text{H}_2\text{O} \rightarrow ?$
 b) $\text{Al}_2\text{O}_3 + \text{NaOH} \rightarrow ?$
 c) $\text{ZnO} + \text{HCl} \rightarrow ?$

- Q. 33) Ozone acts as a oxidising agent and reducing agent. Explain with example.
- Q. 34) Explain the structure of SO_2 molecule.
- Q. 35) Explain the lead chamber process of the manufacture of sulphuric acid.
- Q. 36) What is the action of hot and concentrated H_2SO_4 on the following.
 a) HI b) Zn c) FeSO_4
- Q. 37) K_{a2} of H_2SO_4 is smaller than K_{a1} in water, explain. Write four uses of H_2SO_4
- Q. 38) Explain - a) At room temperature hydrogen fluoride is a liquid while all other hydrogen halides are gases.
 b) Reducing character of hydrogen halides.
- Q. 39) How is chlorine obtained from -
 a) bleaching powder b) rock salt c) PbO_2 ?
- Q. 40) what is the reaction of chlorine with
 a) SO_2 b) CO c) ammonia?
- Q. 41) What is aquaregia? What is the action of aquaregia on i) Au and ii) Pt ?
- Q. 42) How are following interhalogen compounds prepared
 a) ClF_3 b) ICl_3 c) BrF_5 ?
- Q. 43) Explain the structure of interhalogen compound of the type XX'_3 ?
- Q. 44) Write four uses of inter halogen compounds. Explain ICl is more reactive than I_2 .
- Q. 45) Explain Bartlett reaction.
- Q. 46) Write a note on compounds of noble gases?

● **Section D - Questions of 5 marks LA**

- Q. 1) Draw the structure of SO_2 molecule. Distinguish between conductor and semiconductor.
 What is the action of following on sulphur
 a) NaOH b) Fluorine c) Copper
- Q. 2) What are interhalogen compounds? Explain the structure of ClF_3 .
 Describe the anomalous behaviour of fluorine with reference to
 a) Hydrogen bonding b) Oxidation states

- Q. 3) What is the action of hot and concentrated nitric acid on antimony?
Write the reaction involved in large scale preparation of sulphuric acid by contact process.
- Q. 4) Ozone acts as oxidising and reducing agents. Explain with examples
What are basic oxides? Explain with suitable reaction.
Though nitrogen exhibit +5 Oxidation state, it does not form pentahalide, give reason.
- Q. 5) What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of CO_2
Give the reaction for bleaching action of Cl_2 . Describe the formation of IF_7 .
- Q. 6) Why are halogens coloured?
converts- a) HCl into Cl_2 b) Cl_2 into HCl
Write the disproportionation reaction of H_3PO_3 .

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Topic 8 : 'd' and 'f' block elements

● **Section A - Questions of 1 mark VSA of difficulty level**

- Q. 1) Why Ni (II) compounds are thermodynamically more stable than Pt (II) compounds where as Pt (IV) compounds more stable than Ni (II) compounds ?
- Q. 2) What is the change in oxidation state of chromium when potassium dichromate is treated with dilute sulphuric acid?
- Q. 3) What is the change in colour of potassium dichromate when aq. KOH is added in it.
- Q. 4) What is the value of effective magnetic moment of zinc in +2 oxidation state? ($z = 30$)
- Q. 5) Why blue colour of copper sulphate solution in water changes to yellow when treated with concentrated hydrochloric acid?
- Q. 6) What is the trend in ionic radii of elements of first transition series when oxidation state changes from +2 to +3 ?
- Q. 7) Write a chemical equation for burning of lanthanoids (Ln) in oxygen ?
- Q. 8) Why basic character in lanthanoid hydroxides decreases across the period?
- Q. 9) What are different oxidation states of lanthanoids observed other than common oxidation state?
- Q. 10) What is oxidation state of manganese in manganate form?
- Q. 11) Which oxidation state of titanium ($z = 22$) is more stable?
- Q. 12) Name the transition element of highest density.
- Q. 13) Why melting point of transition elements across a period first increases, attains maximum value and then decreases?
- Q. 14) Which property of zinc, cadmium and mercury is common as their atomic number is considered?

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)**

- Q. 1) Write general electronic configuration of 3d series of d - block elements.
- Q. 2) Which elements of 3d and 4d transition series are soft elements?
- Q. 3) What are different possible oxidation states of chromium ($z = 24$)?

- Q.4) Which element of first transition series possesses highest first ionization enthalpy?
- Q. 5) Write the name of last transition element of 3d series
- Q. 6) Why are metals like chromium and molybdenum very hard?
- Q. 7) Why is manganese ($z=25$) more stable in +2 state than +3 oxidation state?

● **Section B - Questions of 2 Marks SAI**

- Q. 1) Which oxidation states of scandium ($z=21$), titanium ($z=22$) form colourless complexes ?
- Q. 2) What are different factors responsible for colour of transition ions?
- Q. 3) What is a role of catalyst in chemical reactions?
- Q. 4) Write uses of potassium dichromate.
- Q. 5) Draw structures of permanganate ion and chromate ion with their charges.
- Q. 6) State most stable oxidation state of manganese and iron? Why it is stable?
- Q. 7) Write the names of alloys of copper.
- Q. 8) Calculate effective magnetic moment of copper ($z=29$)
- Q. 9) Explain formation of interstitial compounds by transition elements.
- Q. 10) Which shells are called as penultimate and prepenultimate shells?
- Q. 11) State the position of cerium ($z=58$) and uranium ($z=92$) in periodic table?
- Q. 12) Write general electronic configuration of lanthanoids. What are transuranic elements ?
- Q. 13) Write position of following elements in periodic table
- | | |
|--------------------------|------------------------|
| i) Lanthanum ($z=57$) | ii) Cerium ($z=58$) |
| iii) Actinium ($z=89$) | iv) Thorium ($z=90$) |
- Q. 14) Explain lanthanoid contraction.

● **Section C - Questions of 3 Marks SAI**

- Q. 1) Write properties of interstitial compounds of transition metals.
- Q. 2) What is the action

- Q. 2) What is action of following on acidified potassium dichromate
 i) aq. KOH ii) KI iii) SO_2 ?
- Q. 3) Distinguish between lanthanoids and actinoids.
- Q. 4) Write observed electronic configuration of
 i) Uranium ($Z = 92$) ii) Europium ($z = 63$)
 iii) Gadolinium ($z = 64$)
- Q. 5) What are different factors responsible for colour of transition metal ions? In which 3-d-element d-d transition is not possible?

● **Section D - Questions of 5 marks LA**

- Q. 1) Explain the steps involved in the manufacture of potassium dichromate from chromite ore.
 What is the action of acidified potassium dichromate on acetaldehyde?
- Q. 2) How is potassium permanganate prepared from pyrolusite using potassium carbonate in air, by using electrolytic oxidation? Write formula for malachite and cuprite.
- Q. 3) Write different possible oxidation states for first five elements of 3d transition series.
- Q. 4) Explain d-d transition of electrons in transition metal complexes. Show diagrammatic representation for splitting of d - orbitals. State one example of complex ion in which colour is observed due to splitting of d-orbitals.

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Topic 9 : Coordination compounds

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) What is coordination number of platinum in diammine dichloro platinum (II) complex ?
- Q. 2) Write formula of sodium dicyano aurate (I) complex.
- Q. 3) What is systematic name of $[\text{Cu}(\text{H}_2\text{O})_2(\text{NH}_3)_5]\text{Cl}_2$?
- Q. 4) Why is Bis (ethylene diammine) zinc (II) ion is more stable than Tetrammine Zinc (II) ion ?
- Q. 5) What is IUPAC name of $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$?
- Q. 6) Copper sulphate solution on mixing with ammonia (ratio 1:4) does not exhibit test for Cu^{2+} ions but of sulphate ion. Explain.
- Q. 7) Write formula for coordinate complex sodium hexanitrito -N- cobaltate
- Q. 8) Identify the type of ligands in pentammine nitro cobalt (III) chloride.
- Q. 9) Which d-orbitals possess more energy in octahedral complexes ?
- Q. 10) What is effective atomic number of Fe in $[\text{Fe}(\text{CN})_6]^{4-}$ ion? (Given Z of. Fe =26)
- Q. 11) What is oxidation number of nickel in $[\text{Ni}(\text{CO})_4]$?
- Q. 12) State EAN rule.
- Q. 13) Write a formula for potassiumtrioxalatoaluminate (III).

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)

- Q. 1) What are monodentate ligands ? Write one example.
- Q. 2) How many donating sites are present in a ligand ethylenediaminetetraacetate ion?
- Q. 3) What is oxidation number of cobalt in Tris (ethylene diammine) cobalt (III) ion?
- Q. 4) Explain heteroleptic complex with example.
- Q. 5) What is a net charge on hexacyanoferrate (II) complex ion?
- Q. 6) What are double salts?.
- Q. 7) What is oxidation number of nickel in tetracarbonyl nickel ?
- Q. 8) Write formula of dichloro bis (ethylenediammine) platinum (iv) ion.
- Q. 9) Write IUPAC name of $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$.

Q. 10) What type of geometry of coordinate complexes does not exhibit geometrical isomerism?

● **Section B - Questions of 2 Marks SAI**

Q. 1) Explain double salts and coordination compounds with examples.

Q. 2) Calculate effective atomic number of iron in hexacyanoferrate (III) ion and of nickel in tetracarbonyl nickel. (Fe ($z = 26$), Ni ($z = 27$))

Q. 3) Classify following complexes as cationic, anionic or neutral ion

i) Potassium tetracyano aurate (III) ion

ii) Penta aquachlorochromium (III) chloride.

Q. 4) How many moles of Cl^- ions are furnished by two moles each of the following and calculate net charge on complex ions?

i) $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl}$

ii) $\text{K}_2[\text{PtCl}_6]$

Q. 5) Explain geometrical isomerism in $[\text{Pt}(\text{gly})_2]$

Q. 6) Draw structures of cis and trans isomers of $[\text{Co}(\text{en})_2(\text{NO}_3)_2]^+$

Q. 7) Explain the terms - chelation and chirality.

Q. 8) Explain hybridisation and geometry of $[\text{NiCl}_4]^{2-}$ on the basis of valence bond theory.

Q. 9) What are the limitations of valence bond theory?

Q. 10) Why crystal field theory is superior over valence bond theory?

● **Section C - Questions of 3 Marks SAI**

Q. 1) Using abbreviations of following ligands identify the number of donor sites and write the formula of each ligand.

i) en

ii) gly

iii) py

Q. 2) Write salient features of crystal field theory.

Q. 3) Explain splitting of d-orbitals due to approaching ligands in octahedral complexes and tetrahedral complexes.

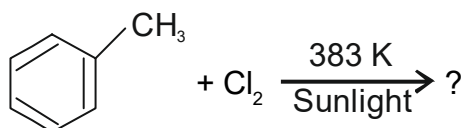
Q. 4) Hexaaqua manganese (II) ion contains five unpaired electrons while hexacyano ion contains only one unpaired electron. Explain.



Chapter 10 : Halogen derivatives of Alkanes and Arenes

● Very Short Answer Questions (VSA) (1 Mark With Difficulty Level)

- Q. 1) Write IUPAC name of $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-\text{CH}=\text{CH}-\text{C}(\text{CH}_3)_3$.
- Q. 2) Write Structure of tert-alkyl halide having molecular formula $\text{C}_5\text{H}_{11}\text{Br}$.
- Q. 3) Give balanced chemical equation for the action of antimony trifluoride on 2, 2 - Dichloropropane.
- Q. 4) What is IUPAC name of an alcohol used in the preparation of 2 - Chloro - 2, 4 - dimethyl hexane.
- Q. 5) Draw the structure of the major monohaloproduct obtained in the following reaction.



- Q. 6) How is Bromoethane converted into Ethylcarbamide?
- Q. 7) Write IUPAC name of product expected from reaction of Sodium methoxide with Isobutylbromide.
- Q. 8) Monochloroderivative (A) when dissolved in ether and treated with sodium metal gives single hydrocarbon product 2, 2, 5, 5- Tetramethylhexane, what is the formula of compound A?
- Q. 9) Which isomer of $\text{C}_4\text{H}_9\text{Cl}$ will have the lowest boiling point?
- Q. 10) Which reagent is used to introduce nitro group in haloarenes?
- Q. 11) Give balanced chemical equation for the reaction of chlorobenzene with acetyl chloride.
- Q. 12) Arrange the following groups in descending order of priority in assigning R, S configuration. $-\text{NH}_2$, $-\text{SO}_3\text{H}$, $-\text{OCH}_3$, $-\text{COOH}$ and $-\text{Cl}$
- Q. 13) Compound A (C_4H_8) on treatment with HBr gives compound B which is optically inactive. What is structure of A?
- Q. 14) Which polyhalide is used as dry cleaning agent and as a pesticide to kill insects in stored grains?
- Q. 15) Write structural formula of DDT.

- Q. 16) Why is sulphuric acid not used in reaction of alcohols with potassium iodide?
- Q. 17) Alkyl Fluorides are not prepared by halogenation of alkane. Give reason.
- Q. 18) Write the name of reaction of alkyl chlorides or bromides with metallic fluorides, to form Alkyl Fluorides.

● **Very Short Answer Questions - Section A (which can be combined with Sections B / C / D.)**

- Q. 1) What are halogen derivatives of alkanes?
- Q. 2) What are alkyl halides?
- Q. 3) Write IUPAC name of tert - butyl bromide.
- Q. 4) Draw the structure of 1, 2, 3 - Trichloropropane.
- Q. 5) How is chloroethane prepared from ethane?
- Q. 6) Write a chemical reaction for action of HBr on isopropyl alcohol.
- Q. 7) How is ethyl chloride prepared from alcohol using thionyl chloride?
- Q. 8) What is the action of moist silver oxide on Bromoethane?
- Q. 9) Write the name of product obtained by action of alcoholic KCN on ethyl bromide.
- Q. 10) Write a chemical equation for action of alcoholic silver propionate on ethyl bromide.
- Q. 11) How is ethene prepared from Bromoethane?
- Q. 12) What is Grignard's reagent?
- Q. 13) What is optical activity?
- Q. 14) Define Asymmetric carbon atom.
- Q. 15) What is dextro form?
- Q. 16) What is laevo form?
- Q. 17) What is Racemic form?
- Q. 19) Write IUPAC name of m - dibromobenzene.
- Q. 20) Write uses of iodoform.

● **Section B - Questions of 2 Marks SAI**

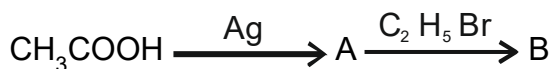
- Q. 1) How are following compounds obtained from alcohols using PCl_3 ?

a) 2 - Chloropropane b) 2 - Chloro - 2 - methylpropane.

Q. 2) Describe the action of excess of ammonia on

a) Isopropyl bromide b) Isobutyl chloride.

Q. 3) Identify A and B in the following.



Q. 4) How is 2 - Chloropropane converted into 1 - Bromopropane?

Q. 5) Explain Ammonolysis.

Q. 6) Explain dehydrohalogenation reaction of 2 - Bromobutane.

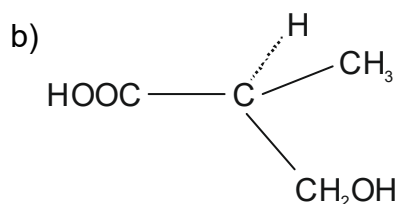
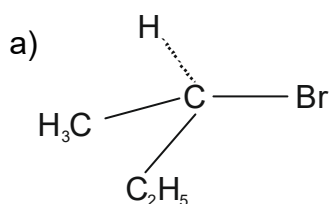
Q. 7) What is Grignard's reagent? How is it prepared?

Q. 8) State and explain Markownikoff's Rule.

Q. 9) Predict the expected product and write balanced chemical equation for a substitution reaction of Isobutyl chloride with sodium ethoxide.

Q. 10) Define optical activity. Draw the structures of optical isomers of lactic acid.

Q. 11) Assign R or S designation to each of the following.



Q.12) Write the reaction mechanism of reaction of o-nitrochlorobenzene with alkali.

Q. 13) Explain Friedel Crafts Alkylation reaction.

Q. 14) Explain Wurtz Fittig reaction with suitable example.

Q. 15) Write a note on Sandmeyer's reaction.

Q. 16) How is Ethanol converted into Butane?

Q. 17) How is Ethene converted into ethyl magnesium bromide?

Q. 18) How is propene converted into Butanenitrile?

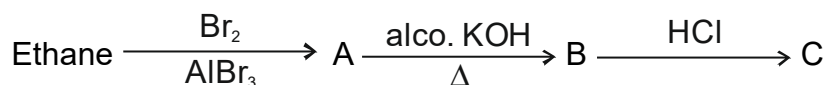
Q. 19) Write uses of Freons.

Q. 20) Draw structural formula and write the IUPAC name of DDT.

Q. 21) Draw the resonating structures of chlorobenzene.

● **Section C - Questions of 3 Marks SAll**

Q. 1) Identify A, B and C in the following



Q. 2) How are following compounds prepared from benzene diazonium chloride

a) Chlorobenzene b) Bromobenzene c) Iodobenzene?

Q. 3) How is chlorobenzene converted into

a) Phenol b) Cyanobenzene c) Aniline ?

Q. 4) Give the mechanism of alkaline hydrolysis of Bromomethane.

Q. 5) Write the mechanism of alkaline hydrolysis of an alkyl halide which involves formation of carbocation as an intermediate.

Q. 6) Differentiate between SN^1 and SN^2 mechanism.

Q. 7) Define the following terms

a) Dextro form b) Laevo form c) Racemic form

Q. 8) Write balanced chemical equations for the action of following reagents on 2 - Chlorobutane.

a) Aqueous potassium hydroxide b) Sodium methoxide
c) Silver propionate

Q. 9) How is Iodoethane prepared from :- a) Ethyl bromide b) Ethanol c) Ethene ?

Q. 10) How is Chloromethane converted into Ethyl magnesium bromide?

Q. 11) Explain nature of C - X bond in haloarenes.

Q. 12) The dipole moment of chlorobenzene is lower than cyclohexyl chloride. Explain.

Q. 13) Give balanced chemical equations for the following.

a) Action of AgF on Chloromethane,
b) Action of CoF_2 on Bromoethane,
c) Action of Hg_2F_2 on 1 - Chloropropane.

Q. 14) Give reason : Haloarenes are less reactive towards the nucleophilic substitution reactions.

Q. 15) Write uses and environmental effect of chloroform.

Q. 16) Aryl halides undergo electrophilic substitution reaction slowly. Give reason.

- Q. 17) Write structures and IUPAC names of all possible isomers of $C_5H_{11}Br$ which are secondary alkyl halides.
- Q. 18) Write enantiomeric forms of
- a) Bromochlorofluoromethane b) Glyceraldehyde c) Butan - 2 - ol
- Q. 19) Write uses and environmental effects of freons.

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Chapter 11 : Alcohols, phenols and ethers

● **Section A - Questions of 1 mark VSA of difficulty level**

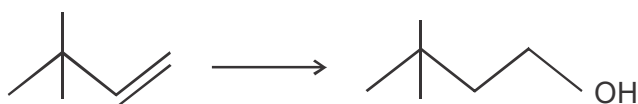
Q. 1) Why is water not used as solvent in synthesis of Grignard reagent ?

Q. 2) How is propan-1-ol synthesised by using Grignard reagent ?

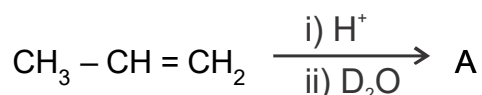
Q. 3) Name the method which can give following product



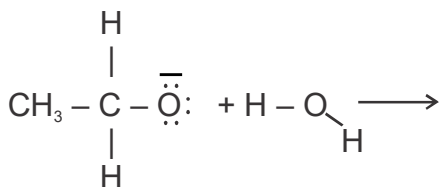
Q. 4) Name the method which can give following product.



Q. 5) Identify the product of the following reaction

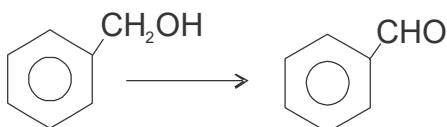


Q. 6) Protonation of following compound gives alcohol. Indicate electron migration in the reaction.



Q. 7) Identify the alcohol having molecular formula $\text{C}_4\text{H}_{10}\text{O}$, which gives white turbidity with conc. $\text{HCl} / \text{ZnCl}_2$ immediately.

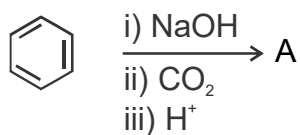
Q. 8) Mention the suitable reagent to carry out following oxidation.



Q. 9) Identify the product obtained by industrial synthesis of carboxylation of phenoxide

ion, followed by acidification.

Q. 10) What is the product A obtained in the following reaction?



Q. 11) Which positions are occupied by - NO₂ group during nitration of carbolic acid ?

Q. 12) Write name of reactants used for the preparation of ethyl t-butyl ether.

Q. 13) How many structural isomers of pentyl alcohol on oxidation will produce ketones only ?

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)**

Q. 1) Write the number of possible isomers of ether having molecular formula C₄H₁₀O.

Q. 2) The product formed in the reaction of reverse of dehydration of alcohol is

Q. 3) Which rule is obeyed by Hydroboration oxidation process ?

Q. 4) Why concentrated sulphuric acid is used in the process of dehydration of alcohol?

Q. 5) Name the solvent used with diborane in Hydroboration - Oxidation of alkene.

Q. 6) Name the reagents for the complete Hydroboration - Oxidation reaction in Step I and Step II.

Q. 7) Write the name of the test by which methanol can be distinguished from ethanol.

Q. 8) Write all the isomers of molecular formula C₇H₈O.

Q. 9) Write the name of reactant used for preparation of phenol, which gives byproduct used as solvent.

Q. 10) Ether is a good solvent for Grignard reagent, which property make it a good solvent ?

Q. 11) The C—O—C bond angle in dimethyl ether is.....

Q. 12) Why phenols are more acidic than alcohol ?

Q. 13) How many nitro groups are present in picric acid ?

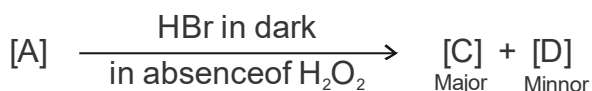
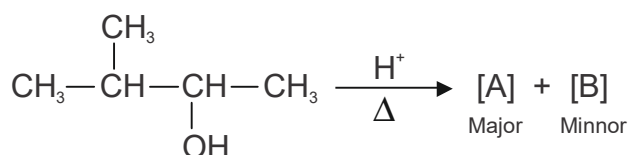
Q. 14) How many alcohols with molecular formula C₄H₁₀O are chiral in nature ?

Q. 1) Predict which member of following pair will be more soluble in water and why ?
Heptan - 1 - ol and 4-methylphenol

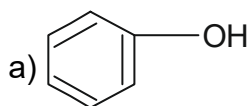
a) $C_4H_{10}O$ which gives white turbidity with conc $HCl / ZnCl_2$ immediately.

b) $C_5H_{12}O$ which neither reacts with dilute HCl nor gives Iodoform test, however is oxidised to carboxylic acid.

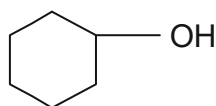
Q. 4) Identify A, B, C and D in the following sets of reactions.



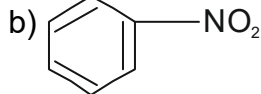
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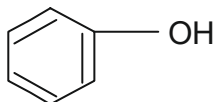
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OH



a) o-nitrophenol

Q. 7) Convert phenol into

a) salicylic acid

Q. 8) Write structures of alcoholic and ether isomers of a compound having molecular formula $C_7H_{16}O$.

Q. 6) Explain the following with an example.

a) Unsymmetrical ether

b) Allylic alcohol

Write uses of Phenol.

Q. 7) What is the action of neutral ferric chloride solution on phenol ? Draw all possible resonating structures of phenoxide ion.

Q. 8) Write the mechanisms of the reaction of HI with methoxy methane.

Q. 9) Write equations of following reactions.

a) Alkylation of anisole

b) Nitration of anisole

c) Acetylation of anisole

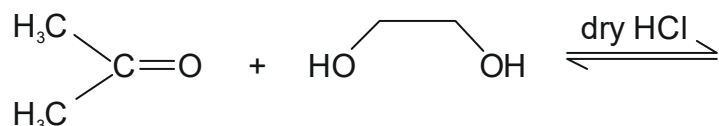
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Chapter 12 : Aldehydes ketones and carboxylic acid

● **Section A - Questions of 1 mark VSA of difficulty level**

Q. 1) What happens when acetyl chloride is treated with dibenzyl cadmium ?

Q. 2) Complete the following reaction :



Q. 3) What is the action of dilute HCl on acetaldehyde diethyl acetal ?

Q. 4) The addition of ammonia derivative of $\text{H}_2\text{N-Z}$ type to aldehyde and ketone is not favoured in strongly acidic medium . Why?

Q. 5) Name the reagent used for the conversion of phenylacetic acid to 2-Bromo-2-phenylacetic acid.

Q. 6) Give reason :

"The addition reactions in aldehydes and ketones are nucleophilic in nature."

Q. 7) Draw the structure of 2, 4-Dinitrophenylhydrazone of benzaldehyde.

Q. 8) Convert Cyclopropane carboxylic acid into cyclopropylmethanol.

Q. 9) Give reason :

"Aromatic carboxylic acids do not undergo Friedel-Crafts reaction."

Q.10) Write the name of two compounds which do not contain carbonyl group but show iodoform test.

Q. 11) Convert : Cyclohexylacetylene into cyclohexylacetone.

Q. 12) Arrange the following compounds according to increasing order of their reactivity towards nucleophilic addition.

acetophenone, benzaldehyde, benzophenone

Q. 13) Give reason, in semicarbazide, $-\text{NH}_2$ group bonded to carbonyl group is not involved in the formation of semicarbazone.

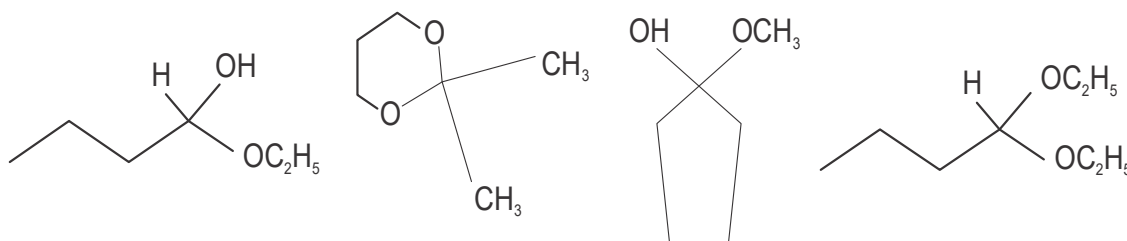
Q. 14) Fehling solution does not oxidise benzaldehyde but Tollen's reagent oxidises benzaldehyde. Give reason.

Q. 6) Prepare acetic anhydride from

i) acetic acid

ii) acetyl chloride.

Q. 7) Classify the following compounds as acetals, ketals, hemiacetals and hemiketals.

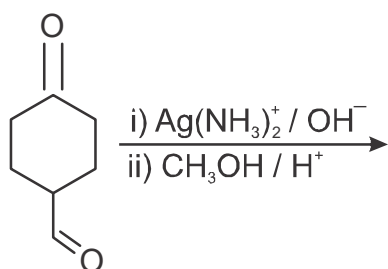


Q. 8) Give chemical test to distinguish between

a) Pentan-2-one and Pentan-3-one

b) Benzaldehyde and Acetophenone

Q. 9) Complete the following reaction



Q. 10) What is the action of the following on 4-Methylpent-3-en-2-one

a) Ammonia

b) Lithium aluminium hydride in ether ?

Q. 11) Complete the following reactions :

a) Benzene + Benzoyl chloride $\xrightarrow{\text{anhy. AlCl}_3}$

b) Benzene- 1,2-Dicarboxylic acid + Thionyl chloride $\xrightarrow{\Delta}$

Q. 12) Aldehydes are more reactive toward nucleophilic addition reactions than ketones, Explain.

Q. 13) Give reason the α -hydrogen of aldehydes and ketones is acidic in nature.

Q. 14) Write note on (each 2 marks)

i) Tollen's reagent

(V) Gatterman-Koch formylation

(II) Cannizzaro reaction

(VI) Clemmensen reduction

(IX) Crossed Cannizzaro reaction.

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a) Benzamide

b) Phenyl magnesium bromide

c) Ethylbenzoate

Q. 12) Write a note on carboxylation of Grignard reagent.

Q. 13) What is the effect of electron withdrawing substituents on acidity of carboxylic acids with respect to

a) number of substituents

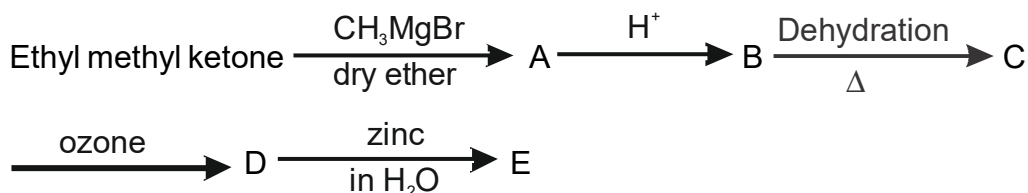
b) position of substituents?

Q. 14) Write a note on Hell-Vohlard- Zelinsky reaction.

● **Section D - LA - 5 Marks**

Q. 1) Explain the mechanism of formation of acetaldehyde diethyl acetal from acetaldehyde and excess of anhydrous ethanol in dry HCl.

Q. 2) Complete the following reactions :



Q. 3) Convert o-xylene into phthalimide. Write uses of formic acid.

Q. 4) Write Cannizzaro reaction for isobutyraldehyde.

Q. 5) Explain self oxidation - reduction of aldehydes having no α – hydrogen atom. What are soaps?

Explain the process of saponification with suitable example.

Q. 6) Convert benzaldehyde into –

1) benzyl alcohol

2) m-nitrobenzaldehyde

3) benzaldehyde semicarbazone

4) mandelonitrile

5) benzaldoxime

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Chapter 13 : Organic compounds containing nitrogen

● Section A - Very Short Answer (Diffuculty Level)

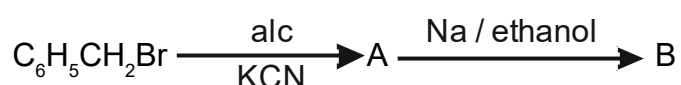
- Q. 1) Write the IUPAC name of the compound formed by action of chlorine and sodium hydroxide on nitro alkane which can be used as an effective insecticide.
- Q. 2) Draw structures of tautomers exhibited by primary nitro alkane containing α - hydrogen atom.
- Q. 3) Write reaction of p-toluene sulphonyl chloride with diethyl amine.
- Q. 4) Draw the structure of chemical reagent used in Hinsberg test to distinguish between primary, secondary and tertiary amine.
- Q. 5) Write the general formula of azo compound formed during azo -coupling reaction.
- Q. 6) Write a chemical reaction showing basic nature of amine.
- Q. 7) How many moles of ethyl bromide is required to convert ethanamine to N, N-diethyl ethanamine?
- Q. 8) Why aryl halides do not normally react with ammonia?

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)

- Q. 1) Write the name of the compound formed by the action of silver nitrite on primary alkyl halide.
- Q. 2) Write the reducing agent used to convert cyanide to amine.
- Q. 3) Write the name of amide which gives ethanamine by Hoffmann bromamide reaction.
- Q. 4) Identify the product in the reaction which on reduction forms secondary amine.
 $\text{RNH}_2 + \text{CHCl}_3 + \text{KOH} \rightarrow \text{Product}$
- Q. 5) Write IUPAC name of triethyl amine.
- Q. 6) Why primary aliphatic amines are stronger base than ammonia ?
- Q. 7) Write the order of basicity of alkylamine in gaseous phase.

● **Section B - Questions of 2 Marks SAI**

- Q. 1) Convert the following
 a) Aldoxime to primary nitro alkane.
 b) Ketoxime to secondary nitro alkane.
- Q. 2) Write chemical reactions involved in Nef-Carbonyl synthesis to prepare an aldehyde and ketone.
- Q. 3) Write note on Gabriel phthalimide synthesis.
- Q. 4) Write preparation of ethanamine from a) acetonitrile b) propanamide.
- Q. 5) Identify A and B in the following reactions.



- Q. 6) Write and name the reaction to prepare amine containing less number of carbon atoms from acid-amide.
- Q. 7) Explain, amines are basic in nature with one reaction.
- Q. 8) Write chemical reactions involved when benzene diazonium salt is treated with phenol and aniline.
- Q. 9) Identify product (A) and name the following conversion.
- $$[\text{C}_2\text{H}_5\text{N}^+(\text{CH}_3)_3]\text{OH}^- \xrightarrow{\Delta} \text{A} + (\text{CH}_3)_3\text{N} + \text{H}_2\text{O}$$
- Q. 10) How methanamine can be distinguished from N-methyl methanamine and N, N - dimethyl methanamine? Write the reagents used and reaction involved in it.
- Q. 11) An anomatic compound A of formula $\text{C}_7\text{H}_6\text{O}_2$ on treatment with aqueous ammonia and heating forms compound B which on treatment with Br_2 and KOH forms a compound C of molecular formula $\text{C}_6\text{H}_7\text{N}$. Write the reaction.
- Q. 12) What is diazotisation ? Write diazotisation reaction of aniline.

● **Section C - Questions of 3 Marks SAI**

- Q. 1) Write the reactions to distinguish between primary, secondary and tertiary amine using nitrous acid.
- Q. 2) How ethanamine can be prepared from
 i) Acetaldoxime

- ii) Nitroethane
- iii) Iodoethane?
- Q. 3) Distinguish between primary, secondary and tertiary amine using p - toluene sulphonyl chloride.
- Q. 4) How following can be prepared from Aniline
 - a) p - Bromoaniline
 - b) p - Nitroaniline
 - c) Sulphanilic acid ?
- Q. 5) How benzene diazonium chloride can be converted to
 - i) chlorobenzene
 - ii) Iodobenzene
 - iii) Hydroxy benzene?

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Chapter 14 : Biomolecules

● **Section A - Questions of 1 mark VSA of difficulty level**

- Q. 1) Out of the two crossed lines in the representation of Fischer projection, what does the horizontal line represents ?
- Q. 2) Name the product obtained when alcohol is added to a carbonyl group in presence of dry HCl ?
- Q. 3) Draw the structures of fructose for Haworth projection formulae.
- Q. 4) Write the name of the fraction that constitutes 80 % starch and is water insoluble ?
- Q. 5) Write the structure of β - D - (-) - fructofuranose.
- Q. 6) Which lipid is found on the feather of birds and animal fur ?
- Q. 7) Which hormone controls carbohydrate metabolism ?
- Q. 8) Name the only heterocyclic nitrogen base, which is present in DNA but not in RNA ?
- Q. 9) Through which linkage polynucleotides are joined ?
- Q. 10) Which vitamin deficiency in human blood increases blood clotting time ?
- Q. 11) How many chiral carbon atoms are present in fructose ?
- Q. 12) Which linkage joins the monosaccharide units in sucrose ?
- Q. 13) Which lipids are present in essential oils ?
- Q. 14) Write a reaction that indicates presence of aldehyde group in glucose.
- Q. 15) Draw the cyclic five membered ring structure of furan.

● **Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)**

- Q. 1) Name the compound that does not fit into the formula $C_x(H_2O)_y$, but is a carbohydrate.
- Q. 2) Name the compounds which are biopolymers of α - amino acids ?
- Q. 3) Which enzyme converts maltose into sugar ?
- Q. 4) Name the irreversible process of precipitation of proteins.
- Q. 5) Which of the following vitamins are water soluble ? a) vitamin - A b) vitamin - B
c) vitamin - C

- Q. 6) Which polysaccharide is the main constituent of cell wall in plants ?
- Q. 7) What happens when starch is boiled with dilute sulphuric acid at 393 K ?
- Q. 8) What are biomolecules ?
- Q. 9) What are oligosaccharides ?
- Q. 10) Specify the role of chalk powder during the preparation of glucose from starch.

● **Section B - Questions of 2 Marks SAI**

- Q. 1) What are carbohydrates ? Write the structure of D - (-) erythrose.
- Q. 2) What is the general formula of carbohydrates ? Why this formula is not applicable to all the carbohydrates ?
- Q. 3) Write the chemical reaction for the commercial method of preparation of glucose. Why is activated charcoal added during the reaction ?
- Q. 4) What happens when dilute nitric acid reacts with a) glucose b) gluconic acid?
- Q. 5) Write the structures showing conversion from Fischer projection formula to Haworth projection formula for glucose.
- Q. 6) What are polysaccharides ? How do Amylose and Amylopectin differ from each other ?
- Q. 7) Explain the term zwitter ion with example.
- Q. 8) Explain how dipeptide linkage is formed, with reference to amino acids.
- Q. 9) How are proteins classified on the basis of their molecular shapes ?
- Q. 10) What is denaturation of proteins ? Explain with example.
- Q. 11) Write names of vitamins present in the following sources :
- | | | | |
|---------|-------------|-----------------|-----------|
| a) Rice | b) Egg yolk | c) Sweet potato | d) Orange |
|---------|-------------|-----------------|-----------|
- Q. 12) How are vitamins classified on the basis of their chemical structure ?
- Q. 13) Classify the following proteins on the basis of their molecular shapes.
- | | | | |
|-------------|------------|----------------|------------|
| a) Collagen | b) Albumin | c) Haemoglobin | d) Myosin. |
|-------------|------------|----------------|------------|

● **Section C - Questions of 3 Marks SAll**

- Q. 1) Indicate the following in Fischer projection, formula :
- a) Tetrahedral carbon atoms.
 - b) Longest continuous chain of carbon atom.
 - c) The most oxidised carbon atoms.
- Q. 2) Draw the structures of D - glyceraldehyde and L - glyceraldehyde. Explain the difference between them with reference to optical property.
- Q. 3) What happens when sucrose is boiled with dilute sulphuric acid? Write the reaction of gluconic acid with dilute nitric acid. Write the name of the product.
- Q. 4) State the need felt for cyclic structure of glucose.
- Q. 5) Classify proteins with one example each.
- Q. 6) Write the function of each of the following : a) thyroxine b) insulin
Name the endocrine glands which secrete these hormones.
- Q. 7) What are lipids ? Which lipids have following functions ?
- a) Vital waterproofing for body surface.
 - b) Lowers blood pressure & gastric secretion.
- Q. 8) Write the name of the sources and diseases caused due to deficiency of vitamin E, K and P.
- Q. 9) Classify the following peoteins
- | | | |
|------------|----------------|------------|
| a) Keratin | b) Haemoglobin | c) Albumin |
| d) Myosin | e) Collagen | f) Insulin |



Chapter 15 : Polymers

- **Section A - Questions of 1 mark VSA of difficulty level**

- Q. 1) Give example for cross-linked polymer.
- Q. 2) Write application of polytetrafluoroethylene.
- Q. 3) Under what conditions is Nylon - 6 prepared ?
- Q. 4) Name the phenol- formaldehyde polymers.
- Q. 5) Which polymer is obtained from 2-chlorobuta -1, 3-diene ?
- Q. 6) Draw the structure for repeating unit formed from nylon salt ?
- Q. 7) Which product is obtained on addition polymerization of Vinyl Cyanide ?
- Q. 8) Write the formula for monomers used in the preparation of dextran.
- Q. 9) Name the catalyst which is formed from titanium chloride & triethyl aluminium.
- Q. 10) Under what conditions are low density polymers formed ?
- Q. 11) Which catalyst is used in the preparation of dacron ?
- Q. 12) What is the percentage of sulphur in rubber which is used in making of tyres ?
- Q. 13) Which polymer is used in preparing human hair wigs ?
- Q. 14) Which type of polymer based on structure is obtained when phenol reacts with formaldehyde ?

- **Section A - Questions of 1 mark VSA (Which can be combined with sections B / C / D.)**

- Q. 1) Write uses of Bakelite.
- Q. 2) Write the formula for the starting material of Nylon - 6,6.
- Q. 3) What is fibre ?
- Q. 4) What are elastomers ?
- Q. 5) Name the polymer which is obtained from acrylonitrile.
- Q. 6) Write the names of biodegradable polymers.

● **Section B - Questions of 2 Marks SAI**

- Q. 1) What does term SBR stand for ? Write its application.
- Q. 2) What are nonbiodegradable polymers ? Explain with example.
- Q. 3) Explain need for vulcanization of rubber.
- Q. 4) Write the structures of
a) Novolac b) Melamine.
- Q. 5) Explain what happens when ϵ -caprolactum is heated at 533K ?
- Q. 6) Write differences between low and high density polymers.
- Q. 7) How are polymers classified on the basis of molecular forces ?
- Q. 8) What happens when
a) Acrylonitrile reacts with 1, 3 - butadiene.
b) Lactic acid reacts with glycolic acid?

● **Section C - Questions of 3 Marks SAI**

- Q. 1) Explain with reaction, why is Bakelite termed as formaldehyde phenol?
- Q. 2) Why is the polymer prepared from hexamethylene diamine and adipic acid termed as nylon - 6,6 ? Write the reaction.
- Q. 3) Explain the steps involved in the chain growth polymerization.
- Q. 4) Write the chemical reaction that takes place when formaldehyde reacts with melamine. Which articles can be prepared from low density polymers ?
- Q. 5) How is Teflon prepared ? State its applications. What are heteropolymers ?

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Chapter 16 : Chemistry in everyday life

● Section A - Questions of 1 mark VSA of difficulty level

- Q. 1) Write the structure of Codeine.
- Q. 2) How is Aspirin obtained from salicylic acid ?
- Q. 3) What are narrow spectrum antibiotics ?
- Q. 4) What are broad spectrum antibiotics ?
- Q. 5) What are cationic detergents ?
- Q. 6) What are anionic detergents ?
- Q. 7) What are nonionic detergents ?
- Q. 8) Write a structure of BHA.
- Q. 9) Write a structure of saccharine.
- Q. 10) Write the structural formula of Aspirin
- Q. 11) What are chemical messengers ?
- Q. 12) Write structure of penicillin.
- Q. 13) Write structure of Novestrol.
- Q. 14) Write structure of Norethindrone.
- Q. 15) Write molecular formula of Bithional.
- Q. 16) Write structure of Seldane.
- Q. 17) Write structure of Aspartame.
- Q. 18) Identify the functional group in the following detergent molecule.
- $$\text{CH}_3 - (\text{CH}_2)_{10} - \text{CH}_2\text{OSO}_3^- \text{Na}^+$$

● Section A - Questions of 1 Mark VSA (Which can be combined with sections B / C / D.)

- Q. 1) What are analgesics ?
- Q. 2) What are tranquilizers ?
- Q. 3) What are antimicrobials ?
- Q. 4) What are antibiotics ?
- Q. 5) What are antiseptics ?

- Q. 6) What are antifertility drugs ?
- Q. 7) What are antacids ?
- Q. 8) What are antihistamins ?
- Q. 9) What are antioxidants ?
- Q. 10) What are synthetic detergents ?
- Q. 11) What is chemotherapy ?
- Q. 12) What are disinfectants ?

● **Section B - Questions of 2 Marks SAI**

- Q. 1) What is an ideal drug ?
- Q. 2) What are the uses of side effects of tranquillizers ?
- Q. 3) How tranquillizers work in body ?
- Q. 4) What is the difference between narcotic and non narcotic analgesics ?
- Q. 5) Explain difference between bactericidal and bacteriostatic antibiotics.
- Q. 6) Write structures of chloroxylenol and terpineol ?
- Q. 7) How does antihistamins work in human body ?
- Q. 8) What are food preservatives ? Give an example of food preservative.
- Q. 9) Explain the role of antioxidant in food preservation.
- Q. 10) Soap damages fibers of clothes when used in hard water. Explain why ?

● **Section C - Questions of 3 Marks SAI**

- Q. 1) Define the term Drug. State the ways of classification of drugs.
- Q. 2) Explain drug - enzyme interaction.
- Q. 3) Explain three physical methods for preservation of food.
- Q. 4) Describe three chemical methods for preservation of food.
- Q. 5) State the uses of sulphur dioxide and sulphite as antioxidants.
- Q. 6) Explain the different types of detergents.



