

SYLLABUS & DESIGN OF THE QUESTION PAPER

CODE : 043

Time : 3 Hrs.

Max. Marks : 70

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows:

A. Weightage to content / subject units

Unit No.	Title	Marks
Unit I	Solid State (deleted for the session 2019-20)	4
Unit II	Solutions	5
Unit III	Electrochemistry	5
Unit IV	Chemical kinetics	5
Unit V	Surface chemistry	4
Unit VI	General principles and processes of Isolation of Elements	3
Unit VII	p-Block Elements	8
Unit VIII	d – and f- Block Elements	5
Unit IX	Coordination Compounds	3
Unit X	Haloalkanes and Haloarenes	4
Unit XI	Alcohols, Phenols and Ethers	4
Unit XII	Aldehydes, Ketones and Carboxylic acids	6
Unit XIII	Organic compounds containing Nitrogen	4
Unit XIV	Biomolecules	4
Unit XV	Polymers	3
Unit XVI	Chemistry in Everyday life	3
Total		70

B. Weightage in the form of questions

QUESTION WISE BREAK UP

Type of Question	Mark per Question	Total No. of Questions	Total Marks
VSA/ Objective	1	20	20
SA	2	7	14
LA-I	3	7	21
LA-II	5	3	15
Total		37	70

C. Scheme of Options

1. There will be no overall option.
2. Internal choices (either / or type) in five questions has been given in questions testing higher mental abilities in the following types of questions:-
 - (i) One in two marks questions
 - (ii) One in three marks questions
 - (iii) All the three in five marks questions

D. Guidelines for Units 10 – 13 of syllabus

These units include questions on :

- | | | | |
|-------|---|---|---------|
| (i) | Nomenclature | : | 2 marks |
| (ii) | Reasoning | : | 6 marks |
| (iii) | Distinguishing between compounds | : | 2 marks |
| (iv) | Name reactions | : | 2 marks |
| (v) | Reaction Mechanism | : | 2 marks |
| (vi) | Word problems (conversions) covering
Properties and reactions of functional Groups : | | 2 marks |

E. Numericals:

Weightage of 8-10 marks in total has been assigned to numericals.

F. Weightage to difficulty level of questions

S. No.	Estimated difficulty level	Percentage
1.	Easy	15
2.	Average	70
3.	Difficult	15

A question may vary in difficulty level from individual to individual. As such, the approximation in respect of each question will be made by the paper setter on the basis of general expectation from the group as a whole. The provision is only to make the paper balanced in nature rather than to determine the pattern of making at any stage.

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### PRACTICALS

| Evaluation of Scheme for Examination | Marks     |
|--------------------------------------|-----------|
| Volumetric Analysis                  | 10        |
| Salt Analysis                        | 6         |
| Content Based Experiment             | 4         |
| Class record and viva                | 5         |
| Investigatory Project                | 5         |
| <b>Total</b>                         | <b>30</b> |

### Practical Syllabus

A. Surface Chemistry.

- (a) Preparation of one lyophilic and one lyophobic sol.  
Lyophilic sol – starch, egg albumin and gum  
Lyophobic sol – aluminium hydroxide, ferric hydroxide, arsenious sulphide.
- (b) Study of the role of emulsifying agent in stabilizing the emulsions of different oils.

B. Chemical Kinetics

- (a) Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.
- (b) Study of reaction rates of any one of the following:
  - (i) Reaction of iodine ion with hydrogen peroxide at room temperature using different concentration of iodine ions.
  - (ii) Reaction between potassium iodide,  $\text{KIO}_3$  and sodium sulphite: ( $\text{Na}_2\text{SO}_3$ ) using starch solution as indicator (clock reaction).

C. Thermo chemistry

Any one of the following experiments

- (i) Enthalpy of dissolution of copper sulphate or potassium nitrate.
- (ii) Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH)
- (iii) Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone and chloroform

D. Electrochemistry

Variation of cell potential in  $\text{Zn}/\text{Zn}^{2+} \parallel \text{Cu}^{2+}/\text{Cu}$  with change in concentration of electrolytes ( $\text{CuSO}_4$  or  $\text{ZnSO}_4$ ) at room temperature.

E. Chromatography

- (i) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of  $R_f$  values.
- (ii) Separation of constituents present in an inorganic mixture containing two cations only (constituents having wide difference in  $R_f$  values to be provided).

F. Preparation of Inorganic Compounds

- (i) Preparation of double salt of ferrous ammonium sulphate or potash alum.
- (ii) Preparation of potassium ferric oxalate.

G. Preparation of Organic Compounds

- (i) Acetanilide
- (ii) Di – benzal acetone
- (iii) p-Nitroacetanilide.
- (iv) Aniline yellow or 2-Naphthol aniline dye.
- (v) Iodoform

H. Test for the functional groups present in organic compounds.

Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.

I. Study of carbohydrates, fats and proteins in pure form and detection of their presence in given food stuffs.

J. Determination of concentration / molarity of  $\text{KMnO}_4$  solution by titrating it against a standard solution of:

- (i) Oxalic acid,
- (ii) Ferrous ammonium sulphate

(Students will be required to prepare standard solutions by weighing themselves).

K. Qualitative analysis

Determination of one cation and one anion in a given salt.

Cations –  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{As}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$

Anions –  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_2^-$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$

(Note : Insoluble salts excluded)

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PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

A Few suggested Projects.

- (i) Study of presence of oxalate ions in guava fruit at different stages of ripening.
- (ii) Study of quantity of casein present in different samples of milk.
- (iii) Preparation of soyabean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.
- (iv) Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc.):
- (v) Study of digestion of starch by salivary amylase and, effect of PH and temperature on it.
- (vi) Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, Potato juice, carrot juice etc.
- (vii) Extraction of essential oils present in Saunf (aniseed), Ajwain (carum), Illaichi (cardamom).
- (viii) Study of common food adulterants in fat, oil, butter, sugar, turmeric powder, chilli powder and pepper.

Note: Any investigatory project, which involves about 10 periods of work, can be chosen with the approval of the teacher.

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## Topics Covered

### **Unit I: Solid State**

#### **Contents:**

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties.

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Unit II: Solutions

Contents

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties-relative lowering of vapour pressure, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass.

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### **Unit III: Electrochemistry**

#### **Contents**

Redox reactions, conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, fuel cells; corrosion.

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Unit IV: Chemical Kinetics

Contents

Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment)

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### **Unit V: Surface Chemistry**

#### **Contents**

Adsorption – physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis : homogenous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophilic, lyophobic, multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsion-types of emulsions.

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Unit VI: General Principles and Processes of Isolation of Elements

Contents

Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and Iron.

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## Unit VII: p – Block Elements

### Contents

Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen- preparation, properties and uses; compounds of nitrogen: preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides ( $\text{PCl}_3$ ,  $\text{PCl}_5$ ) and oxoacids (elementary idea only)

Group 16 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; dioxygen: preparation, properties and uses; simple oxides; Ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).

Group 17 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).

Group 18 elements: General introduction, electronic configuration. Occurrence, trends in physical and chemical properties, uses.

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Unit VIII: d and f Block Elements

Contents

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals- metallic character, ionization enthalpy, oxidation states, ionic radii, colour catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 .

Lanthanoids – electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction.

Actinoids – Electronic configuration, oxidation states.

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## Unit IX: Coordination Compounds

### Contents

Coordination compounds – Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear

coordination compounds. Bonding; isomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

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Unit X: Haloalkanes and Haloarenes.

Contents

Haloalkanes : Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions.

Haloarenes : Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only)

Uses and environmental effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

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## **Unit XI: Alcohols, Phenols and Ethers**

### **Contents**

Alcohols : Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, some important compounds-methanol and ethanol.

Phenols : Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

Ethers : Nomenclature, methods of preparation, physical and chemical properties, uses.

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Unit XII: Aldehydes, Ketones and Carboxylic Acids

Contents

Aldehydes and Ketones : Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids : Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

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## **Unit XIII: Organic compounds containing Nitrogen**

### **Contents**

Amines : Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

Cyanides and Isocyanides : Will be mentioned at relevant places in context.

Diazonium salts : Preparation, chemical reactions and importance in synthetic organic chemistry.

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Unit XIV: Biomolecules

Contents

Carbohydrates : Classification (aldoses and ketoses), monosaccharides (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance.

Proteins : Elementary idea of α – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Vitamins : Classification and functions.

Nucleic Acids : DNA and RNA

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## Unit XV: Polymers

### Contents

Classification natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polythene, nylon, polyesters, bakelite, rubber.

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Unit XVI: Chemistry in everyday life:

Contents

- (i) Chemicals in medicines – analgesics, tranquilizers, antiseptics, disinfectant, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
- (ii) Chemicals in food – preservatives, artificial sweetening agents.
- (iii) Cleansing agents - soaps and detergents, cleansing action.

ASSIGNMENT

Chapter : 1 (Solid State)

- Q.1. Given for iron edge length = 286 pm and density = 7.86 g/cm^3 . Find the type of cubic lattice to which crystal belongs. Also calculate the radius of iron atom (at.wt Fe = 55.85)
- Q.2. Differentiate between schottky defect and frenkel defect?
- Q.3. The unit cell of an element of atomic mass 108 and density 10.5 g/cm^3 is a cube with edge length 409 pm. Find the structure of the crystal lattice.
- Q.4. What is the distance between K^+ and F^- in KF, if the density of KF is 2.48 g/cm^3 ?
- Q.5. Define the terms:
- (i) F – centre (ii) Pyroelectricity (iii) Piezoelectricity
- Q.6. Differentiate between stoichiometric and non-stoichiometric defect.
- Q.7. Differentiate between ferromagnetism, anti-ferromagnetism and ferrimagnetism.
- Q.8. What are octa-hedral and tetrahedral void?
- Q.9. A Solid AB has NaCl structure, If the radius of cation 'A' is 100 pm. What is the radius of anion 'B'?
- Q.10. The length of unit cell edge of BCC metal crystal is 352 pm. Calculate the radius of an atom of the metal.
- Q.11. A solid $\text{A}^+ \text{B}^-$ has NaCl type close packed structure. If the anion has a radius of 250 pm. What should be the ideal radius for the cation. Can a cation C^- having a radius of 180 pm. Be slipped into the tetrahedral site of crystal $\text{A}^+ \text{B}^-$? Give reasons for your answer.
- Q.12. Why do solids have high density and low compressibility?
- Q.13. Why is melting point of crystalline solid is sharp whereas amorphous solid is not?
- Q.14. Why do ionic solids have high melting and boiling points?
- Q.15. Why does electrical conductivity of most metals decrease with increase in temperature?
- Q.16. What are molecular crystals? Name the two types of forces holding the constituting particles. Give two examples.
- Q.17. The nearest neighbour Ag atoms in the silver crystal are $2.5 \times 10^{-8} \text{ cm}$. Presuming fcc structure of the crystal, what will be density of silver? [At. Wt. of Ag = 108 g mol^{-1}]
- Q.18. Give differences between isotropic and anisotropic substance.

- Q.19. What type of lattice does diamond crystallize in? How many carbon atoms are present per unit cell? How many carbon atoms surround each 'C' atom and how are they arranged?
- Q.20. (i) Calculate the packing efficiency in fcc crystal.
(ii) How many octahedral voids are present in fcc crystal?
- Q.21. Explain the following giving example:
- (i) Intrinsic semiconductor (ii) 12-16 compounds
(iii) Ferromagnetic substance.

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Chapter : 2 (Solution)

- Q.1. The freezing point of pure nitrobenzene is 278.8K. When 2.5g of unknown substance is dissolved in 100 g of nitrobenzene, the freezing point of solution is found to be 276.8 K. If the freezing point depression constant of nitrobenzene is 6K g mol^{-1} . What is the molar mass of unknown substance?
- Q.2. One litre aqueous solution of sucrose (molar mass 342g) weighing 1015g is found to recorded an osmotic pressure at 4.82atm at 293K. What is the molality of the sucrose solution? ($R = .0821\text{ atm /Kmol}$)
- Q.3. A solution containing 12.5 g of non-electrolyte substance in 175g of water gave a boiling point elevation of 0.70K. Calculate the molar mass of the substance [$K_b = 0.52\text{ kg/mol}$]
- Q.4. Calculate the amount KCl which must be added to 1kg of water so that the freezing point is depressed by 3K. ($K_f = 1.86\text{Kkg/mol}$).
- Q.5. Which has highest freezing point?
- (i) 1M glucose (ii) 1M CaCl_2 (iii) 1M AlF_3 (iv) 1M NaCl
- Q.6. Define the terms –
- (i) Ebullioscopic constant (ii) Cryoscopic constant
(iii) Raoult's Law (iv) Vant hoff's factor.
- Q.7. Calculate the boiling point of a solution containing 1.8 g of non volatile solute dissolved in 90g of benzene. The boiling of pure benzene is 353.23K. ($K_b = 2.53\text{ Kkg/mol}$. Molar mass of solute = 58g).
- Q.8. Calculate the amount of NaCl which must be added to 100g water so that the freezing point is depressed by 2K. ($K_f = 1.86\text{K/mol}$)
- Q.9. Calculate the mole fraction of water in a mixture of 12g water, 108g acetic acid and 92g ethyl alcohol.

- Q.10. Determine the V.P. of an aqueous solution containing 10% by mass of urea at 40°C (V.P of water = 55.3 mmHg)
- Q.11. Calculate the molality of 1 molar solution of sodium nitrate the density of solution 1.25 g/cm³.
- Q.12. Calculate the boiling point of 1 molar aqueous solution (Density 1.04 g/cm³) of KCl (K_b for water .52 K kg/mol, Atomic mass K = 39, Cl = 35.5)
- Q.13. What is meant by ideal solution?
- Q.14. Define colligative property.
- Q.15. The solubility of Ba(OH)₂.8H₂O is 5.6 g per 100 g of water. What is molality of OH⁻ in saturated solution? [At. Mass of Ba = 137, H = 1, O = 16]
- Q.16. A solution containing 12.5 g of non-electrolyte substance in 175 g of water gave a boiling point elevation 0.70 K. Calculate molar mass of solute.
- Q.17. A decimolar solution of K₄[Fe(CN)₆] is 50% dissociated at 300 K. Calculate the osmotic pressure of the solution. $R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$.
- Q.18. With the help of suitable diagrams explain positive and negative deviations from Raoult's Law.
- Q.19. Define osmotic pressure. How does it vary with concentration and temperature?
- Q.20. Calculate the molality of K₂CO₃ solution which is formed by dissolving 2.5 g of it in 1 litre of solution.
 $D = 0.85 \text{ g ml}^{-1}$. (At. Wt. of K = 39, C = 12, O = 16)
- Q.21. The osmotic pressure of blood is 8.21 atm at 37°C. How much glucose would be added per litre for an intravenous injection that is at same osmotic pressure as blood?
- Q.22. 5 g of compound A was dissolved in 100 g of water at 303 K. The vapour pressure of solution is 4.16 kPa whereas vapour pressure of pure water is 4.24 kPa. Calculate molecular weight of solute A.
- Q.23. At 298 K, the vapour pressure of pure water is 23.75 mm Hg, calculate vapour pressure of solution over 10% aqueous solute on the urea (Molecular weight = 60 g mol⁻¹) and also calculate the osmotic pressure at 298 K.
- Q.24. Calculate the normal boiling point of sample of sea water containing 3.5% NaCl and 0.13% of MgCl₂ by mass. Given $K_b = 0.52 \text{ K kg mol}^{-1}$. [Mol. Wt. of NaCl = 58.5, MgCl₂ = 95 g mol⁻¹]
- Q.25. What is meant by freezing point? In a solution of urea, 3.0 g of it is dissolved in 100 ml of water. What will be the freezing point of this solution? [K_f for H₂O = 1.86 K kg mol⁻¹, density of water = 1 g ml⁻¹]

- Q.26. Phenol associates in benzene to certain extent to form dimer. A solution contains 20×10^{-3} kg of phenol in 1 kg of benzene has its freezing point decreased by 0.61K. Calculate the fraction of phenol that has dimerised. [K_f for benzene = 5.12K/m]

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Chapter : 3 (Electro-Chemistry)

- Q.1. Calculate EMF
 $\text{Mg} | \text{Mg}^{2+} (0.001\text{M}) || \text{Cu}^{2+} (0.0001\text{M}) | \text{Cu}$
Given, $E^\circ \text{Cu}^{2+} / \text{Cu} = 0.337$; $E^\circ \text{Mg}^{2+} / \text{Mg} = -2.37 \text{ V}$
- Q.2. Calculate EMF
 $\text{Pt} | \text{Br}_2 (\text{l}) / \text{Br}^- (0.01\text{M}) // \text{H}^+ (0.03\text{M}) / \text{H}_2 (1 \text{ atm}) / \text{Pt}$
Given, $E^\circ \text{Br}_2 / \text{Br}^- = 1.076 \text{ V}$
- Q.3. Give a brief account of corrosion and its mechanism.
- Q.4. For the reaction
 $\text{PCl}_5 (\text{g}) = \text{PCl}_3 (\text{g}) + \text{Cl}_2 (\text{g})$
At 298 K, the value of $K = 1.8 \times 10^{-7}$
What is the ΔG° for this reaction?
- Q.5. How many coulombs are required to produce?
(i) 20 gms. Of Calcium from Calcium chloride
(ii) 50 gms. Of Al from Al_2O_3
- Q.6. What is cathodic protection? Explain with example.
- Q.7. How long a current of 3 Ampere has to be passed through a solution of silver nitrate to deposit at metal surface of 80 cm^2 with a 0.005 mm thick layer? Density of Ag is 10.5 gm cm^3 At wt of Ag-108 a.m.u.
- Q.8. What is the value of em.f of a cell at equilibrium?
- Q.9. Differentiate between molar conductivity and equivalent conductivity.
- Q.10. The resistance of 0.001 M NaCl solution in a conductivity cell was found to be 210 ohm. The specific conductance of this solution is $4.5 \times 10^{-3} \text{ S/cm}$. What is the cell constant of the cell.
- Q.11. What is the use of SHE or NHE. How it determines the e.m.f of a single electrode.
- Q.12. How long will it take an electric current of 0.15 A to deposit all the copper from 500ml of 0.05M copper sulphate solution.
- Q.13. 0.05M NaOH solution offered a resistance of 31.6 ohm in a conductivity cell at 298K if the cell constant of the cell is 0.367 cm^{-1} . Calculate the molar conductivity of NaOH solution.

- Q.14. How does the molar conductance of strong electrolyte vary with its concentration in solution?
- Q.15. What would happen if the protective tin coating over an iron bucket is broken from some places?
- Q.16. Give an example of 'fuel cell'.
- Q.17. Suggest a metal that can be used for cathodic protection of iron against rusting.
- Q.18. Write Nernst equation for the electrode reaction, $M^{n+} (aq) + ne^- \rightarrow M(s)$
- Q.19. Write the electrode reactions for hydrogen electrode and its potential.
- Q.20. Why does electrolysis of aqueous solution of NaBr and NaI give Br_2 and I_2 respectively whereas that of NaF gives O_2 instead of F_2 ?
- Q.21. Estimate the minimum potential difference needed to reduce Al_2O_3 at $500^\circ C$. The free energy change for the decomposition reaction.
 $\frac{2}{3} Al_2O_3 \rightarrow \frac{4}{3} Al + O_2$ is $\Delta G = + 960 \text{ KJ}$ ($1F = 96500 \text{ C mol}^{-1}$)
- Q.22. For what concentration of $Ag (aq)$ will the EMF of the given cell be zero at $25^\circ C$, if the concentration of $Cu^{2+} (aq)$ is $0.1M$?
- $$Cu + 2Ag^+ \longrightarrow Cu^{2+} + 2Ag$$
- Given $E^\circ_{Ag^+/Ag} = + 0.80 \text{ V}$, $E^\circ_{Cu^{2+}/Cu} = + 0.34 \text{ V}$
- Q.23. Calculate E_{cell} for the cell
 $Al | Al^{3+} (0.01M) || Fe^{2+} (0.02M) | Fe$
- Given that $E^\circ_{Al^{3+}/Al} = - 1.66V$, and $E^\circ_{Fe^{2+}/Fe} = - 0.44V$
- Q.24. How many grams of chlorine can be produced by electrolysis of molten NaCl with a current of 1.0 amp for 15 minutes?
- Q.25. (i) Why does a dry cell become dead after a long time, even if it has not been used?
(ii) Why does a mercury cell give a constant voltage throughout its life?
- Q.26. The measured resistance of a conductance cell containing $7.5 \times 10^{-3}M$ solution of KCl at $25^\circ C$ was 1005 ohm. Calculate (a) Specific conductance (b) Molar conductance of the solution. Cell constant = 1.25 cm^{-1}
- Q.27. Calculate ΔG° and the equilibrium constant for the cell reaction;
 $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$
Given $E^\circ_{Cl_2/Cl^-} = +1.36 \text{ V}$. $E^\circ_{I_2/I^-} = +0.536V$.
- Q.28. (i) Explain the following giving reasons:
(a) Electrolysis of aqueous solution of NaCl gives H_2 at cathode and Cl_2 gas at anode.

- (b) Electrolysis of aqueous solution of CuBr_2 gives Cu at cathode and Br_2 or I_2 at the anode whereas electrolysis of fluoride does not give F_2 at the anode.

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Chapter : 4 (Chemical Kinetics)

- Q.1. A first order reaction is 20% complete in 10 minutes. Calculate the time taken for the reaction to go to 80% completion.
- Q.2. A first order reaction is 75% complete in 60 minutes. Find the half life of this reaction.
- Q.3. The rate of a particular reaction quadruples when the temperature changes from 293 K to 313 K. Calculate the energy of activation for the reaction.
- Q.4. Explain the process of photosensitization.
- Q.5. Give the units for second order reaction.
- Q.6. The rate constant of a reaction is $3 \times 10^{-2} \text{ h}^{-1}$. What is the order of reaction?
- Q.7. For a first order reaction, it takes five minutes for the initial concentration of 0.6 mol/L to become 0.4 mol/L. How long will it take for the initial concentration become 0.3 mol/L
- Q.8. 60% of a first order reaction was completed in 60 minutes. When was it half completed?
- Q.9. Name one zero order reaction.
- Q.10. What is Pseudo unimolecular reaction? Give two examples.
- Q.11. For reaction $2\text{A} \rightarrow 2\text{B} + \text{C}$ the rate constant is $1.72 \times 10^{-5} \text{ s}^{-1}$ at 298 K and $2.40 \times 10^{-7} \text{ s}^{-1}$ at 338 K respectively Calculate the (a) Activation energy (b) Arrhenius constant (C) Rate at 318 K
- Q.12. The rate of decomposition of H_2O_2 at a particular temperature is measured by titrating the solution with Acidic KMnO_4 solution. Following were obtained. Verify from the data it's a first order reaction.

t (min)	0	10	20
Mc (KMnO_4)	22.8	13.8	8.3

- Q.13. A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of the reaction?
- Q.14. How is rate constant related to the concentration of reactants?
- Q.15. Differentiate between reaction rate and reaction rate constant.
- Q.16. Differentiate between order and molecularity.

- Q.17. State any one condition under which a biomolecular reaction may be kinetically of first order.
- Q.18. The rate law for the decomposition of N_2O_5 is $\text{rate} = k[\text{N}_2\text{O}_5]$. What is the significance of 'k' in this equation?
- Q.19. For the reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ express the rate of reaction in terms of formation of ammonia.
- Q.20. The specific rate of reaction is $4.2 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$. What is the order of reaction?
- Q.21. 1 litre of 2M acetic acid is mixed with 1 litre of 3 M ethyl alcohol to form an ester. What would be the decrease in the initial rate if each solution is diluted by equal volume of water?
- Q.22. The reaction $2\text{NO} + \text{Br}_2 \rightarrow 2\text{NOBr}$ has the mechanism.
- Q.23. (i) Step I $\text{NO} + \text{Br}_2 \rightarrow \text{NOBr}$ (fast)
(ii) Step II $\text{NOBr} + \text{NO} \rightarrow 2\text{NOBr}$ (slow)
- What will be the rate law?
- Q.24. Calculate the value of activation energy. If rate of reaction doubles when rise in temperature from 295 K to 305 K takes place. [$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$]
- Q.25. Discuss the effect of –
- (i) Catalyst (ii) Concentration on the rate of reaction.
- Q.26. The decomposition reaction of a compound follows a first order rate law. If it takes 15 minutes for 20% of original material to react, calculate (i) the specific rate constant (ii) the time at which 10% of the original material remains unreacted. (iii) the time it takes for the next 20% of the reactant left to react after the first 15 minutes.
- Q.27. Nitric oxide, NO, reacts with oxygen to produce nitrogen dioxide:
- $$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$$
- The rate law for this reaction is
 $\text{Rate} = k [\text{NO}]^2 [\text{O}_2]$
 Propose a mechanism for the above reaction.
- Q.28. The following data were obtained on performing three experiments:
- $$2\text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{NOCl}(\text{g})$$

Expt	$[\text{Cl}_2]$ in mol L^{-1}	$[\text{NO}]$ in mol L^{-1}	Initial rate In $\text{mol L}^{-1} \text{ s}^{-1}$
1.	0.02	0.01	2.40×10^{-4}
2.	0.02	0.03	1.16×10^{-3}
3.	0.04	0.03	4.32×10^{-3}

Determine

- (i) The order with respect to Cl_2 and NO
- (ii) Rate law
- (iii) Rate constant.

=====

Chapter: 5 (Surface Chemistry)

- Q.1. What is the effect of increase of temperature on the adsorption of a gas on a solid surface?
- Q.2. What do you understand by electrophoresis.
- Q.3. What is the difference between a colloidal solution and an emulsion?
- Q.4. Explain the terms 'Brownian movement' and 'Peptization'.
- Q.5. Explain the terms multimolecular colloids and macromolecular colloids.
- Q.6. Explain the terms electrodialysis and Tyndall effect.
- Q.7. What are Zeolites. Describe some of their features.
- Q.8. Write the Freundlich adsorption equation and explain the symbols used.
- Q.9. Explain the terms physisorption and chemisorption. How does adsorption of a gas on a solid surface vary with pressure?
- Q.10. Explain the phenomenon which takes place when ferric hydroxide sol is added to a gold sol. Write whether the gold sol is macromolecular or multimolecular colloid.
- Q.11. What is meant by peptization?
- Q.12. Give an example of an associated colloid
- Q.13. On passing H_2S through dilute HNO_3 solution, the colourless solution becomes turbid. Why?
- Q.14. Name the method by which Gold sol can be prepared.
- Q.15. Why is sky blue in colour?
- Q.16. What are emulsions? Write two applications of emulsification.
- Q.17. What is meant by a 'Shape –selective catalyst'? Give an example in which shape-selectivity of a catalyst is exhibited.
- Q.18. Taking two examples of heterogeneous catalytic reactions, explain how does heterogeneous catalyst help in the chemical reaction.
- Q.19. What happens when an electric field is applied to colloidal dispersion? Give reason.
- Q.20. Explain the following terms:
 - (i) Emulsification
 - (ii) Chemisorption

- Q.21. Differentiate between lyophilic and lyophobic colloids. How can we prepare a colloidal solution of silver?
- Q.22. Explain the terms giving examples:
- (i) Selectivity of catalyst (ii) Activity of catalyst.
- Q.23. Give four differences between physical and chemical adsorption. What is the effect of temperature on chemical adsorption?
- Q.24. Explain Freundlich adsorption isotherm with the help of a diagram and give its mathematical expression. How does physical adsorption vary with pressure?
- Q.25. Explain the following terms with suitable example:
- (i) Gel (ii) Aerosol (iii) Hydrosol.
- =====

Chapter : 6 (General Principles And Processes of Isolation of Elements)

- Q.1. Name the most abundant metal in earth crust.
- Q.2. Name sulphide ore of copper and silver.
- Q.3. Describe froth floatation process. What is the role of stabilizer and of depressant? Give an example of each.
- Q.4. What is meant by chemical separation? Illustrate with the help of example
- Q.5. Name the chief ores of the following in the earth's crust:
- Q.6. Describe the principle of each of the following processes:
- (i) Van-Arkel Method (ii) Zone refining
(iii) Electrolytic refining
- Q.7. Describe the principle of extraction of each of the following:
- (i) Sn from SnO_2 (ii) Zn from ZnO (iii) Cr from Cr_2O_3
- Q.8. Write short notes on following giving one example :
- (i) Roasting (ii) Calcination (iii) Smelting.
- Q.9. How is chemical reduction different from electrolytic reduction? How is silver obtained from argentite? Give chemical reactions involved.
- Q.10. (i) Write short notes on the following giving example:
- (a) Magnetic separation (b) Aluminothermic process
(c) Liqutation.
- (ii) Give one example of the following for extraction of metal.
- (a) Auto-reduction (b) H_2 is used as reducing agent.
- =====

Chapter: 7 (Representative Elements (P Block))

Q.1. Account for the following:

- (i) PbX_2 is more stable than PbX_4 ($\text{X} = \text{Cl}, \text{Br}, \text{I}$)
- (ii) HI in aqueous solution is stronger acid than HCl
- (iii) Noble gases exhibit low chemical activity.
- (iv) Solid carbon di oxide is called dry ice.

Q.2. How would you account for the following:

- (i) Maximum number of covalents bonds formed by nitrogen.
- (ii) How do XeF_2 and XeF_4 act a fluoride donor while XeF_4 at as a fluoride acceptor.

Q.3. What is inert pair effect?

Q.4. Draw the structure of XeOF_4 .

Q.5. Describe the trends in properties of group 16 elements.

- (i) Metallic character
- (ii) Catenation
- (iii) Stability of hydrides
- (iv) Capability to form halides

Q.6. Give the comparative account of the chemistry of hydrides (stability and basic character) and halides (MX_3 and MX_5) of N and P.

Q.7. Why SF_6 exists where as SH_6 does not?

Q.8. Why is NH_3 liquid whereas PH_3 gas?

Q.9. Which halogen has higher bond dissociation energy and why?

Q.10. Compare giving reasons, the oxidizing powers of F_2 and Cl_2 .

Q.11. Which of the xenon fluorides molecule is isostructural with IF_5 ? Draw the structure of its molecules.

Q.12. Give reasons:

- (i) NH_3 has higher dipole moment than NF_3 .
- (ii) Acidic character of hydrides of group 16 increases down the group.

Q.13. Give reasons for the differences in the following:

- (i) Reactivities of nitrogen and phosphorus.
- (ii) Stabilities of +2 oxidation state of tin and lead.

Q.14. (i) Arrange the hydrides of group 15 in increasing order of basic strength
(ii) Arrange hydrogen halides in increasing order of their boiling points.

Q.15. Give appropriate reasons for each of the following observations:

- (i) Sulphur vapour exhibits some paramagnetic behaviour.
- (ii) Interhalogen compounds are more reactive than halogens.
- (iii) Of the noble gases only xenon is known to form real chemical compounds.

- (iv) Despite lower electron affinity 'F₂' is stronger oxidizing agent than 'Cl₂'.
- (v) Nitrogen shows little tendency for catenation, whereas phosphorus shows a clear tendency for catenation.

- Q.16. (i) Xe has highest polarizing power. Why?
(ii) Halogens are coloured. Why?
(iii) Noble gases are mostly chemically inert. Why?
(iv) Nitrogen does not form pentahalide. Why?
(v) Bismuth is a strong oxidizing agent in pentavalent state. Why?

Q.17. Complete and balance the following chemical equations:

- | | |
|---|---|
| (i) F ₂ + H ₂ O (cold) → | (ii) Li + N ₂ (cold) → |
| (iii) CuO + NH ₃ → | (iv) BrO ₃ ⁻ + F ₂ + OH ⁻ → |
| (v) Ca ₃ P ₂ + H ₂ O → | |

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Chapter: 8 (Transition Elements (d Block & f Block Elements))

- Q.1. Why is platinum (iv) state is more stable than nickel (iv) state.
- Q.2. Why do most transition metal ions exhibit paramagnetism why is V⁴⁺ colour as V⁵⁺ colourless.
- Q.3. How is potassium dichromate prepared from chromite ore? Draw the structure of chromate ion and dichromate ion.
- Q.4. What is lanthanide contraction? What is the consequences of lanthanide contraction?
- Q.5. Explain the following properties of transition elements.
- | | |
|---------------------------------|--|
| (i) Metallic character | (v) Tendency to exhibit variable oxidation state |
| (ii) Tendency to form complexes | (vi) Catalytic behaviour |
| (iii) Magnetic behaviour | (vii) Formation of Interstitial compound. |
| (iv) Colour compounds | (ix) Enthalpy of atomization. |
- Q.6. Which is the trivalent ion having the smallest size in the lanthanide series?
- Q.7. Why the first I.E. of 5-d transition metals are higher than 3-d and 4-d transition metals.
- Q.8. Write the general configuration of inner transition elements what are misch and transuranic elements.
- Q.9. K₂PtCl₆ is well known where as corresponding compound of Ni is not known why.
- Q.10. Why are transition metal fluorides ionic in nature where as chlorides and bromides Are covalent in nature. Give the structure of CuCl₂.

- Q.11. Illustrate the oxidizing properties of potassium permanganate in acidic and basic media.
- Q.12. Name a transition metal which does not exhibit variation in oxidation state in its compounds.
- Q.13. Name a transition metal which exhibits variation in oxidation state in its compounds.
- Q.14. K_2PtCl_6 is well known compound whereas corresponding Ni compound is not known, why?
- Q.15. What is general electronic configuration of lanthanoids?
- Q.16. Why is HCl acid not used to acidify potassium permanganate solution in volumetric analysis?
- Q.17. What are inner transition elements? Write their general electronic configuration.
- Q.18. Explain why –
- (i) E° for Mn^{3+}/Mn^{2+} couple is more positive than that of Fe^{3+}/Fe^{2+}
(At. Nos. of Mn = 25, Fe = 26)
 - (ii) Ce^{3+} can be easily oxidized to Ce^{4+} (At. No. of Ce = 58)
- Q.19. What chemical changes take place when
- (i) MnO_2 is fused with KOH in air?
 - (ii) pH of chromate solution is progressively lowered?
- Q.20. Mention the direct consequences of the following factors on the chemical behaviour of the transition metals:
- (i) They have incompletely filled d –orbitals in the ground state or in one of the oxidized states of their atoms.
 - (ii) They contribute more valence electrons per atom in the formation of metallic bonds.
- Q.21. Explain the following giving reasons:
- (i) It is difficult to separate the lanthanoid elements in pure state.
 - (ii) The first ionization energies of 5d transition elements are higher than those of the 3d or 4d transition elements of the corresponding groups.
- Q.22. With the help of ionic equations describe what happens when
- (i) pH of a solution of dichromate ion is raised.
 - (ii) Potassium manganate is electrochemically oxidized.
- Q.23. (i) Assign reason for each of the following:
- (a) Transition metals exhibit higher enthalpies of atomization.
 - (b) The transition metals form interstitial compounds.

- (ii) Mention two uses of potassium permanganate in the laboratory.
- Q.24. With the help of equations explain the preparation of potassium dichromate from chromite ore. Why is for the reactions involved.
- Q.25. Describe the preparation of potassium permanganate from pyrolusite ore. Write the chemical equation for the reactions involved.
- Q.26. Account for the following:
- (i) Transition elements have higher boiling points.
 - (ii) Zn, Cd and Hg are normally not regarded as transition elements.
 - (iii) Sc forms no coloured ions yet it is regarded as transition elements.
 - (iv) Transition elements show variable oxidation states.
 - (v) Zr resembles with Hf.

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Chapter : 9 (Cordination Compounds and Organometallics)

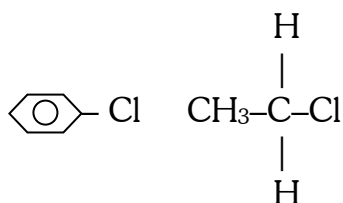
- Q.1. Give one example each of a complex ion and a double salt.
- Q.2. Give the IUPAC of the following.
- | | |
|---|---|
| (i) $[(\text{NH}_3) \text{H}_2\text{O Pt-NO}_2] \text{Br.}$ | (iv) $\text{K}_4[\text{Ni}(\text{CN})_4]^{2-}$ |
| (ii) $[\text{Co}(\text{NH}_3)_5 \text{Cl}]\text{Cl}_2$ | (v) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ |
| (iii) $[\text{Ag}(\text{NH}_3)_5]\text{Cl}$ | (vi) $\text{Cu}_2[\text{Fe}(\text{CN})_6]^{2-}$ |
- Q.3. Give example of each of the following :
- | | |
|-----------------------------|----------------------------|
| (i) Ionization isomerism | (iv) Geometrical isomerism |
| (ii) Coordination isomerism | (v) Optical isomerism |
| (iii) Linkage isomerism | |
- Q.4. Predict shape geometry and magnetic behaviour of the following.
- | | |
|---------------------------------------|--|
| (i) $[\text{Co}(\text{NH}_3)_6]^{3+}$ | (ii) $[\text{Fe}(\text{CO})_4]^{2-}$ |
| (iii) $[\text{Co}(\text{CO})_4]^{3+}$ | (iv) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ |
- Q.5. Write the application of coordination compounds in:
- | | |
|------------------------|--------------------|
| (i) Analytic chemistry | (iii) Life process |
| (ii) Metallurgy | |
- Q.6. What is meant by hexadentate ligand? Give one example. How is such a ligand useful for measuring hardness of water?
- Q.7. What is a chelating ligand? Give one example.
- Q.8. Give one use of Ziegler Natta catalyst.
- Q.9. Name the ionization isomer of $[\text{Cr}(\text{H}_2\text{O})_5\text{Br}]\text{SO}_4$
- Q.10. What is ambidentate ligand? Give an example.

- Q.11. $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic while $[\text{Fe}(\text{CN})_6]^{4-}$ is diamagnetic. Explain.
- Q.12. Giving suitable example, describe the importance of the formation of complex compounds in
- The estimation of hardness of water
 - Its extraction from its natural source.
- Q.13. Write all the isomers of $[\text{Co}(\text{NH}_3)_5\text{SCN}]\text{Cl}_2$.
- Q.14. Write IUPAC name of $[\text{Co}(\text{en})_2(\text{NH}_3)_2]\text{Cl}_3$
- Q.15. Deduce the magnetic behaviour of each of the following;
- $[\text{Cr}(\text{NH}_3)_5\text{Cl}]^{2+}$
 - $\text{Fe}(\text{CO})_5$
[At. No. of Cr = 24, Fe = 26]
- Q.16. Account for the following:
- $[\text{Cr}(\text{NH}_3)_6]^{3+}$ is paramagnetic and octahedral whereas $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic and square planar.
- Q.17. Write IUPAC name of (i) $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$ (ii) $\text{K}_3[\text{Cr}(\text{CN})_6]$
- Q.18. Explain geometrical isomerism with reference to square planar complexes giving one example. How is tetrahedral complexes with simple ligands do not exhibit geometrical isomerism?
- Q.19. Explain the structure and magnetic behaviour of the species $[\text{Ni}(\text{CO})_4]$ molecule.
- Q.20. Explain each of the following observations:
- Tetrahedral Ni(II) complexes are paramagnetic but square planar Ni(II) complexes are diamagnetic.
 - Only transition metals are known to form π – complexes.

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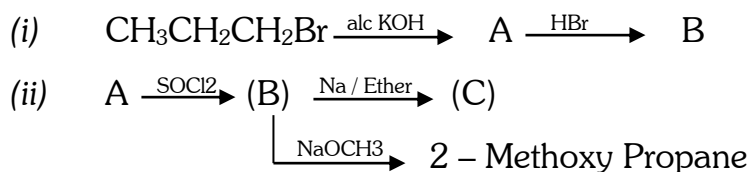
Chapter: 10 (Haloalkanes and Haloarenes)

- Q.1. Which of the two C–Cl bonds shown below will have more dipole moment?



- Q.2. Give one chemical test to distinguish between $\text{C}_2\text{H}_5\text{Br}$ and $\text{C}_6\text{H}_5\text{Br}$.
- Q.3. Write the IUPAC name of D.D.T.

Q.4. Complete the following sequence of reactions:



Q.5. Why ring substitution in chlorobenzene occurs preferably at ortho and para positions?

Q.6. Write a short note on sandmeyer's reaction.

Q.7. How would you convert methyl bromide into:

- (i) Methanoic acid (ii) Methylamine.

Q.8. Explain why:

- (i) Chlorobutane has higher B.P. than 2-chloro butane.
(ii) Alkyl halides undergo nucleophilic substitution reactions.
(iii) Alkyl halides are insoluble in water though they have C-X polar bond.

Q.9. Arrange each set of compounds in order of increasing B.P.

- (i) CH_3Cl , CH_3Br , $\text{C}_2\text{H}_5\text{Br}$
(ii) CH_3Br , CH_2Br_2 , CHBr_3
(iii) $\text{CH}_3\text{CH}_2\text{CH}_3$, $\text{CH}_3\text{CH}_2\text{-CH}_2\text{Br}$, $\text{CH}_3\text{-CH(Br)-CH}_3$

Q.10. Primary alkyl halide (A) $\text{C}_4\text{H}_9\text{Br}$ reacted with alc KOH to give compound (B) compound (B) is reacted with HBr to give (C) which is an isomer of (A). When (A) was reacted with sodium metal it gave a compound (D) C_8H_{18} that was different than the compound when n-Butyl bromide was reacted with sodium. Give the structural formula of (A) and write the reactions for all the reactions.

Q.11. Arrange the following in increasing order of boiling point:

- (i) Bromomethane, bromoform, chloromethane, dibromomethane
(ii) Propane, 1-chloropropane, isopropyl chloride, 1-chlorobutane

Q.12. Complete the following reactions:

Q.13. What happens when: (Give chemical reactions)

- (i) Cyclohexanol is treated with thionyl chloride?
(ii) p-Hydroxybenzyl alcohol is heated with HCl?
(iii) Ethyl bromide is refluxed with NaI in acetone?
(iv) Ethyl bromide is treated with mercurous fluoride?

Q.14. Convert:

- (i) Acetylene to Pent -2-yne
(ii) Tert-butyl bromide to Isobutyl bromide
(iii) Butan -1-ol to But-1-ene

Q.15. Convert:

- (i) Chlorobenzene to p-nitrophenol
(ii) Benzene to aniline
(iii) 2, 4, 6-Trinitrochlorobenzene to Benzene

Q.16. Write short notes on

- (i) Wurtz reaction
(ii) Carbylamine reaction
(iii) Wurtz-Fitting reaction

Q.17. How will you distinguish between:

- (a) Chlorobenzene and Benzyl chloride?
(b) Methanol and Ethanol?
(c) Ethylamine and Diethylamine?

Q.18. What is meant by S_N1 and S_N2 mechanism? Illustrate with the help of example and discuss the stereochemistry involved.

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Chapter : 11 (Alcohol, Phenol & Ether)

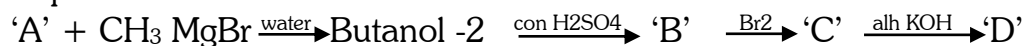
Q.1. How can the following be obtained.

- (i) Phenol from benzene diazonium chloride
(ii) Ethyl alcohol to methyl alcohol
(iii) 2, 4, 6 – Tri bromo phenol from phenol?

Q.2. Distinguish between:-

- (i) Methanol and ethanol
(ii) 1 – propanol and 2-propanol
(iii) 2-propanol and 2-methyl-2-propanol

Q.3. Write the structural formula of the organic compound A, B, C, D in the following sequence of reactions:



Q.4. Explain the name reactions:

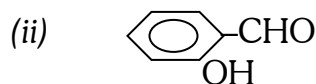
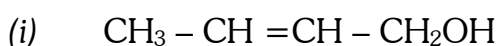
- (i) Sandmeyer reaction
(ii) Friedel-Crafts reaction
(iii) Williamsons synthesis
(iv) Riemeier-Tiemann reaction.

Q.5. Explain the following:

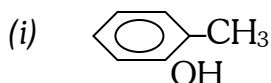
- (i) How is cumene obtained from benzene?
(ii) Why is chloroform stored in dark coloured bottles?

- (iii) What is an ambident group?
- (iv) Markownikoff's rule and Saytzeff rule.
- (v) Phenol's are more acidic than alcohols

- Q.6. How are primary secondary and tertiary alcohol's are prepared from grignard reagent?
- Q.7. How will you convert phenol to Aspirin? Give two important uses of glycerol?
- Q.8. What is haloform reaction? Write balanced equations for it.
- Q.9. How will you commercially prepare phenol? Distinguish it from Ethanol.
- Q.10. Write IUPAC names of the following:



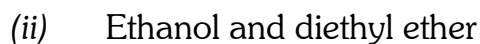
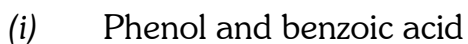
- Q.11. Write IUPAC names of the following:



- Q.12. Give mechanisms of following reactions:



- Q.13. Distinguish between the following by suitable chemical test:



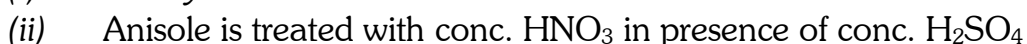
- Q.14. Write short notes on:

Electrophilic substitution reactions in aromatic ethers.

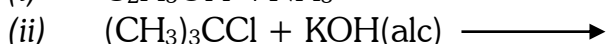
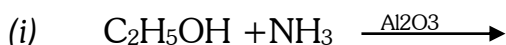
- Q.15. Convert the following:

Phenol to Aspirin

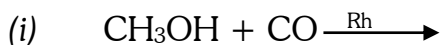
- Q.16. Convert:



- Q.17. Complete the following reactions:



- Q.18. Complete the following reactions:



- Q.19. (i) Convert Phenol to Bromophenol
(ii) Convert Ethene to Propanol

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Chapter : 12 (Aldehyde, Ketone, Acid & Derivatives)

Q.1. Explain with suitable examples:

- | | |
|---------------------------|----------------------------|
| (i) Rosenmund reaction | (v) Wolf Kishner Reduction |
| (ii) Aldol condensation | (vi) Hoffman Bromoamide |
| (iii) Cannizzaro reaction | (vii) HVZ Reaction |
| (iv) Kolbe's reaction | |

Q.2. Conversion :-

- | | |
|-------------------------------------|--------------------------------------|
| (i) Propanoic acid to acetic acid | (vi) Acetophenone to benzoic acid |
| (ii) Acetaldehyde to acetone | (v) Anisole to orthonitroanisole |
| (iii) Acetophenone to ethyl benzene | (vi) Ethanoic acid to propanoic acid |

Q.3. Discuss the test and write the equations of reactions for distinguishing between aldehydes and ketones.

Q.4. Explain why cleavage of phenyl alkyl ether with HBr always gives phenol and alkyl bromide and not bromobenzene and alkanols.

Q.5. How is the presence of peroxides in ethers detected and removed? Why peroxides are dangerous?

Q.6. How will you obtain an aldehyde and ketone by ozonolysis of alkenes?

Q.7. What happens when

- | | |
|--------------------------------|-----------------------------------|
| (i) Methanol + $\text{RMgX} =$ | (ii) Ethanol + $\text{RMgX} =$ |
| (iii) Ketone + $\text{RMgX} =$ | (iv) Sodium acetate + soda lime = |

Q.8. How will you prepare the following: (Give a reaction of each)

- | | |
|----------------|---------------------|
| (i) Acid amide | (ii) Acid anhydride |
| (iii) Ester | (iv) Acid chloride |

Q.9. Give reasons:

- The boiling points of aldehydes and ketones are lower than the corresponding alcohols and acids.
- The boiling points of ethers are lower than their isomeric alcohols.
- During the preparation of ammonia derivatives from aldehydes or ketones. pH of the reactions is carefully controlled.

Q.10. What are oxonium salts? Under what condition they are prepared?

Q.11. A compound (a) with molecular formula $\text{C}_5\text{H}_{12}\text{O}$ on oxidation forms compound (B) with molecular formula $\text{C}_5\text{H}_{10}\text{O}$. The compound (B) gives iodoform test but

does not reduce ammoniacal silver nitrate. (B) on reduction with amalgamated zinc and HCl gives compound (C) with molecular formula C_5H_{12} . Identify A, B and C. Write down chemical equation.

Q.12. How will you distinguish;

- (i) Alcohol and phenol (ii) Acetaldehyde and propanone
- (iii) Methanal and Ethanal (iv) 2-Pentanone and 3-Pentanone

Q.13. Distinguish between acetaldehyde and acetone by suitable chemical test.

Q.14. Mention an industrial product manufactured from methanal.

Q.15. Mention an important use of methanoic acid.

Q.16. Distinguish between formic acid and acetic acid by a suitable chemical test.

Q.17. Give reasons for the following:

- (i) Aldehydes are more reactive than ketones in nucleophilic reactions.
- (ii) Most aromatic acids are solids but acids of acetic acid group are mostly liquids.

Q.18. Write the complete reaction for each of the following conversions stating the conditions necessary.

- (i) Toluene to Benzaldehyde (ii) Benzoyl chloride to Benzaldehyde

Q.19. How will you account for the following?

- (i) Chloroacetic acid is stronger acid than acetic acid
- (ii) Ethers possess a net dipole moment even if they are symmetrical in structure. Aqueous solutions of formaldehyde and acetaldehyde.

Q.20. Suggest a test for distinguishing between the following pairs:

- (i) Aqueous solutions of phenol and benzoic acid
- (ii) Aqueous solutions of formaldehyde and acetaldehyde.

Q.21. Write the names and structural formulae of the products in each of the following:

- (i) Reaction of semicarbazide ($NH_2CONHNH_2$) with formaldehyde
- (ii) Oxidation of ethylbenzene with alkaline $KMnO_4$.

Q.22. Convert :

- (i) Propanoic acid to 1-propanol (ii) Toluene to benzoic acid

Q.23. Write the names and structures of the products formed in the following reactions:

- (i) Reactions of C_2H_5MgBr with 2-butanone followed by acid hydrolysis
- (ii) Reaction of thionyl chloride with benzoic acid.

Q.24. Convert :

- (i) An aldehyde to and acetal
- (ii) Benzoic acid to m-nitrobenzoic acid.
- (iii) Benzoic acid to 3-bromobenzoic acid

Q.25. How will you convert?

- (i) Acetophenone to ethylbenzene
- (ii) Acetamide to ethylamine
- (iii) Propanone to 2-propanol

State the conditions and reactions in each case.

Q.26. An organic compound 'A' C_8H_6 on treatment with dilute H_2SO_4 containing mercuric sulphate gives compound 'B'. Which can also be obtained from a reaction of benzene with acid chloride in presence of $AlCl_3$? 'B' on treatment with I_2 in aq. KOH gives 'C' and a yellow compound 'D' Identify A, B, C and D. Give the chemical reactions involved.

Q.27. Convert :

- (i) Acetylene to acetic acid.
- (ii) Acetaldehyde to lactic acid
- (iii) Toluene to benzene.

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Chapter : 13 (Amines)

Q.1. Explain the following name reactions.

- (i) Gabriel phthalimide synthesis.
- (ii) Carbylamine reactin.

Q.2. How is sulphanilic acid prepared? Why sulphanilic acid has a high mp of 573K.

Q.3. Conversions

- (i) m-nitroaniline to m-iodochlorobenzene
- (ii) Benzene to m-bromophenol
- (iii) Aniline to benzoic acid
- (iv) P-chloroaniline to p-chlorobenzylamine
- (v) Benzene to m-bromoaniline
- (vi) Aniline to benzonitrile
- (vii) Aniline to acetanilide

Q.4. Discuss the basic character of primary, secondary, tertiary amines with respect to aniline and ammonia.

Q.5. Account for the following.

- (i) It is difficult to prepare pure amines by ammonolysis of alkyl halides.

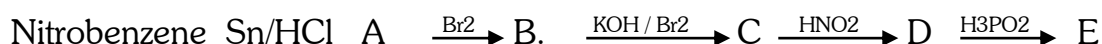
- (ii) Amines are higher boiling compounds than hydrocarbons of corresponding molecular masses but have lower boiling points than the corresponding alcohols or carboxylic acid.
- (iii) Aniline is a weaker base than cyclohexyl amine.
- (iv) Methyl amine in water reacts with ferric hydroxide.
- (v) Silver chloride dissolves in methyl amine solution.

Q.6. An organic compound 'A' having molecular formula C_2H_3N on reduction gave another compound 'B'. B on treatment with HNO_2 gave ethyl alcohol and warming with chloroform and alc KOH gave an offensive smelling substance C. Identify A, B and C and write down equation involved.

Q.7. What is Zwitter ion how it is formed?

Q.8. What is Hinsberg test give reactions involved?

Q.9. Complete the reaction.



Q.10. Write zwitter ion of aminoacetic acid.

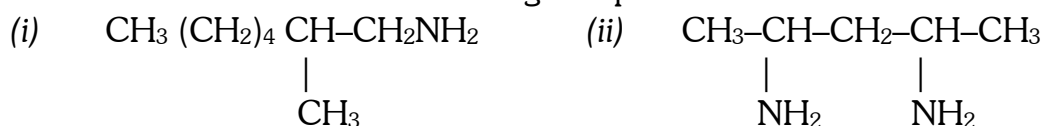
Q.11. Distinguish between benzylamine and para-toluidine by suitable chemical test.

Q.12. Arrange the following in decreasing order of basic strength:

NH_3 , triethylamine, aniline, ethylamine, diethylamine in aqueous solution

Q.13. Write all the steps to convert aniline to p-nitroaniline.

Q.14. Write IUPAC names of the following compounds:



Q.15. Explain the reaction of aniline with a mixture of concentrated nitric acid and concentrated sulphuric acid.

Q.16. Account for the following:

- (i) Aniline is less basic than NH_3
- (ii) Aqueous solution of methylamine reacts with $FeCl_3$ to precipitate $Fe(OH)_3$

Q.17. Illustrate the following with an example of each of reaction:

- (i) Coupling reaction in diazonium compounds
- (ii) Acylation reaction.

Q.18. Starting with methyl iodide, how would you prepare

- (i) Trimethylamine
- (ii) N, N – dimethylaniline

Write the complete reaction involved in each case.

- Q.19. Mention the chief use of quaternary ammonium salts derived from long chain amines.
- Q.20. Explain Why:
- (i) Tertiary amines do not undergo acylation reaction
 - (ii) Aniline readily reacts with bromine to give 2, 4, 6 – tribromoaniline.
- Q.21. Give reason:
- (i) Aniline is a weaker base than cyclohexylamine.
 - (ii) Amines have lower boiling points than those of the corresponding alcohols.
- Q.22. Suggest chemical reactions for the following reactions:
- (i) Aniline to benzoic acid
 - (ii) n-Hexanenitrile to 1-aminopentane
 - (iii) p-Chloroaniline to p-chlorobenzylamine.

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Chapter: 14 (Polymers)

- Q.1. What is difference between Nylon-6 and Nylon-66
- Q.2. Explain the difference between chain and step growth polymerization. How is nylon-66 synthesized?
- Q.3. What is buna-S? How is it synthesized?
- Q.4. Write the equations for the synthesis of
- (i) Polymethyl methacrylate
 - (ii) Polyacrylonitrile
 - (iii) Teflon
 - (iv) PVC
 - (v) Glyptal
- Also give one important use of each polymer
- Q.5. Write the names and structure of the monomers of the following polymers
- (i) Polystyrene
 - (ii) Neoprene
- Q.6. What is meant by a copolymer? Illustrate with two examples. Write the equation for the preparation of any one of the two copolymers cited.
- Q.7. Give monomers of Glyptal.
- Q.8. Write monomers with structures for the following polymers:
- (i) Nylon-66
 - (ii) Neoprene
- Q.9. How are polymers classified into different categories on the basis of intermolecular forces? Give one example of a polymer of each of these categories.

- Q.10. For the following polymers. Name the monomers with structures:
(i) Natural rubber (ii) Terylene
- Q.11. Differentiate between thermoplastics and thermosetting polymers. Give an example of each class.
- Q.12. Define and give an example of (i) Elastomers (ii) Co-polymers.
- Q.13. Give two differences between step growth and chain growth polymerization.
- Q.14. How will you prepare Nylon-6? Give two examples.
- Q.15. Give mechanism of cationic polymerization.
- Q.16. What are biodegradable polymers? Give two examples.
- Q.17. What are chain transfer agents? Explain with the help of example.

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Chapter : 15 (Bio-molecules)

- Q.1. If a fragment of one strand of DNA has the base sequence CCATGCATG. What is the base sequence of the complementary strand?
- Q.2. What type of bonding occurs in globular protein?
- Q.3. What are phospholipids?
- Q.4. Write and explain the general structure of triglycerides.
- Q.5. What is peptide bond? Explain the tertiary structure of proteins.
- Q.6. What is glycosidic bond illustrate its formation with an example?
- Q.7. What do you understand by tertiary structures of proteins? Mention the forces involved in forming these structures.
- Q.8. How many molecules of ATP are produced per molecule of glucose in glycolysis?
- Q.9. Explain the term anomers.
- Q.10. What is the importance of amino acids to us?
- Q.11. Why are carbohydrates optically active?
- Q.12. Name two essential amino acids.
- Q.13. What are polysaccharides? Give one example.
- Q.14. Give two differences between α -glucose and β -glucose.
- Q.15. Give two important functions of nucleotides.
- Q.16. The melting point and solubility of amino acids are generally higher than that of corresponding haloacids Explain.

Q.17. Explain the following terms:

- (i) Monosaccharides (ii) Reducing sugar

Q.18. What are fat soluble vitamins? Give deficiency diseases of Vitamin E and K.

Q.19. State difference between globular and fibrous protein. Give one example of each.

Q.20. State the difference between the following pairs:

- (i) α – Helix and β – pleated sheet structure
(ii) Primary and secondary structures of protein
(iii) Enzymes and co-enzymes.

Q.21. (i) Give the products of hydrolysis of :

- (a) Maltose (b) Lactose
(ii) The two strands of DNA are not identical but complementary' Explain this statement.

Q.22. (i) Write the structural and functional differences between RNA and DNA.

(ii) What are different types of RNA found in cell?

(iii) What is difference between nucleoside and nucleotide?

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Chapter: 16 (Chemistry in Everyday Life)

Q.1. Write the name of two narcotics which are used as analgesics.

Q.2. Name the chemical responsible for the antiseptic properties of dettol.

Q.3. Define the following terms and give one example in each case:

- (i) Antibiotics. (ii) Tranquilizers.

Q.4. Describe the following with suitable examples.

- (i) Disinfectants (ii) Tranquilizers

Q.5. State an example each and function of the following:

- (i) Tranquilizers (ii) Wide spectrum antibiotics

Q.6. Sleeping pills are recommended by doctors to patients suffering from sleeplessness but it is not advisable to take dose without consultation with the doctor. Why?

Q.7. "Ranitidine is an antacid". Explain the statement.

Q.8. What is soap chemically? Why does it not give sufficient lather with hard water?

Q.9. Write the chemical equation for preparing sodium soap from glyceryl stearate.

Q.10. What are antiseptics? How are they different from disinfectant?

Q.11. Write short notes on

(i) Antihistamines

(ii) Antacids

Give one example of each

Q.12. Define the following and give examples:

(i) Antipyretics

(ii) Analgesics.

Q.13. Define antioxidants. Give two examples.

Q.14. What are preservatives? Give two examples.

Q.15. Give two examples of artificial sweeteners. What are their advantages over natural sweeteners?

Q.16. Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem? Name two drugs.

Q.17. What are cationic detergents? Give one example. What type of detergents are biodegradable?.

Q.18. Label the hydrophilic and hydrophobic parts in the following compounds.

(i) $\text{CH}_3(\text{CH}_2)_{10}\text{CH}_2\text{OSO}_3^- \text{Na}^+$

(ii) $\text{CH}_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$

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**MID TERM EXAM MODEL TEST PAPER**

**(Unsolved)**

**Time : 3 hrs.**

**M.M. : 70**

Instructions : -

- (i) All questions are compulsory.
- (ii) Question nos. 1 to 8 are very short answer questions, carrying 1 mark each. Answer these in one word or about one sentence each.
- (iii) Question nos. 9 to 18 are short answer question, carrying 2 marks each. Answer about 30 words each.
- (iv) Question nos. 19 to 27 are short answer question, carrying 3 marks each. Answer these in about 40 words each.
- (v) Question nos. 28 to 30 are long answer questions, carrying 5 marks each answer these in about 70 words each.
- (vi) Use long table if necessary.

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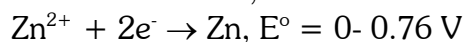
- Q.1. What is the maximum possible coordination number of an atom in an hcp crystal structure of an element?
- Q.2. State the formula relating pressure of a gas with its mole fraction in a liquid solution in contact with it.
- Q.3. Predict the product of electrolysis in: an aqueous solution of  $\text{AgNO}_3$  with platinum electrodes.
- Q.4. Express the relation between the half life period of a reactant and its initial concentration for a reaction of  $n^{\text{th}}$  order.
- Q.5. What is shape – selective catalysis?
- Q.6. Account for the following
  - (i) Silicon is an insulator but silicon doped with phosphorous acts as a semi conductor.
  - (ii) Some of the glass object recovered from ancient monument look milky instead of being transparent.
- Q.7. Derive a mathematical expression for Raoult's law for solution of non volatile solute in volatile solvents.

OR

What is an azeotrope? What type of azeotrope mixture is ethanol and water?

- Q.8. Which colligative property is preferred for the molecular mass determination of macromolecules and why?

Q.9. On the basis of given data whether zinc would be oxidized or not when placed in contact with a solution of nickel salt



Q.10. What is normal hydrogen electrode? Give the reaction that occurs at this electrode when it acts as a positive electrode in the electrochemical cell.

Q.11. Show graphically how the rate of a first order reaction with only one reactant depends upon the concentration of the reactant. Give one example of a first order reaction.

Q.12. Give two difference between physisorption and chemisorption.

Q.13. Derive an expression to calculate the available volume occupied by sphere (atoms) i.e. percentage efficiency in cases of ccp type of close packing.

Q.14. Niobium crystallizes in body centered cubic structure. If density is  $8.55 \text{ g cm}^{-3}$ . Calculate atomic radius of Niobium.

[given atomic mass of Niobium =  $94 \text{ g mol}^{-1}$ ]

Q.15. How many lattice points are there in one unit cell of each of the following lattice?

- (i) face centered cubic
- (ii) face centered tetragonal
- (iii) body centered cubic

Q.16. The vapour pressure of pure benzene at  $25^\circ \text{ C}$  is  $639.7 \text{ mm Hg}$  and the vapour pressure of a solution of a volatile solute in benzene at the same temperature is  $631.9 \text{ mm Hg}$ . Calculate the mole fraction of solute and molality of the solution.

Q.17. Explain with a suitable diagram and appropriate examples why some non ideal solutions show negative deviation from ideal behavior.

Q.18. What are fuel cells? With the help of a diagram describe the working of a fuel cell.

Q.19. Calculate the cell potential for the following cell at  $25^\circ \text{ C}$ .



$$\text{Given } E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$$

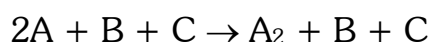
$$E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14\text{V}$$

Q.20. Mention the factors that affect the rate of a chemical reaction (three only)

Q.21. The rate constant for a first order reaction is  $60 \text{ s}^{-1}$ . How much time will it reduce the initial concentration of the reactant to its  $1/16^{\text{th}}$  value?

OR

For the reaction



The rate =  $k[A][B]^2$  with  $k = 2.0 \times 10^{-6} \text{ M}^{-2} \text{ s}^{-1}$

Calculate the initial rate of the reaction when  $[A] = 0.1\text{M}$ ,  $[B] = 0.2\text{M}$  and  $[C] = 0.8 \text{ M}$  if the rate of reverse reaction is negligible then calculate the rate of reaction after  $[A]$  is reduced to  $0.06\text{M}$ .

Q.22. Illustrate with examples

- (i) Lyophilic and lyophobic sols
- (ii) Multimolecular and Macromolecular colloids

Q.23. Explain the following observation

- (i) A beam of light passing through a colloidal solution has a visible path.
- (ii) Passing an electric current through a colloidal solution removes colloidal particles from it.
- (iii) Ferric hydroxide sol coagulates on addition of a solution of potassium sulphate.

Q.24. State hardy – schulze rule. Explain by giving an example.

- Q.25. (i) Define electrical conductivity and molar conductivity of a solution and write the unit of molar conductivity.
- (ii) The  $E^\circ$  value corresponding to the following two reduction electrode processes are:
- (a)  $\text{Cu}^+ / \text{Cu} = + 0.52\text{V}$
  - (b)  $\text{Cu}^{2+} / \text{Cu}^+ = + 0.16\text{V}$

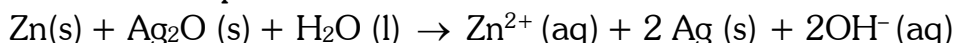
Formulate the galvanic cell for their combination. What will be the standard cell potential for it?

Calculate  $\Delta_r G^\circ$  for the cell reaction ( $F = 96500 \text{ Cmol}^{-1}$ )

- Q.26. (i) What is vant't Hoff factor? What type of value can it have if in solution the solute molecules undergo association?
- (ii) Concentrated sulphuric acid has a density of  $1.9\text{g ml}^{-1}$  and 99%  $\text{H}_2\text{SO}_4$  by weight. Calculate the molarity of  $\text{H}_2\text{SO}_4$  in the acid.

- Q.27. (i) The activation energy of reaction is  $75.2\text{kJ mol}^{-1}$  in the absence of a catalyst and  $50.14\text{kJ mol}^{-1}$  with a catalyst. How many times will the rate of reaction grow in the presence of the catalyst if the reaction proceeds at  $25^\circ \text{C}$ ?
- (ii) For the reaction  $\text{A} \rightarrow \text{B}$ , deduce the integrated form of rate law.

- Q.28. (i) In the button cell, widely used in watch and other devices, the following reaction takes places.



Determine  $E^\circ$  and  $\Delta_r G^\circ$  for the reaction

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

$E^\circ_{\text{Zn}^{2+}/\text{Zn}} = - 0.76\text{V}$

(ii) Explain with examples the term weak and strong electrolytes.

Q.29. (i) With the help of a suitable diagram show that the vapour pressure of a solution is lower than the pure solvent, causes a lowering of freezing point the solution compared to that of the pure solvent.

(ii) Calculate the amount of NaCl which must be added to one kilogram of water so that the freezing point is depressed by 2K. for water  $K_f = 1.86\text{K Kg mol}^{-1}$

Q.30. (i) A reaction is first order in A and second order in B.

(a) Write differential rate equation

(b) How is the rate affected when the concentration of B is tripled?

(ii) In a reaction between A and B, the initial rate of reaction was measured for different initial concentrations of A and B as given below:

|                     |                       |                       |                       |
|---------------------|-----------------------|-----------------------|-----------------------|
| A/M                 | 0.20                  | 0.20                  | 0.40                  |
| B/M                 | 0.30                  | 0.10                  | 0.10                  |
| ro/Ms <sup>-1</sup> | $5.07 \times 10^{-5}$ | $5.07 \times 10^{-5}$ | $14.6 \times 10^{-5}$ |

What is the order of reaction with respect to A and B?

**MID TERM EXAM MODEL TEST PAPER**

**(Solved)**

**Time : 3 hrs.**

**M.M. : 70**

Instructions : -

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Q.1. What happen to vapour pressure of water if a table spoon of sugar is added to it?

Ans. Addition of non volatile solute lowers the vapour pressure of solvent (water)

Q.2.  $\text{Fe}_3\text{O}_4$  is ferromagnetic at room temperature and becomes paramagnetic at 850K explain.

Ans. Due to randomization of spin at high temperature.

Q.3. Why do we say that a metallic conduction does not involve the transfer of any matter?

Ans. Metallic conduction is carried by the movement of electrons and not ions like an electrolytic conduction. Hence metallic conduction does not involve transfer of any matter.

Q.4. Identify the reaction order from each of the following rate constants.

(i)  $k = 6.2 \times 10^{-5} \text{ l mol}^{-1} \text{ sec}^{-1}$

(ii)  $k = 4.0 \times 10^{-4} \text{ Sec}^{-1}$

Ans. Order can be predicated by the inspection of units of rate constant

(i) Second order reaction

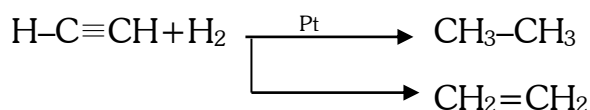
(ii) First order reaction

Q.5. How do to adsorption of a gas related to its critical temperature.

Ans. Higher is the critical temperature of a gas; greater is the ease of liquefaction of gas larger are the Vander waal's forces of attraction. Therefore, greater is the adsorption

Q.6. Explain the terms selectivity of a catalyst.

Ans. The ability of the catalyst to direct a reaction give a particular product is called selectivity.



Q.7. Classify each of the following as being either a p type semiconductor

- (i) Ge doped with In (ii) B doped with Si

Ans. (i) Ge belong to groups 14 and In belong to group 13  
 $\therefore$ , an electron deficient hole is created and it is a p- type semiconductor

(ii) B belong to group 13 and Si belong to group 14.  
 $\therefore$ , there will be a free electron and it is a n type semiconductor

Q.8. What do you understand by the terms hypertonic and hypotonic solution?

Ans. If a solution has more osmotic pressure than some other solution it is called hypertonic. On the other hand, a solution having less osmotic pressure than the other solution is called hypotonic. Thus a hypertonic solution will be more concentrated with respect to other solution and a hypotonic will be less concentrated with respect to other solution.

Q.9. How is a Ni Cad cell different from a mercury cell?

Ans. A Ni Cad cell is a secondary cell which can be recharged and reused.

Q.10. Define Henry's law and give its mathematical expression

Ans. The law states that the mass of a gas dissolved per unit volume of the solvent at given temperature is proportional to the pressure of the gas in equilibrium with the solution

$$m \propto p$$
$$m = k P$$

Where m is the mass of the gas dissolved per unit volume of the solvent, and P is the pressure of the gas in equilibrium with the solution.

Q.11. How is the word catalyst different from catalysis.

Ans. The substance which increase the rates of a reaction and can recovered chemically unchanged in mass and composition after the reaction are called catalysts.  
The phenomena of increasing the rate of a reaction by a catalyst is called catalysis.

Q.12. Give two factors which affect corrosion.

Ans. (i) Position of metals in emf series. More the reactivity of metal, more is the possibility of the metal getting corroded.



- (iii) Presence of impurities in metal. The impurities help in setting up Voltaic cells, which increase the speed of corrosion.

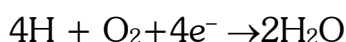
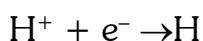
**OR**

Name the theory behind the mechanism of rusting of iron. Also give the reaction at the different electrodes.

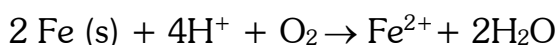
Ans. Main theory is electrochemical theory of rusting

Cell reaction at anode  $[\text{Fe(s)} \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-}] \times 2$

at cathode



over all reaction



Q13. (i) Calculated the overall order of a reaction, when is the rate expression

(a)  $\text{Rate} = k[\text{A}]^{1/2} [\text{B}]^{3/2}$

(b)  $\text{Rate} = k[\text{A}]^{3/2} [\text{B}]^{-1}$

(ii) The reaction  $\text{A} + \text{B} \rightarrow \text{C}$ , has zero order, write rate equation.

Ans. (i) (a)  $\text{Rate} = k[\text{A}]^{1/2} [\text{B}]^{3/2}$

$$\text{Order} = \frac{1}{2} + \frac{3}{2} = 2 = \text{second order}$$

(b)  $\text{Rate} = k [\text{A}]^{3/2} [\text{B}]^{-1}$

$$\text{Order} = \frac{3}{2} + (-1) = \frac{1}{2} = \text{half order}$$

(ii)  $\text{A} + \text{B} \rightarrow \text{C}$  rate equation is  $\text{rate} = k[\text{A}]^0[\text{B}]^0$

Q.14. State two condition which cause frenkel defects. Also give two examples where these defects can be located.

Ans. This defect generally occurred in compounds in which

(i) Coordination numbers is low

(ii) Anions are much larger in size than the cation.

There defects can be found in silver halides such as AgCl, Ag Br, AgI and ZnS.

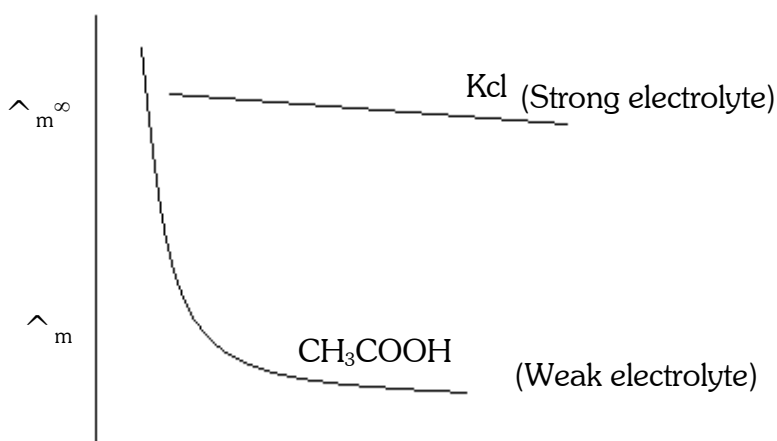
Q.15. Under what condition vant Hoff's factors 'i' is (i) equal to unity (ii) less than 1 (iii) greater than 1. Explain your answer.

Ans. (i) When the solute does not undergo any dissociation or association in the solution ie, for non electrolyte solute

(ii) When the solute undergo association in the solution

(iii) When the solute undergoes dissociation in the solution.

Q.16. Draw the graph showing the variation of molar conductivity with concentration for strong and weak electrolytes. Can we find  $\Lambda_m^\infty$  for weak and strong electrolyte using the graph.



$\Lambda_m^\infty$  can be found only for strong electrolyte by extrapolating it but  $\Lambda_m^\infty$  can not be found for weak electrolytes.

Q.17. The rate of a particular reaction triples when temperature changes from the 50°C to 100°C. Calculate the activation energy of the reaction ( $R = 8.314 \text{ J / K / Mole}$ )

$$\text{Ans. } \log \frac{k_2}{k_1} = \frac{E_a}{2.303} \left[ \frac{T_2 - T_1}{T_1 T_2} \right]$$

$$\frac{k_2}{k_1} = 3$$

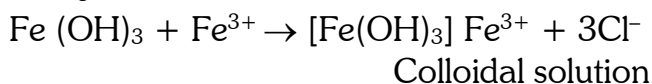
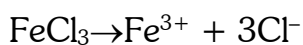
$$\log 3 = \frac{E_a}{2.303 \times 8.314} \left[ \frac{373 - 323}{323 \times 373} \right]$$

$$0.0477 = \frac{E_a \times 50}{2.303 \times 8.314 \times 323 \times 373}$$

$$E_a = 22012 \text{ J / mol}$$

Q.18. What happens when a freshly prepared  $\text{Fe}(\text{OH})_3$  is shaken with little amount of dilute solution of  $\text{FeCl}_3$ ?

Ans. A reddish brown colloidal solution of  $\text{Fe}(\text{OH})_3$  is obtained. This process is called peptization solution and form positively charged colloidal solution



Q.19. (i) What is meant by the terms coordination number?

(ii) What is the coordination number of atoms (a) in the cubic close packed structure (b) in a body centered cubic structure?

- Ans. (i) Coordination number give the number nearest neighbors with which a given sphere is in contact.  
(ii) (a) 12 (b) 8

OR

Gold (atomic radius = 0.144nm) crystallizes in a face centered unit cell. What is the length of the side of the cell.

Ans. For face centred unit cell, radius of atom

$$r = \frac{a}{2\sqrt{2}}$$

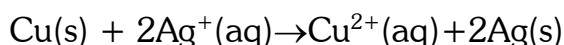
$$a = 2\sqrt{2}.r$$

$$r = 0.144 \text{ nm}$$

$$a = 2 \times 1.414 \times 0.144$$

$$0.407 \text{ nm}$$

Q.20. Calculate the equilibrium constant for the reaction at 298K



Given  $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80\text{V}$  and  $E^\circ_{\text{Cu}^{2+}/\text{Cu}} = 0.34\text{V}$

Ans.  $E^\circ_{\text{cell}} = \frac{0.059}{n} \log K_c$

$$\log K_c = \frac{nE_{\text{cell}}}{0.059}$$

$$E^\circ_{\text{cell}} = E^\circ_{\text{Ag}^+/\text{Ag}} - E^\circ_{\text{Cu}^{2+}/\text{Cu}}$$

$$0.80 - 0.34 = 0.46$$

$$\log K_c = \frac{2 \times 0.46}{0.056} = 15.6$$

$$K_c = 3.98 \times 10^{15}$$

Q.21. The osmotic pressure of a urea solution is 500mm of Hg at 10°C. The solution is diluted and its temp. is raised to 25°C. It is now found that the osmotic pressure of the solution is reduced to 105.3 mm of Hg. determine the extract of dilution of the solution?

Ans. Van't Hoff equation is

$$\pi = \frac{n_B RT}{V}$$

$$\text{at } 10^\circ\text{C} \quad \frac{500}{760} = \frac{n_B \times R \times 283}{V} \quad (\text{i})$$

$$\text{at } 25^\circ\text{C} \quad \frac{105.3}{760} = \frac{n_B \times R \times 298}{V} \quad (\text{ii})$$

Dividing (ii) by (i)

$$\frac{500}{760} \times \frac{760}{105.3} = \frac{283}{V} \times \frac{V}{298}$$

$$\frac{V}{V} = \frac{500 \times 760 \times 298}{760 \times 105.3 \times 283} = 5$$

∴ Solution has been diluted 5 times

Q.22. Name two types of emulsion and two ways of identification of emulsions.

Ans. Two types of emulsions are:

- (i) Oil in water emulsion
- (ii) Water in oil emulsion

Identification of emulsions can be done by following tests

- (i) Dilution test-add water to emulsion. If the emulsion can be diluted with water, this means that water acts as the dispersion medium and it is an example of oil in water emulsion.
- (ii) Dye test- an oil soluble dye is shaken with emulsion. If colour is noticed on looking at a drop of the emulsion, it is oil in water type emulsion. In case entire background is colored it is an example of water in oil type.

Q.23. What are adsorption isobars? Draw adsorption isobars for

- (i) Physical adsorption and
- (ii) Chemical adsorption

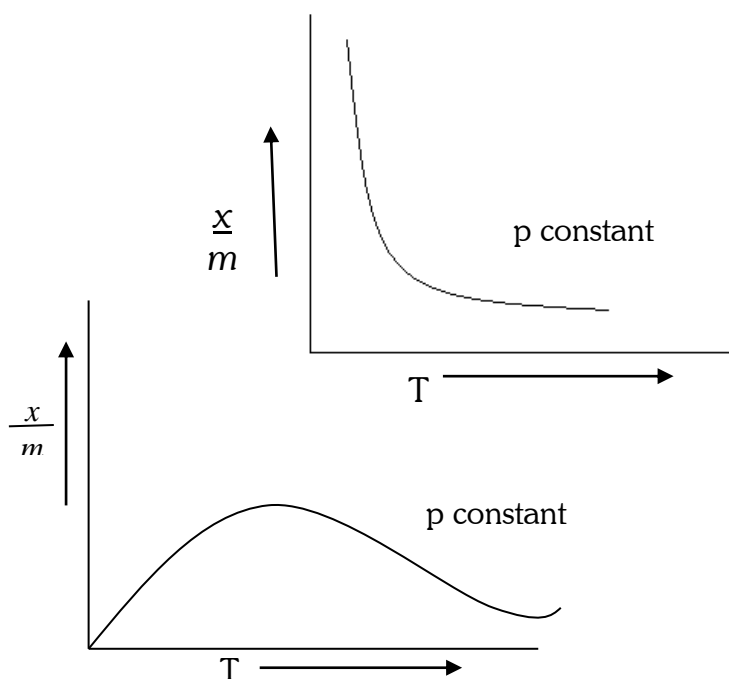
The graph between extent of adsorption and temperature at constant pressure is called adsorption isobar.

Adsorption isobars for

Ans. (i) Physical adsorption

Adsorption isobars for

(ii) Chemical adsorption



Q.24. What do you understand by the terms radius ratio?

The radius of  $\text{Na}^+$  ion is 95 pm and that of  $\text{Cl}^-$  ion is 181 pm. Predict the coordination number of  $\text{Na}^+$  ion.

Ans. The ratio of the radius of the cation to the radius of the anion is called radius ratio

$$\text{Radius ratio} = \frac{\text{Radius of the cation}}{\text{Radius of the anion}} = \frac{r^+}{r^-} = \frac{r(\text{Na}^+)}{r(\text{Cl}^-)} = \frac{95}{181} = 0.524$$

The radius ratio lies between 0.414–0.732. Hence  $\text{Na}^+$  ions prefer to occupy octahedral holes having coordination number 6.

Q.25. (i) With the help of only suitable diagram show that the lower vapour pressure of solution than the pure solvent causes a lowering in freezing point for the solution compared to that of the pure solvent,

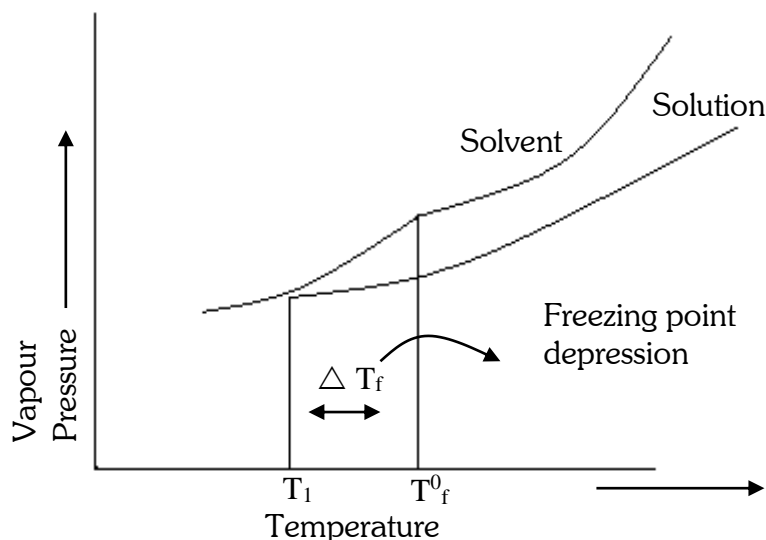
(ii) 45g of ethyl glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ) is mixed with 600g of water, calculate.

(a) Freezing point depression.

(b) The freezing point of the solution.

( $K_f$  for water = 1.86K kg / mol)

Ans.



Depression in freezing point

$$(ii) \quad \Delta T_f = \frac{K_f \times W_B \times 1000}{W_A \times M_B}$$

$$M_B = 2 \times 12 + 6 \times 1 + 2 \times 16 = 62 \text{ g/mol}$$

$$\Delta T_f = \frac{1.86 \times 45 \times 1000}{600 \times 62}$$

$$= 2.25 \text{ K}$$

$$\therefore \text{Freezing point depression} = 2.25 \text{ K}$$

$$\text{Freezing point of aqueous solution} = 273.15 - 2.25 = 270.90 \text{ K}$$

Q.26. (i) Define Kohlrausch's law and give its mathematical expression

- (ii) The molar conductivity at infinite dilution for sodium acetate, hydrochloric acid and sodium chloride are 91, 425.9 and 126.4  $\text{Scm}^2 \text{mol}^{-1}$  respectively at 298K. Calculate the molar conductivity of acetic acid at infinite dilution.

Ans. (i) Kohlraush's law states that at infinite dilution when the dissociation is complete each ion makes a definite contribution towards molar conductivity of the electrolyte irrespective of the nature of the other ion with which it is associated.

$$\Lambda_m^\infty = \nu^+ \lambda^+ + \nu^- \lambda^-$$

Where,  $\nu^+$  and  $\nu^-$  are the number of cation and anion per formula unit of electrolyte and  $\lambda^+$  and  $\lambda^-$  are the molar ionic conductance at infinite dilution.

- (ii) Molar conductivity at infinite dilution for acetic acid can be calculated as

$$\begin{aligned}\Lambda_m^\infty(\text{CH}_3\text{COOH}) &= \lambda_{\text{H}^+} + \lambda_{\text{CH}_3\text{COO}^-} \\ &= \lambda_{\text{CH}_3\text{COO}^-} + \lambda_{\text{Na}^+} + \lambda_{\text{H}^+} + \lambda_{\text{Cl}^-} - \lambda_{\text{Na}^+} - \lambda_{\text{Cl}^-} \\ &= 91 + 425.9 - 126.4 = 390.5 \text{ S cm}^2 \text{mol}^{-1}\end{aligned}$$

Q.27. (i) Is there any reaction for which reaction rate does not decrease with time? Give reason.

- (ii) The decomposition of  $\text{N}_2\text{O}_5$  at 320K according to the following equation follows first order reaction:



The initial concentration of  $\text{N}_2\text{O}_5$  was  $1.24 \times 10^{-2} \text{ mol/l}$  and that after 60 minutes was  $0.20 \times 10^{-2} \text{ mol/l}$ . Calculate the rate constant of the reaction at 320K.

Ans. (i) For a zero order reaction, the reaction rate does not decrease with time because it is independent of concentration of the reactants.

- (ii) For a first order reaction

$$\begin{aligned}k &= \frac{2.303}{t} \log \frac{[R]_0}{[R]} \\ k &= \frac{2.303}{60} \log \frac{1.24 \times 10^{-2}}{0.20 \times 10^{-2}} \\ k &= \frac{2.303}{60} \log 6.2 = \frac{2.303}{60} 0.7924 = 0.0304 \text{ min}^{-1}\end{aligned}$$

Q.28.

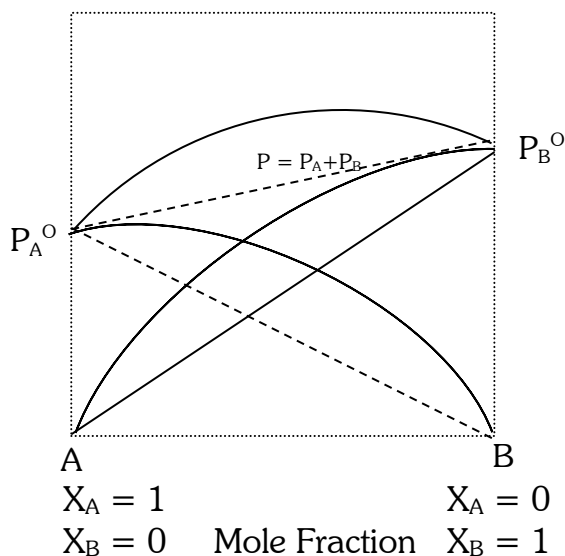
- (i) What is meant by positive deviation from Raoult's law and give an example where this can be observed.
- (ii) An aqueous solution of glucose is made by dissolving 10g of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) in 90g water at 303K. If the vapour pressure of pure water at 303K be 32.8mm. Hg, what would be the vapour pressure of the solution

- Ans. (i) When unlike interaction in the solution are weaker than the like interaction in the liquids forming the solution, then the escaping tendency of A and B types of molecules from the solution becomes more than from pure liquids. As a result, each component of solution has a partial vapour pressure greater than expected on the basis of Raoult's law.

The total vapour pressure will be greater than expected in case of ideal solution of the same composition. This type of behavior of solution is described as positive deviation from Raoult's law.

Mathematically

$$P_A > P_A^0 X_A \text{ and } P_B > P_B^0 X_B$$



- (ii) Acc. to Raoult's law  $P_A = P_A^0 X_A$

$$\text{Moles of water} = \frac{90}{18} = 5$$

$$\text{Moles of glucose} = \frac{10}{180} = 0.0556$$

$$\text{Mole fraction of water, } X_A = \frac{5 + 0.0556}{5} = 0.989$$

$$\text{V.P of solution} = 32.8 \times 0.989 = 32.44 \text{ mm}$$

Q.29

- (i) How is an electrolytic cell different from an electrochemical cell?  
(ii) If  $E^\circ$  for copper electrode is 0.34V, how will you calculate emf value when the solution in contact with it is 0.1 M in copper ions?

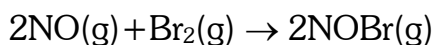
- Ans. (i) Electrochemical cell is a device which converts chemical energy into electrical energy. In electrochemical cell, anode is negative and cathode is positive while it is reverse in electrolytic cell.

- (ii)  $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$  where  $[\text{Cu}^{2+}] = 0.1 \text{ M}$

$$E = E^\circ - \frac{0.59}{2} \log \frac{1}{[\text{Cu}^{2+}]}$$

$$E = 0.34 - \frac{0.59}{2} \log \frac{1}{0.1} = 0.34 - \frac{0.59}{2} \times 1 = 0.31V$$

- Q.30. (i) Define the term activation energy. How is it related to threshold energy?  
(ii) The following data were obtained for the reaction



| Expt | Initial conc. |                    | Mol/l/Min             |
|------|---------------|--------------------|-----------------------|
|      | [NO]          | [Br <sub>2</sub> ] |                       |
| I    | 0.10          | 0.10               | $1.3 \times 10^{-6}$  |
| II   | 0.20          | 0.10               | $5.2 \times 10^{-6}$  |
| III  | 0.20          | 0.30               | $1.56 \times 10^{-6}$ |

- Determine (a) The order w.r.t NO and Br<sub>2</sub>  
(b) The rate law and  
(c) Rate constant

- Ans. (i) The excess energy (over the above) the average energy of the reactants which must be supplied to the reactants to undergo chemical reaction is called activation energy, E<sub>a</sub>  
It is equal to the difference between the threshold energy needed for the reaction and the average kinetic energy of all the reacting molecules  
∴ Activation energy = Threshold energy – average K.E of reacting molecules

- (ii) The rates law may be written as

$$\text{Rate} = k[\text{NO}]^p[\text{Br}_2]^q$$

The Initial Rate Becomes

$$(\text{Rate})_0 = k[\text{NO}]_0^p[\text{Br}_2]_0^q$$

Comparing expt. I and II, we get

$$(\text{Rate})_1 = k(0.1)^p(0.1)^q = 1.3 \times 10^{-6} \quad (1)$$

$$(\text{Rate})_2 = k(0.2)^p(0.1)^q = 5.2 \times 10^{-6} \quad (2)$$

Dividing (1) by (2)

$$\frac{(\text{Rate})_2}{(\text{Rate})_1} = \frac{k(0.2)^p(0.1)^q}{k(0.1)^p(0.1)^q}$$

$$\frac{5.2 \times 10^{-6}}{1.3 \times 10^{-6}} = \frac{2^p}{1^p}$$

$$2^p = 4$$

$$2^p = 2^2$$

$$p = 2$$



This order w.r.t NO is 2

Comparing expts II and III

$$(\text{Rate})_2 = k(0.2)^p(0.1)^q = 5.2 \times 10^{-6} \quad (3)$$

$$(\text{Rate})_3 = k(0.2)^p(0.3)^q = 1.56 \times 10^{-6} \quad (4)$$

Dividing (3) by (4)

$$\frac{k(0.2)^p(0.3)^q}{k(0.2)^p(0.1)^q} = \frac{1.56 \times 10^{-6}}{5.2 \times 10^{-6}}$$

$$3^q = 3$$

$$q = 1$$

This rate law for the reaction

$$\text{Rate} = k[\text{NO}]^2[\text{Br}_2]$$

(iii) Rate constant can be calculated by substituting the values of rate [NO] and [Br<sub>2</sub>] for any experiment

$$k = \frac{\text{Rate}}{[\text{NO}]^2 [\text{Br}_2]} = \frac{1.3 \times 10^{-6}}{(0.1)^2 (0.1)} = 1.3 \times 10^{-3} \text{ mol}^{-2} \text{ l}^2 \text{ sec}^{-1}$$

**MODEL TEST PAPER - 1**

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**General Instructions :-**

- (i) All the questions are compulsory.
  - (ii) Marks for each question are indicated against it.
  - (iii) Q. No. 1 to 8 are very short answer questions and carry one mark each. Answer these in one word or about one sentence each.
  - (iv) Q. NO. 9 to 18 are short answer questions and carry two marks each. Answer these in about 30 words each.
  - (v) Q. No. 19 to 27 are also short answer questions and carry three marks each. Answer these in about 40 words each.
  - (vi) Q. No. 28 to 30 are long answers questions and carry five marks each. Answer these in about 70 words each.
  - (vii) Use log tables, if necessary. Calculators are not allowed.
- =====

- Q.1. What type of substances would make better permanent magnets, ferromagnetic or ferromagnetic and why?
- Q.2. The decomposition reaction of ammonia on platinum surface has a rate constant  $K = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ S}^{-1}$ . What is the order of the reaction?
- Q.3. In the Brown ring test for identification of nitrate ion ( $\text{NO}_3^-$ ), what is the formula of the compound responsible for brown ring formed at the interface of solution and sulphuric acid layers?
- Q.4. How will you convert ethanol to 1-butyne?
- Q.5. Except for vitamin  $\text{B}_{12}$ , all other water soluble vitamins must be supplied regularly in diet, why?
- Q.6. Give the IUPAC name of the following:  
 $(\text{CH}_3)_2 \text{CHCOCH} (\text{CH}_3)_2$
- Q.7. The decomposition of dimethyl ether leads to the formation of  $\text{CH}_4$ ,  $\text{H}_2$  and  $\text{CO}$  and the reaction rate is given by  $\text{Rate} = K[\text{CH}_3\text{OCH}_3]^{3/2}$ . The rate of reaction is followed by increase in pressure in a closed vessel, so the rate can also be expressed in terms of the partial pressure of dimethyl ether. i.e.  $\text{Rate} = K(\text{P}_{\text{CH}_3\text{COOCH}_3})^{3/2}$ . If the pressure is measured in bar and time in minutes, then what are the units of rate and rate constant?
- Q.8. Write the relationship between atomic radius (r) and edge (a) of cubic cell for
- (i) Body-centred cubic unit cell
  - (ii) Face-centred cubic unit cell.
- Q.9. Write short note on:

(i) H-V-Z reaction

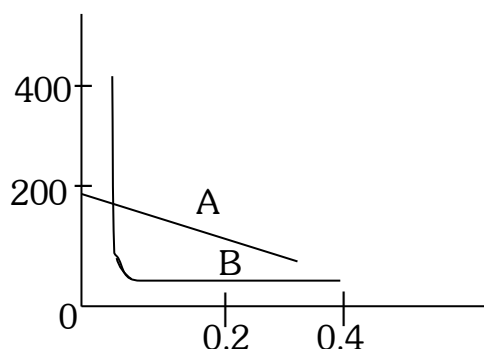
(ii) Wolff Kishner reduction

Q.10. Account for the following:

- (i) Although amino group of aniline is O and P directing in aromatic electrophilic substitution reactions, aniline on nitration gives a substantial amount of nitroaniline.
- (ii) Diazonium salts of aromatic amines are more stable than aliphatic amines.

Q.11. An element has a body centred (bcc) structure with a cell edge of 288 Pm. The density of the element is  $7.2 \text{ g/cm}^3$ . How many atoms are present in 208 g of the element?

Q.12. The following curve is obtained when molar conductivity ( $\Lambda_m$ , y-axis) is plotted against the square root of concentration  $C^{1/2}$  (x-axis) for two electrolytes A and B:



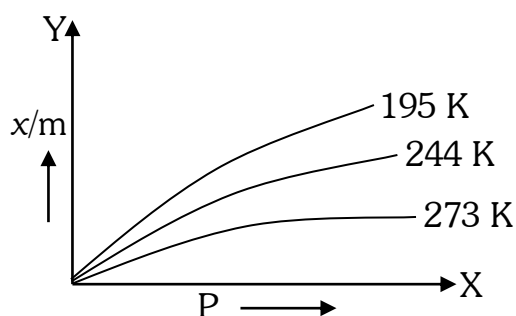
- (i) What can you say about the nature of the two electrolytes A and B?
- (ii) How do you account for the increase in molar conductivity  $\Lambda_m$  for the electrolyte A and B on dilution?

Q.13. (i) Adsorption of a gas on the surface of solid is generally accompanied by a decrease in entropy. Still it is a spontaneous process. Explain.

(ii) How does an increase in temperature effect both physical as well as chemical adsorption?

OR

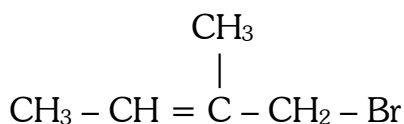
- (i) Consider the adsorption isotherms given below and interpret the variation in the extent of adsorption ( $x/m$ ) when (a) temperature increases at constant pressure (b) pressure increases at constant temperature:



- (ii) Name the catalyst and the promoter used in Haber's process for manufacture of ammonia.

- Q.14. Describe the mechanism of formation of diethyl ether from ethanol in the presence of concentrated sulphuric acid.
- Q.15. (i) Fluorine exhibits only -1 oxidation state whereas other halogens exhibit +1, +3, +5 and +7 oxidation state also. Explain.  
(ii) Does the hydrolysis of  $\text{XeF}_6$  lead to a redox reaction /
- Q.16. How will you distinguish between:  
(i) Aniline and Methylamine  
(ii)  $\text{C}_2\text{H}_5\text{NH}_2$  and  $(\text{C}_2\text{H}_5)_2\text{N} \cdot \text{H}$
- Q.17. Explain the mechanism of enzyme catalysis step wise and diagrammatically with brief explanation.
- Q.18. (i) Why does  $\text{PCl}_3$  fume in moisture?  
(ii) Which form of sulphur shows paramagnetic behaviour?
- Q.19. Calculate the emf of the cell in which the following reaction takes place:  
$$\text{Ni(s)} + 2 \text{Ag}^+ (0.002\text{M}) \rightarrow \text{Ni}^{2+} (0.16\text{M}) + 2 \text{Ag(s)}$$
  
Given that :  
$$E_{\text{Ni}^{2+}(\text{aq}) / \text{Ni(s)}} = -0.25 \text{ V}; E_{\text{Ag}^+(\text{aq}) / \text{Ag(s)}} = 0.80 \text{ V}$$
- Q.20. (i) An ore sample of galena ( $\text{PbS}$ ) is contaminated with zinc blende ( $\text{ZnS}$ ). Name one chemical which can be used to concentrate galena selectively by froth floatation method.  
(ii) Describe a method for refining Nickel.
- Q.21. (i) How can you prepare  $\text{Cl}_2$  from  $\text{HCl}$ ?  
(ii) With which neutral molecule is  $\text{ClO}^-$  isoelectronic?  
(iii) Why are interhalogen compounds more reactive than the halogens except  $\text{F}_2$ ?  
(iv) Why tendency to exhibit-2 oxidation state diminishes from oxygen to polonium ( $\text{Po}$ )?  
(v) Show structural difference of white phosphorus and red phosphorus.  
(vi) Chlorine water has both oxidizing and bleaching properties.
- Q.22. (i) Write the IUPAC name of the following  $\text{Hg} [\text{Co}(\text{SCN})_4]$ .  
(ii) Draw optical isomer of  $[\text{PtCl}_2(\text{en})_2]^{2+}$ .  
(iii)  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  are of different colours in dilute solution. Why?
- Q.23. (i) State the condition under which a bimolecular reaction may be kinetically of first order.  
(ii) Give two main points of differences between order of a reaction and molecularity of a reaction.  
(iii) Write the arrhenious equation showing effect of temperature on the rate constant.

Q.24. (i) Write IUPAC name of



- (ii) Which of the following two compounds would react faster by  $\text{SN}^2$  path way: 1-bromobutane or 2-bromobutane and why?
- (iii) Haloalkanes react with KCN to give alkyl cyanide as main product while with AgCN they form isocyanide as main product. Give reason.
- Q.25. (i) What happens when D(+) glucose is treated with Bromine water?
- (ii) Give two main points of differences between fibrous and globular protein
- (iii) What is the difference between nucleoside and a nucleotide?
- Q.26. (i) How is Buna -N prepared?
- (ii) What is the main purpose of vulcanization of rubber?
- (iii) What are biodegradable polymers? Give one example.
- Q.27 (i) Low level of noradrenaline is the cause of depression. Name two drugs used to cure this problem.
- (ii) Name a substance which can be used as antiseptic as well as disinfectant and in what concentration.
- (iii) Why is the use of aspartame limited to cold foods and drinks?
- Q.28. (i) Define the following terms:
- (a) Mole fraction      (b) Reverse osmosis
- (ii) Heptane and octane form an ideal solution at 373 K, the vapour pressures of pure liquids at this temperature are 105.2 KPa and 46.8 KPa respectively. If the solution contains 25 g of heptane and 28.5 g of octane, calculate:
- (a) Vapour pressure exerted by heptane
- (b) Vapour pressure exerted by solution
- (c) Mole fraction of octane in the vapour phase.

**OR**

- (i) State Henry's Law and mention its two important applications.
- (ii) An antifreeze solution is prepared from 222.6 g of ethylene glycol  $\text{C}_2\text{H}_6\text{O}_2$  and 200 g of water. Calculate the molality of the solution. If the density of the solution is 1.072 g/mL, then what shall be the molarity of the solution?
- Q.29. (i) Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidized.
- (ii) Give one example of disproportionation reaction in aqueous solution.
- (iii) Why Zn, Cd and Hg do not exhibit the general properties of transition elements?

- (iv) Which of the 3d series of the transition metals exhibits the largest number of oxidation state and why?
- (v) Actinoid contraction is greater from elements to element than lanthanoid contraction.

OR

- (i) What is lanthanoid contraction? Give its two main consequences.
- (ii) Explain giving reason:
  - (a) Transition metals generally form coloured compounds.
  - (b) Transition metals generally form complexes.
  - (c) Transition metals have high enthalphy of atomization.

Q.30. How are the following conversions carried?

- (i) Ethanal to butane -1, 3-diol.
- (ii) Benzoid acid to benzaldehyde.
- (iii) Phenol to salicylaldehyde.
- (iv) Ethanol to methyl alcohol.
- (v) Acetone to 4-methyl pent-3-en-2one.

OR

- (i) An organic Compound (A) with molecular formula  $C_8H_8O$  forms an orange red precipitate with 2,4-DNP reagent and gives yellow ppt. on heating with iodine in the presence of sodium hydroxide. It neither reduces Tollen's reagent nor Fehling's solution and nor does it decolorize bromine water. On drastic oxidation with chromic acid, it gives a carboxylic acid (B) having molecular formula  $C_7H_6O_2$ . Identify the compounds 9A) and (B) and write the reactions involved.
- (ii) Write the equation of reaction of preparation –
  - (a) phenol from cumene
  - (b) p-methoy acetophenone from anisole.

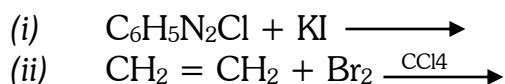
**MODEL TEST PAPER – 2**

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**General Instructions :-**

- (i) All the questions are compulsory.
  - (ii) Marks for each question are indicated against it.
  - (iii) Q. No. 1 to 8 are very short answer questions and carry one mark each. Answer these in one word or about one sentence each.
  - (iv) Q. NO. 9 to 18 are short answer questions and carry two marks each. Answer these in about 30 words each.
  - (v) Q. No. 19 to 27 are also short answer questions and carry three marks each. Answer these in about 40 words each.
  - (vi) Q. No. 28 to 30 are long answers questions and carry five marks each. Answer these in about 70 words each.
  - (vii) Use log tables, if necessary. Calculators are not allowed.
- =====

- Q.1. Define 'order of a chemical reaction'.
- Q.2. What is the total number of atoms per unit cell in a face-centred cubic (fcc) crystal structure?
- Q.3. Why is the bond angle in  $\text{PH}_3$  molecule lesser than that in  $\text{NH}_3$  molecule?
- Q.4. Of physisorption and chemisorption which type of adsorption has a higher enthalpy of adsorption?
- Q.5. Draw the structure of the compound whose IUPAC name is 4-Chloropentan-2-one.
- Q.6. Give the IUPAC name of the following:
- Q.7. Write a chemical reaction in which iodide ion displaces diazonium group from a diazonium salt.
- Q.8. Define the term 'polymerisation'.
- Q.9. List the factors which influence the rate of a chemical reaction.
- Q.10. State the law co-relating the pressure of a gas and its solubility in a liquid. State an application of this law.
- Q.11. A first order decomposition reaction takes 40 minutes for 30% of decomposition. Calculate  $t_{1/2}$  value for it.
- Q.12. Complete the following reaction equations:



- Q.13. (i) Why are haloalkanes more reactive towards nucleophilic substitution reactions than haloarenes?  
(ii) Which one of the following two substances undergoes  $S_N1$  reaction faster and why?  
(a) Primary Haloalkane (b) Secondary Haloalkane

Q.14. Answer the following:

- (i) Which neutral molecule would be isoelectronic with  $Cl^-$ ?  
(ii) Of  $Bi(V)$  and  $Sb(V)$  which may be a stronger oxidizing agent and why?

Q.15. Write complete chemical equations for:

- (i) Oxidation of  $Fe^{2+}$  by  $Cr_2O_7^{2-}$  in acid medium.  
(ii) Oxidation of  $S_2O_3^{2-}$  by  $MnO_4^-$  in neutral aqueous medium.

Q.16. How are the vitamins classified? Mention the chief sources of vitamins A and C.

Q.17. Describe the following. Giving an example for each:

- (i) Glycosidic linkage (ii) Peptide linkage

OR

Describe the following terms in reference to proteins:

- (i) Primary structure (ii) Denaturation

Q.18. What are thermoplastic and thermosetting polymers? Give one example of each.

Q.19. A solution containing 8 g of a substance in 100 g of diethyl ether boils at  $36.86^\circ C$ . Determine the molecular mass of the solute.  
(For ether  $K_b = 2.02 \text{ K kg mol}^{-1}$ )

OR

Calculate the temperature at which a solution containing 54 g of glucose,  $C_6H_{12}O_6$ , in 250 g of water will freeze. [ $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ ]

Q.20. Silver crystallizes in an lattice. The edge length of its unit cell is  $4.077 \times 10^{-8} \text{ cm}$  and its density is  $10.5 \text{ g cm}^{-3}$ . Calculate on this basis the atomic mass of silver. ( $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )

Q.21. Differentiate between multimolecular and macromolecular colloids. Give one example of each. How are these two types of colloids different from associated colloids?

Q.22. How would you account for the following situations?

- (i) The transition metals generally form coloured compounds.  
(ii) With  $3d^4$  configuration,  $Cr^{2+}$  acts as a reducing agent but  $Mn^{3+}$  acts as an oxidizing agent. (Atomic masses,  $Cr = 24$ ,  $Mn = 25$ )



- (iii) The actinoids exhibit a larger number of oxidation states than the corresponding lanthanoids.
- Q.23. (i) What is the basis of formation of the spectro-chemical series?  
(ii) Draw the structures of geometrical isomers of the following coordination complexes:  
 $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  and  $[\text{CoCl}(\text{en})_2]^+$   
(en = ethylenediamine and atomic number of Co is 27)
- Q.24. (i) Name the reagents and write the chemical equations for the preparation of the following compounds by williamson's synthesis.  
(a) Ethoxybenzene  
(b) 2-Methyl-2-methoxypropane  
(ii) Why do phenols not give the protonation reaction readily?
- Q.25. What chemical principle is involved in choosing a reducing agent for getting the metal from its oxide ore? Consider the metal oxides,  $\text{Al}_2\text{O}_3$  and  $\text{Fe}_2\text{O}_3$ , and justify the choice of reducing agent in each case.
- Q.26. Account the following observations:  
(i)  $\text{pK}_b$  value for aniline is more than that for methylamine.  
(ii) Methylamine in water reacts with ferric chloride to give a precipitate of ferric hydroxide.  
(iii) Aniline does not undergo Friedel-crafts reaction.
- Q.27. Mention one use each of the following drugs:  
(i) Ranitidine  
(ii) Paracetamol  
(iii) Tincture of iodine
- Q.28. Conductivity of 0.00241 M acetic acid is  $7.896 \times 10^{-5} \text{ S cm}^{-1}$ . Calculate its molar conductivity. If  $\wedge^\circ_m$  for acetic acid is  $390.5 \text{ S cm}^2 \text{ mol}^{-1}$ . What is its dissociation constant?

OR

Three electrolytic cells A, B and C containing solutions of zinc sulphate, silver nitrate and copper sulphate respectively are connected in series. A steady current of 1.5 ampere is passed through them until 1.45 g of silver is deposited at the cathode of cell B. How long did the current flow? What mass of copper and what mass of zinc were deposited on the concerned electrodes? (Atomic masses: Ag = 108, Zn = 65.4, Cu = 64.5, all in amu)

- Q.29. (i) Giving a chemical equation each, illustrate the following processes:  
(a) Cannizzaro reaction  
(b) Acetylation  
(c) Decarboxylation

- (ii) State chemical tests to distinguish between the following pairs of compounds:
- (a) Propanal and Propanone
  - (b) Phenol and Benzoic acid

OR

- (i) An organic compound A contains 69.77% carbon, 11.63% hydrogen and the rest is oxygen. The molecular mass of the compound is 86. It does not reduce Tollen's reagent but forms an addition product with sodium hydrogen sulphite and gives positive iodoform test. On vigorous oxidation it gives ethanoic and propanoic acids. Write the possible structure of the compound A.
- (ii) Write the chemical tests to distinguish between the following pairs of compounds;
- (a) Acetophenone and Benzophenone
  - (b) Ethanal and Propanal

Q.30. Assign reasons for the following:

- (i) Sulphur vapour is paramagnetic.
- (ii) Ammonia ( $\text{NH}_3$ ) has greater affinity for protons than phosphine ( $\text{PH}_3$ )
- (iii) The negative value of electron gain enthalpy of fluorine is less than that of chlorine.
- (iv)  $\text{SF}_6$  is much less reactive than  $\text{SF}_4$
- (v) Of the noble gases only xenon is known to form well-established chemical

OR

- (i) Describe the favourable conditions for the manufacture of
- (a) Ammonia by Haber's process, and
  - (b) sulphuric acid by contact process.
- (ii) Draw the structure of the following:
- (a)  $\text{PCl}_5$  (g)
  - (b)  $\text{S}_8$  (g)
  - (c)  $\text{ClF}_3$  (g)

**MODEL TEST PAPER – 3**

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**General Instructions :-**

- (i) All the questions are compulsory.
  - (ii) Marks for each question are indicated against it.
  - (iii) Q. No. 1 to 8 are very short answer questions and carry one mark each. Answer these in one word or about one sentence each.
  - (iv) Q. NO. 9 to 18 are short answer questions and carry two marks each. Answer these in about 30 words each.
  - (v) Q. No. 19 to 27 are also short answer questions and carry three marks each. Answer these in about 40 words each.
  - (vi) Q. No. 28 to 30 are long answers questions and carry five marks each. Answer these in about 70 words each.
  - (vii) Use log tables, if necessary. Calculators are not allowed.
- =====

Q.1. What is the number of atoms in a unit cell of a face-centred cubic crystal?

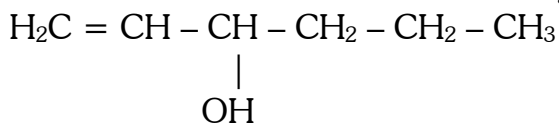
Q.2. What is the 'coagulation' process?

Q.3. Why is red phosphorus less reactive than white phosphorus?

Q.4. What is meant by the term 'pyrometallurgy'?

Q.5. Write the structural formula of I-phenylpentan – 1 – one.

Q.6. Give the IUPAC name of the following compound:

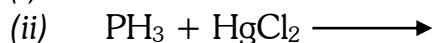
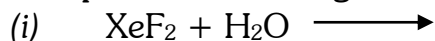


Q.7. What does '6,6' indicate in the name nylon – 6,6?

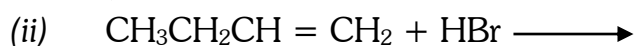
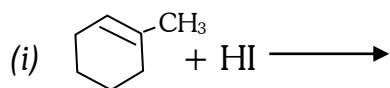
Q.8. Arrange the following compounds in an increasing order of basic strengths in their aqueous solutions:



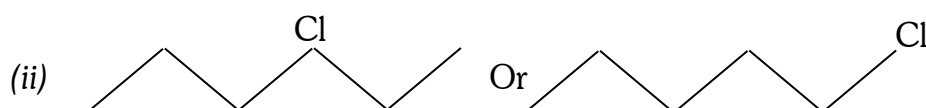
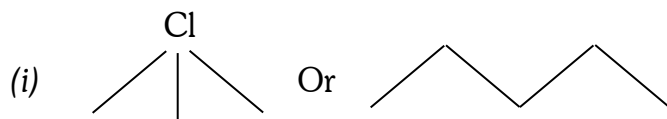
Q.9. Complete the following chemical reaction equations:



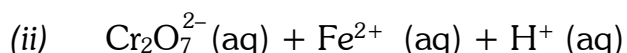
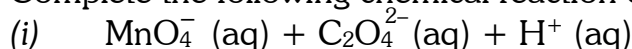
Q.10. Complete the following reaction equations:



Q.11. Which one in the following pairs undergoes  $\text{S}_\text{N}1$  substitution reaction faster and why?



Q.12. Complete the following chemical reaction equations:



Q.13. Describe the role of the following:

(i) NaCN in the extraction of silver from a silver ore.

(ii) Cryolite in the extraction of aluminium from pure alumina.

Q.14. Define the following:

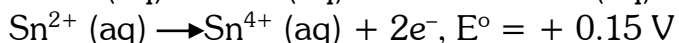
(i) Order of a reaction

(ii) Activation energy of a reaction

Q.15. What type of cell is a lead storage battery? Write the anode and the cathode reactions and the overall cell reaction occurring in the use of a lead storage battery.

OR

Two half cell reactions of an electrochemical cell are given below:



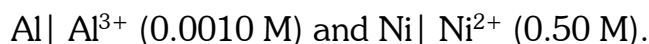
Construct the redox equation from the two half cell reactions and predict if this reaction favours formation of reactants or product shown in the equation.

Q.16. Name the four bases present in DNA. Which one of these is not present in RNA?

Q.17. Differentiate between condensation and addition polymerisations. Give one example each of the resulting polymers.

Q.18. Name two fat soluble vitamins, their sources and the diseases caused due to their deficiency in diet.

- Q.19. Silver crystallises with face-centred cubic unit cells. Each side of the unit cell has a length of 409 pm. What is the radius of an atom of silver? (Assume that each face atom is touching the four corner atoms.)
- Q.20. A first order reaction has a rate constant of  $0.0051 \text{ min}^{-1}$ . If we begin with 0.10 M concentration of the reactant, what concentration of the reactant will be left after 3 hours?
- Q.21. A voltaic cell is set up at  $25^\circ \text{C}$  with the following half – cells :



Write the equation for the cell reaction that occurs when the cell generates and electric current and determine the cell potential.

(Given :  $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$  ,  $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66 \text{ V}$ )

- Q.22. What happens in the following activities and why?

- (i) An electrolyte is added to a hydrated ferric oxide sol in water.
- (ii) A beam of light is passed through a colloidal solution.
- (iii) An electric current is passed through a colloidal solution.

- Q.23. Explain the following:

- (i) Low spin octahedral complexes of nickel are not known.
- (ii) The  $\pi$ -complexes are known for transition elements only.
- (iii) CO is a stronger ligand than  $\text{NH}_3$  for many metals.

OR

Compare the following complexes with respect to structural shapes of units, magnetic behaviour and hybrid orbitals involved in units:

- (i)  $[\text{Ni}(\text{CN})_4]^{2-}$
- (ii)  $[\text{NiCl}_4]^{2-}$
- (iii)  $[\text{CoF}_6]^{3-}$

[At. Nos. : Ni = 28; Co = 27]

- Q.24. How would you account for the following:

- (i) Many of the transition elements and their compounds can act as good catalysts.
- (ii) The metallic radii of the third (5d) series of transition elements are virtually the same as those of the corresponding members of the second series.
- (iii) There is a greater range of oxidation states among the actinoids than among the lanthanoid.

- Q.25. Explain the following observations:

- (i) The boiling point of ethanol is higher than that of methoxymethane.
- (ii) Phenol is more acidic than ethanol.
- (iii) o – and p – nitrophenols are more acidic than phenol.

(i) 
$$\text{R} - \overset{\text{O}}{\underset{||}{\text{C}}} - \text{NH}_2 \xrightarrow[\text{H}_2\text{O}]{\text{LiAlH}_4}$$

(ii) 
$$\text{C}_6\text{H}_5\text{N}_2\text{Cl} + \text{H}_3\text{PO}_2 + \text{H}_2\text{O} \longrightarrow$$

(iii) 
$$\text{C}_6\text{H}_5\text{NH}_2 + \text{Br}_2 (\text{aq}) \longrightarrow$$

- (i) Cationic detergents
- (ii) Enzymes
- (iii) Sweetening agents

(a) Mole fraction (b) Van't Hoff factor

OR

(a) Colligative properties
(b) Molality of a solution

Q.29. (i) Write chemical equations to illustrate the following name bearing reactions:

(a) Cannizzaro's reaction  
(b) Hall – Volhard – Zelinsky reaction

(ii) Give chemical tests to distinguish between the following pairs of compounds:

(a) Propanal and Propanone  
(b) Acetophenone and Benzophenone

(c) Phenol and Benzoic acid

OR

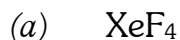
(iii) How will you bring about the following conversions:

(a) Ethanol to 3 – hydroxybutanal  
(b) Benzaldehyde to Benzophenone

(iv) An organic compound A has the molecular formula  $C_8H_{16}O_2$ . It gets hydrolysed with dilute sulphuric acid and gives a carboxylic acid B and an

alcohol C. Oxidation of C with chromic acid also produced B. C on dehydration reaction give but – 1 – ene. Write equations for the reactions involved.

Q.30. (i) Draw the structures of the following:



(ii) Explain the following observations:

(a) Phosphorus has a greater tendency for catenation than nitrogen.

(b) The negative value of electron gain enthalpy is less for fluorine than that for chlorine.

(c) Hydrogen fluoride has a much higher point than hydrogen chloride.

OR

(iii) Draw the structure of the following:



(iv) Explain the following observation:

(a) Ammonia has a higher boiling point than phosphine.

(b) Helium does not form any chemical compound.

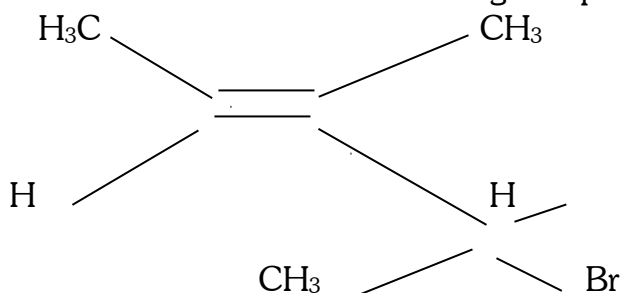
(c) Bi (V) is a stronger oxidising agent than Sb (V).

**MODEL TEST PAPER - 4**

General Instructions :

- (i) All questions are compulsory.
- (ii) Marks for each question are indicated against it.
- (iii) Questions number 1 to 8 are very short-answer questions and carry 1 mark each.
- (iv) Questions number 9 to 18 are short-answer questions and carry 2 marks each.
- (v) Questions number 19 to 27 are also short-answer questions and carry 3 marks each.
- (vi) Questions number 28 to 30 are long answer questions and carry 5 marks each.
- (vii) Use Log Tables, if necessary. Use of calculators is not allowed.

1. Write a distinguishing feature of metallic solids.
2. Fluorine does not exhibit any positive oxidation state. Why?
3. Differentiate between molarity and molality of a solution.
4. Write the structure of the molecule of a compound whose IUPAC name is : 1-phenylpropan-2-ol
5. What is Tollen's reagent? Write one usefulness of this reagent.
6. Give the IUPAC name of the following compound :



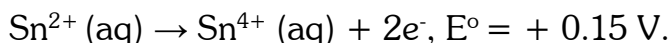
7. What does the designation '6,6' mean in the name nylon – 6,6 ?
8. What are the products of hydrolysis of sucrose?
9. Given that the standard electrode potentials ( $E^\circ$ ) of metals are :  
 $\text{K}^+ / \text{K} = -2.93 \text{ V}$ ,  $\text{Ag}^+ / \text{Ag} = 0.80 \text{ V}$ ,  $\text{Cu}^{2+} / \text{Cu} = 0.34 \text{ V}$ ,  
 $\text{Mg}^{2+} / \text{Mg} = -2.37 \text{ V}$ ,  $\text{Cr}^{3+} / \text{Cr} = -0.74 \text{ V}$ ,  $\text{Fe}^{2+} / \text{Fe} = -0.44 \text{ V}$ .  
Arrange these metals in an increasing order of their reducing power.

OR

Two half-reactions of an electrochemical cell are given below :







Construct the redox reaction equation from the two half-reactions and calculate the cell potential from the Standard potentials and predict if the reaction is reactant or product favoured.

10. Express the relation among the cell constant, the resistance of the solution in the cell and the conductivity of the solution. How is the conductivity of a solution related to its molar conductivity?
11. Define the terms, 'osmosis' and 'osmotic pressure'. What is the advantage of using osmotic pressure as compared to other colligative properties for the determination of molar masses of solutes in solutions?
12. Complete the following chemical reaction equations :
- (i)  $\text{I}_2 + \text{HNO}_3 \rightarrow$   
(conc.)
- (ii)  $\text{HgCl}_2 + \text{PH}_3 \rightarrow$
13. What is meant by coagulation of a colloidal solution? Name any method by which coagulation of lyophobic sols can be carried out.
14. Describe the following :
- (i) Tyndall effect (ii) Shape – selective catalysis
15. Identify A and B in each of the following processes
- (i)  $\text{CH}_3\text{CH}_2\text{Cl} \xrightarrow{\text{NaCN}} \text{A} \xrightarrow[\text{Ni} / \text{H}_2]{\text{reduction}} \text{B}$
- (ii)  $\text{C}_6\text{H}_5\text{NH}_2 \xrightarrow{\text{NaNO}_2 / \text{HCl}} \text{A} \xrightarrow[\text{OH}^{-}]{\text{C}_6\text{H}_5\text{NH}_2} \text{B}$
16. Draw the structural formulae of the following compounds :
- (i)  $\text{H}_4\text{P}_2\text{O}_5$  (ii)  $\text{XeF}_4$
17. Give the chemical tests to distinguish between the following pairs of compounds :
- (i) Ethylamine and Aniline (ii) Aniline and Benzylamine
18. Draw the molecular structures of the monomers of
- (i) PVC (ii) Teflon
19. Silver crystallises in fcc lattice. If the edge length of the unit cell is  $4.07 \times 10^{-8} \text{ cm}$  and the density of the crystal is  $10.5 \text{ g cm}^{-3}$ , calculate the atomic mass of the silver. ( $N_A = 6.02 \times 10^{23} \text{ atoms mol}^{-1}$ )

20. 15 g of an unknown molecular substance was dissolved in 450 g of water. The resulting solution freezes at  $-0.34^{\circ}\text{C}$ . What is the molar mass of the substance? ( $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ )
21. Describe the role of the following :
- (i) NaCN in the extraction of silver from a silver ore
  - (ii) Iodine in the refining of titanium
  - (ii) Cryolite in the metallurgy of aluminium

OR

Describe the principle involved in each of the following processes of metallurgy :

- (i) Froth floatation method
  - (ii) Electrolytic refining of metals
  - (iii) Zone refining of metals
22. How would you account for the following :
- (i) The electron gain enthalpy with negative sign is less for oxygen than that for sulphur.
  - (ii) Phosphorus shows greater tendency for catenation than nitrogen.
  - (iii) Fluorine never acts as the central atom in polyatomic interhalogen compounds.
23. How would you convert the following :
- (i) Phenol to benzoquinone
  - (ii) Propanone to 2-methylpropan-2-ol
  - (iv) Propene to propan-2-ol
24. How would you differentiate between  $\text{SN}^1$  and  $\text{SN}^2$  mechanisms of substitution reactions? Give one example of each.
25. Write the name, the state of hybridization, the shape and the magnetic behaviour of the following complexes :
- $[\text{CoCl}_4]^{2-}$ ,  $[\text{Ni}(\text{CN})_4]^{2-}$ ,  $[\text{Cr}(\text{H}_2\text{O})_2(\text{C}_2\text{O}_4)_2]^{-}$   
(At. No. : Co = 27, Ni = 28, Cr = 24)
26. Differentiate between fibrous proteins and globular proteins. What is meant by the denaturation of a proteins?
27. Explain the following terms with an example for each :
- (i) Antibiotics
  - (ii) Antiseptics
  - (iii) Analgesics
28. (a) Complete the following chemical equations :
- (i)  $\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + \text{H}_2\text{S} (\text{g}) + \text{H}^+ (\text{aq}) \rightarrow$
  - (ii)  $\text{Cu}^{2+} (\text{aq}) + \text{I}^- (\text{aq}) \rightarrow$

- (b) How would you account for the following :
- (i) The oxidizing power of oxoanions are in the order  $\text{VO}_2^+ < \text{Cr}_2\text{O}_7^{2-} < \text{MnO}_4^-$ .
  - (ii) The third ionization enthalpy of manganese ( $Z = 25$ ) is exceptionally high.
  - (iii)  $\text{Cr}^{2+}$  is a stronger reducing agent than  $\text{Fe}^{2+}$ .

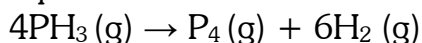
OR

- (a) Complete the following chemical equations :
- (i)  $\text{MnO}_4^- (\text{aq}) + \text{S}_2\text{O}_3^{2-} (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightarrow$
  - (ii)  $\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + \text{Fe}^{2+} (\text{aq}) + \text{H}^+ (\text{aq}) \rightarrow$
- (b) Explain the following observations :
- (i)  $\text{La}^{3+}$  ( $Z = 57$ ) and  $\text{Lu}^{3+}$  ( $Z = 71$ ) do not show any colour in solutions.
  - (ii) Among the divalent cations in the first series of transition elements, manganese exhibits the maximum paramagnetism.
  - (iii)  $\text{Cu}^+$  ion is not known in aqueous solutions.

29. (a) Explain the following terms :

- (i) Rate of a reaction
- (ii) Activation energy of a reaction

- (b) The decomposition of phosphine,  $\text{PH}_3$ , proceeds according to the following equation :



It is found that the reaction follows the following rate equation :

$$\text{Rate} = k [\text{PH}_3].$$

The half – life of  $\text{PH}_3$  is 37.9 s at  $120^\circ \text{C}$ .

- (i) How much time is required for  $3/4^{\text{th}}$  of  $\text{PH}_3$  to decompose?
- (ii) What fraction of the original sample of  $\text{PH}_3$  remains behind after 1 minute?

OR

- (a) Explain the following terms :

- (i) Order of a reaction
- (ii) Molecularity of a reaction

- (b) The rate of a reaction increases four times when the temperature changes from 300 K to 320 K. Calculate the energy of activation of the reaction, assuming that it does not change with temperature.  
( $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ )

30. (a) Illustrate the following name reactions giving a chemical equation in each case :
- (i) Clemmensen reaction                      (ii) Cannizzaro's reaction
- (b) Describe how the following conversions can be brought about :
- (i) Cyclohexanol to Cyclohexan – 1 – one  
(ii) Ethylbenzene to benzoic acid  
(iii) Bromobenzene to benzoic acid

OR

- (a) Illustrate the following name reactions :
- (i) Hell – Volhard – Zelinsky reaction  
(ii) Wolff – Kishner reduction reaction
- (b) How are the following conversions carried out :
- (i) Ethylcyanide to ethanoic acid  
(ii) Butan-1-ol to butanoic acid  
(iii) Methylbenzene to benzoic acid

Write chemical equations for the involved reactions.

**MODEL TEST PAPER – 5**

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General Instructions:

- (i) All questions are compulsory.
- (ii) Marks for each question are indicated against it.
- (iii) Questions number 1 to 8 are very short-answer questions and carry 1 mark each.
- (iv) Questions number 9 to 18 are short-answer questions and carry 2 marks each.
- (v) Questions number 19 to 27 are also short-answer questions and carry 3 marks each.
- (vi) Questions number 28 to 30 are long answer questions and carry 5 marks each.

Use Log Tables, if necessary. Use of calculators is not allowed.

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Q.1. Define 'order of a reaction'.

Q.2. What is meant by 'shape selective catalysis'?

Q.3. Differentiate between a mineral and an ore.

Q.4. What is meant by 'lanthanoid contraction'?

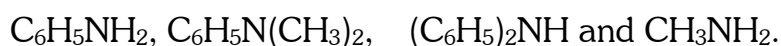
Q.5. Write the IUPAC name of the following compound :



Q.6. Draw the structure of 4-chloropentan-2-one.

Q.7. How would you convert ethanol to ethene?

Q.8. Rearrange the following in an increasing order of their basic strengths:



Q.9. Explain how you can determine the atomic mass of an unknown metal if you know its mass density and the dimensions of unit cells of its crystal.

Q.10. Calculate the packing efficiency of a metal crystal for a simple cubic lattice.

Q.11. State the following :

- (i) Raoult's law in its general form in reference to solutions.
- (ii) Henry's law about partial pressure of a gas in a mixture.

Q.12. What do you understand by the rate law and rate constant of a reaction? Identify the order of a reaction if the units of its rate constant are :

- (i)  $\text{L}^{-1} \text{mol s}^{-1}$
- (ii)  $\text{L mol}^{-1} \text{s}^{-1}$

- Q.13. The thermal decomposition of  $\text{HCO}_2\text{H}$  is a first order reaction with a rate constant of  $2.4 \times 10^{-3} \text{ s}^{-1}$  at a certain temperature. Calculate how long will it take for three-fourths of initial quantity of  $\text{HCO}_2\text{H}$  to decompose. ( $\log 0.25 = 0.6021$ )
- Q.14. Describe the principle controlling each of the following processes :
- (i) Vapour phase refining of titanium metal
  - (ii) Froth flotation method of concentration of a sulphide ore
- Q.15. How would you account for the following :
- (i)  $\text{Cr}^{2+}$  is reducing in nature while with the same d-orbital configuration ( $d^4$ )  $\text{Mn}^{3+}$  is an oxidising agent.
  - (ii) In a transition series of metals, the metal which exhibits the greatest number of oxidation states occurs in the middle of the series.
- Q.16. Complete the following chemical equations :
- (i)  $\text{MnO}_4^- (\text{aq}) + \text{S}_2\text{O}_3^{2-} (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightarrow$
  - (ii)  $\text{Cr}_2\text{O}_7^{2-} (\text{aq}) + \text{Fe}^{2+} (\text{aq}) + \text{H}^+ (\text{aq}) \rightarrow$

OR

**State reasons for the following :**

- (i) Cu (I) ion is not stable in an aqueous solution.
  - (ii) Unlike  $\text{Cr}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Fe}^{3+}$  and the subsequent other  $\text{M}^{2+}$  ions of the 3d series of elements, the 4d and the 5d series metals generally do not form stable cationic species.
- Q.17. Explain what is meant by the following :
- (i) peptide linkage
  - (ii) pyranose structure of glucose
- Q.18. Write the main structural difference between DNA and RNA of the four bases, name those which are common to both DNA and RNA.
- Q.19. A solution prepared by dissolving 8.95 mg of a gene fragment in 35.0 mL of water has an osmotic pressure of 0.335 torr at  $25^\circ \text{C}$ . Assuming that the gene fragment is a non-electrolyte, calculate its molar mass.
- Q.20. Classify colloids where the dispersion medium is water. State their characteristics and write an example of each of these classes.

OR

Explain what is observed when

- (i) an electric current is passed through a sol
- (ii) a beam of light is passed through a sol
- (iii) an electrolyte (say NaCl) is added to ferric hydroxide sol

Q.21. How would you account for the following:

- (i)  $\text{H}_2\text{S}$  is more acidic than  $\text{H}_2\text{O}$ .
- (ii) The N – O bond in is shorter than the N – O bond in
- (iii) Both  $\text{O}_2$  and  $\text{F}_2$  stabilize high oxidation states but the ability of oxygen to stabilize the higher oxidation state exceeds that of fluorine.

Q.22. Explain the following terms giving a suitable example in each case :

- (i) Ambident ligand
- (ii) Denticity of a ligand
- (iii) Crystal field splitting in an octahedral field

Q.23. Rearrange the compounds of each of the following sets in order of reactivity towards  $\text{S}_{\text{N}}2$  displacement :

- (i) 2-Bromo-2methylbutane, 1-Bromopentane, 2-Bromopentane
- (ii) 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 3-Bromo-2-methylbutane
- (iii) 1-Bromobutane, 1-Bromo-2, 2-dimethylpropane, 1-Bromo-2-methylbutane

Q.24. How would you obtain the following :

- (i) Benzoquinone from phenol
- (ii) 2-Methylpropan-2-ol from methylmagnesium bromide
- (iii) Propan-2-ol from propene

Q.25. State reasons for the following :

- (i)  $\text{pK}_{\text{b}}$  value for aniline is more than that for methylamine.
- (ii) Ethylamine is soluble in water whereas aniline is not soluble in water.
- (iii) Primary amines have higher boiling points than tertiary amines.

Q.26. Draw the structures of the monomers of the following polymers :

- (i) Polythene
- (ii) PVC
- (iii) Teflon

Q.27. What are the following substances? Give one example of each.

- (i) Food preservatives
- (ii) Synthetic detergents
- (iii) Antacids

- Q.28. a. What type of a battery is lead storage battery? Write the anode and cathode reactions and the overall cell reaction occurring in the operation of a lead storage battery.
- b. Calculate the potential for half-cell containing  $0.10 \text{ M K}_2\text{Cr}_2\text{O}_7 \text{ (aq)}$ ,  $0.20 \text{ M Cr}^{3+} \text{ (aq)}$  and  $1.0 \times 10^{-4} \text{ M H}^+ \text{ (aq)}$  The half-cell reaction is
- $$\text{(aq)} + 14 \text{ H}^+ \text{ (aq)} + 6\text{e}^- \rightarrow 2 \text{ Cr}^{3+} \text{ (aq)} + 7 \text{ H}_2\text{O} \text{ (l)}, \text{ and the standard electrode potential is given as } E^\circ = 1.33 \text{ V.}$$

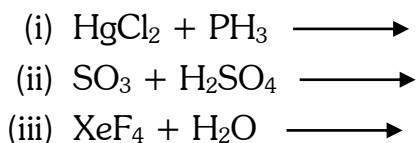
OR

- a. How many moles of mercury will be produced by electrolysis of  $1.0 \text{ M Hg(NO}_3)_2$  solution with a current of  $2.00 \text{ A}$  for  $3 \text{ hours}$ ? [ $\text{Hg (NO}_3)_2 = 200.6 \text{ g mol}^{-1}$ ]
- b. A voltaic cell is set up at  $25^\circ\text{C}$  with the following half-cells  $\text{Al}^{3+} (0.001 \text{ M})$  and  $\text{Ni}^{2+} (0.50 \text{ M})$ . Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential.
- (Given :  $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25 \text{ V}$ ,  $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66 \text{ V}$ )

- Q.29. a. Draw the structures of the following molecules :



- b. Complete the following chemical equations:



OR

- a. What happens when
- (i) chlorine gas is passed through a hot concentrated solution of  $\text{NaOH}$ ?  
(ii) sulphur dioxide gas is passed through an aqueous solution of a  $\text{Fe (III)}$  salt?
- b. Answer the following :
- (i) What is the basicity of  $\text{H}_3\text{PO}_3$  and why?  
(ii) Why does fluorine not play the role of a central atom in interhalogen compounds?  
(iii) Why do noble gases have very low boiling points?



Q.30. a. Illustrate the following name reactions :

- (i) Cannizzaro's reaction                      (ii) Clemmensen reduction

b. How would you obtain the following :

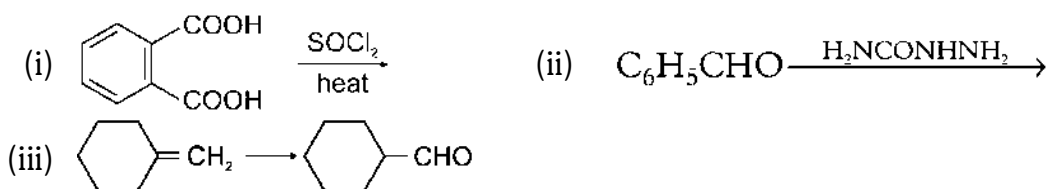
- (i) But-2-enal from ethanal                      (ii) Butanoic acid from butanol  
(iii) Benzoic acid from ethylbenzene

**OR**

a. Give chemical tests to distinguish between the following :

- (i) Benzoic acid and ethyl benzoate  
(ii) Benzaldehyde and acetophenone

b. Complete each synthesis by giving missing reagents or products in the following



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Annual Paper – 2011-12

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General Instruction:

- (i) **All** questions are compulsory.
 - (ii) Marks for each question are indicated against it.
 - (iii) Questions number **1 to 8** are very short-answer questions and carry 1 mark each.
 - (iv) Questions number **9 to 18** are short-answer questions and carry 2 marks each.
 - (v) Questions number **19 to 27** are also short-answer questions and carry 3 marks each.
 - (vi) Questions number **28 to 30** are long-answer questions and carry 5 marks each.
 - (vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.
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Q.1. How may the conductivity of an intrinsic semiconductor be increased?

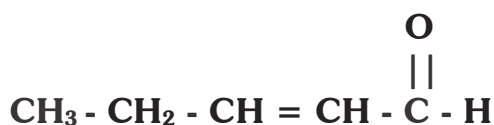
Q.2. Define 'peptization'.

Q.3. How is copper extracted from a low grade ore of it ?

Q.4. Which is a stronger reducing agent, SbH_3 or BiH_3 , and why?

Q.5. What happens when bromine attacks $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{C} \equiv \text{CH}$?

Q.6. Write the IUPAC name of the following :



Q.7. Write the structure of the product obtained when glucose is oxidised with nitric acid.

Q.8. Differentiate between disinfectants and antiseptics.

Q.9. Express the relation among cell constant, resistance of the solution in the cell and conductivity of the solution. How is molar conductivity of a solution related to its conductivity ?

OR

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

Q.10. A reaction is of second order with respect to a reactant. How is its rate affected if the concentration of the reactant is (i) doubled (ii) reduced to half?

Q.11. Which methods are usually employed for purifying the following metals:

(i) Nickel

(ii) Germanium

Mention the principle behind each one of them.

Q.12. Explain the following facts giving appropriate reason in each case :

(i) NF_3 is an exothermic compound whereas NCl_3 is not ..

(ii) All the bonds in SF_4 are not equivalent.

Q.13. Complete the following chemical reaction equations:

(i) $\text{CrO}_7^{2-} + \text{I}^- + \text{H}^+ \longrightarrow$

(ii) $\text{MnO}_4^- + \text{NO}_2^- + \text{H}^+ \longrightarrow$

Q.14. Explain the mechanism of acid catalysed hydration of an alkene to form corresponding alcohol.

Q.15. Explain the following behaviours :

(i) Alcohols are more soluble in water than the hydrocarbons of comparable molecular masses.

(ii) Ortho-nitrophenol is more acidic than ortho-methoxyphenol.

Q.16. Describe the following giving the relevant chemical equation in each case

(i) Carbylamine reaction

(ii) Hofmann's bromamide reaction

Q.17. Complete the following reaction equations

(i) $\text{C}_6\text{H}_5\text{N}_2\text{Cl} + \text{H}_3\text{PO}_2 + \text{H}_2\text{O} \longrightarrow$

(ii) $\text{C}_6\text{H}_{15}\text{NH}_2 + \text{Br}_2 (\text{aq.}) \longrightarrow$

Q.18. What are food preservatives ? Name two such substances.

Q.19. Copper crystallises with face centred cubic unit cell. If the radius of copper atom is 127.8 pm, calculate the density of copper metal.

(Atomic mass of Cu = 63.55 u and

Avogadro's number $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)

OR

Iron has a body centred cubic unit cell with the cell dimension of 286.65 pm. Density of iron is 7.87 g cm⁻³. Use this information to calculate Avogadro's number. (Atomic mass of Fe = 56.0 u)

Q.20. The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is 5.55×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity.

Q.21. The reaction, $\text{N}_2 (\text{g}) + \text{O}_2 (\text{g}) \sim 2 \text{NO} (\text{g})$ contributes to air pollution whenever a fuel is burnt in air at a high temperature. At 1500 K,

Q.22.Explain the following terms giving a suitable example for each :



- (i) Aerosol (ii) Emulsion (iii) Micelle

- (i) Among lanthanoids, Ln (III) compounds are predominant. However, occasionally in solutions or in solid compounds, +2 and +4 ions are also obtained.
- (ii) The $E^\circ_{M^{2+}/M}$ for copper is positive (0.34 V). Copper is the only *IM* metal in the first series of transition elements showing this behaviour.
- (iii) The metallic radii of the third (5d) series of transition metals are nearly the same as those of the corresponding members of the second series.

(i) $[\text{Co}(\text{en})_2 \text{Cl}_2]^+$ (en = ethan-1,2-diamine)
(ii) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$
(iii) $[\text{Co}(\text{NH}_3)_3 \text{Cl}_3]$
(Atomic numbers Cr = 24, Co = 27)

(i) What is meant by chirality of a compound ? Give an example.

(ii) Which one of the following compounds is more easily hydrolyzed by KOH and why?
CH3CHClCH2CH3 or CH3CH2CH2Cl

(iii) Which one undergoes S_N2 substitution reaction faster and why?
 **or** 

Q.27. Differentiate between thermoplastic and thermosetting polymers. Give one example of each.

(i) Define the following terms :
 (a) Mole fraction
 (b) Ideal solution

(ii) 15.0 g of an unknown molecular material is dissolved in 450 g of water. The resulting solution freezes at -0.34°C . What is the molar mass of the material? (K_f for water = $1.86 \text{ K kg mol}^{-1}$)

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- (i) Explain the following :
- (a) Henry's law about dissolution of a gas in a liquid
 - (b) Boiling point elevation constant for a solvent
- (ii) A solution of glycerol ($C_3H_8O_3$) in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of $100.42^\circ C$. What mass of glycerol was dissolved to make this solution? (K_b for water = $0.512 \text{ K kg mol}^{-1}$)

Q.29.

- (i) Draw the molecular structures of the following compounds
- (a) N_2O_5
 - (b) $XeOF_4$
- (ii) Explain the following observations
- (a) Sulphur has a greater tendency for catenation than oxygen.
 - (b) ICl is more reactive than I_2 .
 - (c) Despite lower value of its electron gain enthalpy with negative sign, fluorine (F_2) is a stronger oxidising agent than Cl_2 .

OR

- (i) Complete the following chemical equations:
- (a) $Cu + HNO_3 \text{ (dilute)} \longrightarrow$
 - (b) $XeF_4 + O_2F_2 \longrightarrow$
- (ii) Explain the following observations:
- (a) Phosphorus has greater tendency for catenation than nitrogen.
 - (b) Oxygen is a gas but sulphur a solid.
 - (c) The halogens are coloured. Why?

Q.30.

- (i) Write a suitable chemical equation to complete each of the following transformations :
- (a) Butan-1-ol to butanoic acid
 - (b) 4-Methylacetophenone to benzene-1,4-dicarboxylic acid
- (ii) An organic compound with molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1,2-benzenedicarboxylic acid. Identify the compound.

OR

- (i) Give chemical tests to distinguish between
- (a) Propanol and propanone
 - (b) Benzaldehyde and acetophenone
- (ii) Arrange the following compounds in an increasing order of their property as indicated:
- (a) Acetaldehyde, Acetone, Methyl tert-butyl ketone (reactivity towards HCN)

- (b) Benzoic acid, 3,4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)
- (c) $\text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}$, $\text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH}$, $(\text{CH}_3)_2\text{CHCOOH}$ (acid strength)

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Annual Paper – 2012-13

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General Instruction:

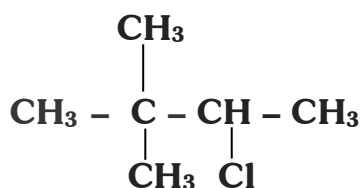
- (i) **All** questions are compulsory.
 - (ii) Marks for each question are indicated against it.
 - (iii) Questions number **1 to 8** are very short-answer questions and carry 1 mark each.
 - (iv) Questions number **9 to 18** are short-answer questions and carry 2 marks each.
 - (v) Questions number **19 to 27** are also short-answer questions and carry 3 marks each.
 - (vi) Questions number **28 to 30** are long-answer questions and carry 5 marks each.
 - (vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.
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Q.1. Of physisorption or chemisorptions, which has a higher enthalpy of adsorption?

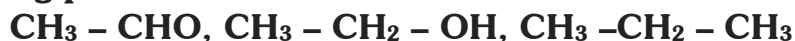
Q.2. Name the method used for refining of copper metal.

Q.3. Name two poisonous gases which can be prepared from chlorine gas.

Q.4. Write the IUPAC name of the following compound:



Q.5. Rearrange the following compounds in the increasing order of their boiling points:



Q.6. Write the structure of n-methylethanamine.

Q.7. What are the products of hydrolysis of sucrose.

Q.8. Is $\left\{ \text{CH}_2 - \underset{\text{Cl}}{\text{CH}} \right\}_n$ a homopolymer or a copolymer?

Q.9. Account for the following:

- (i) Schottky defects lower the density of related solids.
- (ii) Conductivity of silicon increases on doping it with phosphorus.

Q.10. Aluminium crystallizes in an fcc structure. Atomic radius of the metal is 125 pm. What is the length of the side of the unit cell of the metal?

Q.11. The standard electrode potential (E°) for Daniell cell is +1.1 V. Calculate the ΔG° for the reaction.



$$(1F = 96500 \text{ C mol}^{-1})$$

Q.12.

- (i) For a reaction $A+B \rightarrow P$, the rate law is given by,
 $r = k [A]^{1/2}[B]^2$
What is the order of this reaction?
- (ii) A first order reaction is found to have a rate constant $k = 5.5 \times 10^{-14} \text{ s}^{-1}$. Find the half life of the reaction.

Q.13.

- (i) Name the method used for removing gangue from sulphide ores.
- (ii) How is wrought iron different from steel?

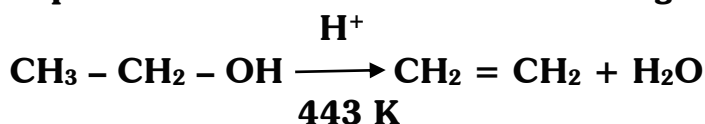
Q.14.

- (i) XeOF_4 (ii) H_3PO_3

Q.15. How are interhalogen compounds formed? What general compositions can be assigned to them?

- (i) Alcohols are more soluble in water than the hydrocarbons of comparable molecular masses.
- (ii) Ortho-nitrophenol is more acidic than ortho-methoxyphenol.

Q.16. Explain the mechanism of the following reactions:



Q.17. Write the equations involved in the following reactions:

- (i) Reimer – Tiemann reaction
- (ii) Williamson's ether synthesis

Q.18. Define thermoplastic and thermosetting polymers. Give one example of each.

OR

What is a biodegradable polymer? Give an example of a biodegradable aliphatic polyester.

Q.19. The rate of a reaction becomes four times when the temperature changes from 293 K to 313 K. Calculate the energy of activation (E_a) of the reaction assuming that it does not change with temperature.

$$[R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}, \log 4 = 0.6021]$$

Q.20. What are the characteristics of the following colloids? Give one example of each.

- (i) Multimolecular colloids

- (ii) Lyophobic sols
- (iii) Emulsions

Q.21. Give reasons for the following:

- (i) Where R is an alkyl group, $R_3P = O$ exists but $R_3N = O$ does not.
- (ii) $PbCl_4$ is more covalent than $PbCl_2$.
- (iii) At room temperature, N_2 is much less reactive.

Q.22. For the complex $[NiCl_4]^{2-}$, write:

- (i) the IUPAC name
 - (ii) the hybridization type.
 - (iii) the shape of the complex.
- (Atomic no. of Ni = 28)

OR

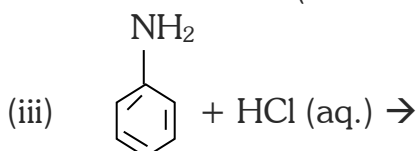
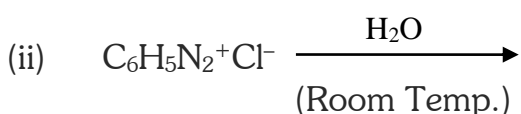
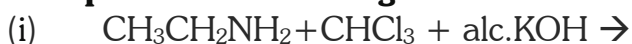
What is meant by crystal field splitting energy? On the basis of crystal field theory, write the electronic configuration of d^4 in terms of t_{2g} and e_g in an octahedral field when:

- (i) $\Delta_0 > P$
- (ii) $\Delta_0 < P$

Q.23. Give reasons for the following:

- (i) Ethyl iodide undergoes S_N2 reaction faster than ethyl bromide.
- (ii) (\pm) 2- Butanol is optically inactive.
- (iii) C – X bond length in halobenzene is smaller than C – X bond length in $CH_3 - X$.

Q.24. Complete the following reactions:



Q.25.

- (i) What class of drug is Ranitidine?
- (ii) If water contains dissolved Ca^{2+} ions, out of soaps and synthetic detergents which will you use for cleaning clothes?
- (iii) Which one of the following is an antiseptic?
0.2% phenol, 1% phenol

Q.26. Calculate the emf of the following cell at $25^\circ C$:



Given $E^\circ_{cell} = + 0.46 V$ and $\log 10^n = n$

Q.27. Shanti, a domestic helper of Mrs. Anuradha, fainted while mopping the floor. Mrs. Anuradha immediately took her to the nearby hospital where she was diagnosed to be severely 'anaemic'. The doctor prescribed an iron rich diet and multivitamins supplement to her. Mrs. Anuradha supported her financially to get medicines. After a month, Shanti was diagnosed to be normal.

After reading the above passage, answer the following questions:

- (i) What values are displayed by Mrs. Anuradha?
- (ii) Name the vitamin whose deficiency causes 'pernicious anaemia'.
- (iii) Give an example of a water soluble vitamin.

Q.28.

- (i) State Raoult's law for a solution containing volatile components. How does Raoult's law become a special case of Henry's law?
- (ii) 1.00 g of a non-electrolyte solute dissolved in 50g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (K_f for benzene = $5.12 \text{ K kg mol}^{-1}$)

OR

- (i) Define the following terms:
 - (a) Ideal solution
 - (b) Azeotrope
 - (c) Osmotic pressure
- (ii) A solution of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) in water is labeled as 10% by weight. What would be the molality of the solution?
(Molar mass of glucose = 180 g mol^{-1})

Q.29.

- (i) Give reasons for the following:
 - (a) Mn^{3+} is a good oxidizing agent.
 - (b) $E^\circ_{\text{M}^{2+}/\text{M}}$ values are not regular for first row transition metals (3d series).
 - (c) although 'F' is more electronegative than 'O', the highest Mn fluoride is MnF_4 , whereas the highest oxide is Mn_2O_7 .
- (ii) Complete the following equations:
 - (a) $2 \text{CrO}_4^{2-} + 2\text{H}^+ \rightarrow$
 - (b) $\text{KMnO}_4 \xrightarrow{\text{heat}}$

OR

- (i) Why do transition elements show variable oxidation states?
 - (a) Name the element showing maximum number of oxidation states among the first series of transition metals from Sc ($Z = 21$) to Zn ($Z = 30$).
 - (b) Name the element which shows only +3 oxidation state.

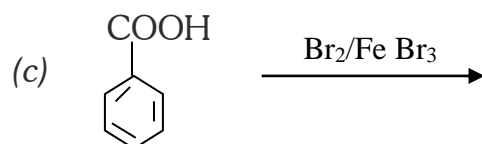
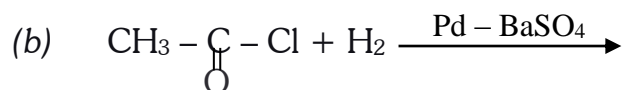
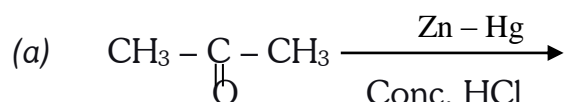
- (ii) What is lanthanoid contraction? Name an important alloy which contains some of the lanthanoid metals.

Q.30.

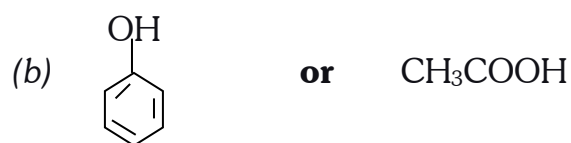
- (i) How will you convert the following:
(a) Propanone to Propan-2-ol
(b) Ethanal to 2-hydroxy propanoic acid.
(c) Toluene to benzoic acid.
(ii) Give simple chemical test to distinguish between:
(a) Pentan-2-one and Pentan-3-one
(b) Ethanal and Propanal

OR

- (i) Write the products of the following reactions:



- (ii) Which acid of each pair shown here would you expect to be stronger?



Board Paper – 2017-18

सामान्य निर्देश:

- (i) सभी प्रश्न अनिवार्य हैं।
- (ii) प्रश्न संख्या 1 से 5 तक अति लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 1 अंक है।
- (iii) प्रश्न संख्या 6 से 10 तक लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 2 अंक हैं।
- (iv) प्रश्न संख्या 11 से 22 तक भी लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 3 अंक हैं।
- (v) प्रश्न संख्या 23 मूल्याधारित प्रश्न है और इसके लिए 4 अंक हैं।
- (vi) प्रश्न संख्या 24 से 26 तक दीर्घ-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 5 अंक हैं।
- (vii) यदि आवश्यकता हो, तो लॉग टेबलों का प्रयोग करें। कैल्कुलेटर्स के उपयोग की अनुमति नहीं है।

General Instructions :

- (i) All questions are compulsory.
- (ii) Questions number 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Questions number 6 to 10 are short answer questions and carry 2 marks each.
- (iv) Questions number 11 to 22 are also short answer questions and carry 3 marks each.
- (v) Question number 23 is a value based question and carries 4 marks.
- (vi) Questions number 24 to 26 are long answer questions and carry 5 marks each.
- (vii) Use log tables, if necessary. Use of calculators is not allowed.

1. FeO का विश्लेषण दर्शाता है कि इसका $\text{Fe}_{0.95}\text{O}$ सूत्र सहित नॉन-स्टॉइकियोमीट्री संघटन होता है। कारण दीजिए। 1

Analysis shows that FeO has a non-stoichiometric composition with formula $\text{Fe}_{0.95}\text{O}$. Give reason.

2. CO (g) और H_2 (g) भिन्न उत्प्रेरकों की उपस्थिति में अभिक्रिया करके भिन्न-भिन्न उत्पाद देते हैं। इन अभिक्रियाओं द्वारा उत्प्रेरक की कौन-सी क्षमता प्रदर्शित होती है ? 1

CO (g) and H_2 (g) react to give different products in the presence of different catalysts. Which ability of the catalyst is shown by these reactions ?

3. संकुल $[\text{Pt}(\text{en})_2\text{Cl}_2]$ में प्लैटिनम की उपसहसंयोजन संख्या और ऑक्सीकरण अवस्था लिखिए ।

1

Write the coordination number and oxidation state of Platinum in the complex $[\text{Pt}(\text{en})_2\text{Cl}_2]$.

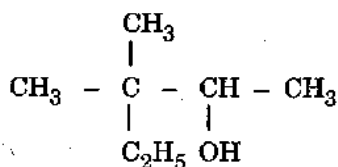
4. क्लोरोबेन्ज़ीन और बेन्ज़िल क्लोराइड में से कौन-सा जलीय NaOH द्वारा आसानी से जल-अपघटित हो जाता है और क्यों ?

1

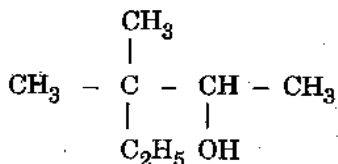
Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why ?

5. निम्नलिखित का आई.यू.पी.ए.सी. नाम लिखिए :

1



Write the IUPAC name of the following :



6. 250 g पानी में 60 g ग्लूकोस (मोलर द्रव्यमान = 180 g mol^{-1}) मिलाने पर बने विलयन का हिमांक परिकलित कीजिए । (पानी के लिए $K_f = 1.86 \text{ K kg mol}^{-1}$)

2

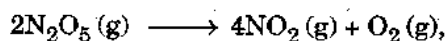
Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g mol^{-1}) in 250 g of water.

(K_f of water = $1.86 \text{ K kg mol}^{-1}$)

7. अभिक्रिया $2\text{N}_2\text{O}_5 (\text{g}) \longrightarrow 4\text{NO}_2 (\text{g}) + \text{O}_2 (\text{g})$ के लिए $\text{NO}_2 (\text{g})$ के निर्माण (विरचन) की दर $2.8 \times 10^{-3} \text{ M s}^{-1}$ है । $\text{N}_2\text{O}_5 (\text{g})$ के विलोपन की दर का परिकलन कीजिए ।

2

For the reaction



the rate of formation of $\text{NO}_2 (\text{g})$ is $2.8 \times 10^{-3} \text{ M s}^{-1}$. Calculate the rate of disappearance of $\text{N}_2\text{O}_5 (\text{g})$.

8. वर्ग-15 के तत्वों के हाइड्राइडों में से, 2
- (a) किसका निम्नतम क्वथनांक होता है ?
 - (b) किसकी अधिकतम क्षारकीय प्रकृति होती है ?
 - (c) किसका उच्चतम आबंध कोण होता है ?
 - (d) किसकी अधिकतम अपचायी प्रकृति होती है ?

Among the hydrides of Group-15 elements, which have the

- (a) lowest boiling point ?
- (b) maximum basic character ?
- (c) highest bond angle ?
- (d) maximum reducing character ?

9. आप निम्नलिखित का रूपांतरण कैसे करते हैं ? 2
- (a) एथेनॉल को प्रोपेनॉन में
 - (b) टॉलूईन को बेन्ज़ोइक अम्ल में

अथवा

निम्नलिखित के लिए कारण दीजिए : 2

- (a) ऐरोमेटिक कार्बोक्सिलिक अम्ल फ्रीडेल-क्राफ्ट्स अभिक्रिया प्रदर्शित नहीं करते हैं ।
- (b) 4-नाइट्रोबेन्ज़ोइक अम्ल का pK_a मान बेन्ज़ोइक अम्ल के pK_a मान से कम होता है ।

How do you convert the following ?

- (a) Ethanal to Propanone
- (b) Toluene to Benzoic acid

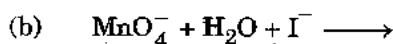
OR

Account for the following :

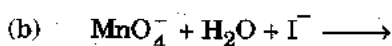
- (a) Aromatic carboxylic acids do not undergo Friedel-Crafts reaction.
- (b) pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid.

10. निम्नलिखित रासायनिक समीकरणों को पूर्ण एवं संतुलित कीजिए :

2



Complete and balance the following chemical equations :



11. निम्नलिखित के लिए कारण दीजिए :

3

- प्रोटीनों और बहुलकों जैसे बृहदाणुओं के मोलर द्रव्यमान ज्ञात करने के लिए परासरण दाब मापन विधि को वरीयता दी जाती है।
- जलीय जन्तुओं के लिए गर्म जल की तुलना में ठंडे जल में रहना अधिक आरामदायक होता है।
- 1 M KCl विलयन का क्वथनांक उन्नयन 1 M शर्करा विलयन के क्वथनांक उन्नयन से लगभग दुगुना होता है।

Give reasons for the following :

- Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.
- Aquatic animals are more comfortable in cold water than in warm water.
- Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.

12. फलक-केन्द्रित घनीय (f.c.c.) संरचना वाले एक तत्व 'X' (परमाणु द्रव्यमान = 40 g mol^{-1}) के एकक कोष्ठिका कोर की लम्बाई 400 pm है। 'X' के 4 g में उपस्थित एकक कोष्ठिकाओं की संख्या तथा 'X' का घनत्व परिकलित कीजिए। ($N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$)

3

An element 'X' (At. mass = 40 g mol^{-1}) having f.c.c. structure, has unit cell edge length of 400 pm. Calculate the density of 'X' and the number of unit cells in 4 g of 'X'. ($N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$)

13. किसी प्रथम कोटि की अभिक्रिया को 50% पूर्ण होने के लिए 300 K पर 40 मिनट लगते हैं और 320 K पर 20 मिनट लगते हैं। अभिक्रिया की सक्रियण ऊर्जा परिकलित कीजिए। (दिया गया है : $\log 2 = 0.3010$, $\log 4 = 0.6021$, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$) 3

A first order reaction is 50% completed in 40 minutes at 300 K and in 20 minutes at 320 K. Calculate the activation energy of the reaction. (Given : $\log 2 = 0.3010$, $\log 4 = 0.6021$, $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$)

14. क्या होता है जब
- किसी ताजे बने Fe(OH)_3 के अवक्षेप को FeCl_3 विलयन की थोड़ी सी मात्रा के साथ हिलाया जाता है ?
 - किसी कोलॉइडी विलयन का दीर्घस्थायी (लगातार) अपोहन किया जाता है ?
 - किसी इमल्शन का अपकेंद्रण किया जाता है ?
- 3

What happens when

- a freshly prepared precipitate of Fe(OH)_3 is shaken with a small amount of FeCl_3 solution ?
- persistent dialysis of a colloidal solution is carried out ?
- an emulsion is centrifuged ?

15. सोने के निष्कर्षण के प्रक्रम से सम्बद्ध रासायनिक अभिक्रियाएँ लिखिए। इस प्रक्रम में तनु NaCN और Zn की भूमिका की व्याख्या कीजिए। 3

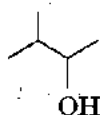
Write the chemical reactions involved in the process of extraction of Gold. Explain the role of dilute NaCN and Zn in this process.

16. कारण दीजिए : 3
- $\text{Mn}^{3+}/\text{Mn}^{2+}$ युग्म के लिए E° का मान $\text{Fe}^{3+}/\text{Fe}^{2+}$ के मान से बहुत अधिक धनात्मक होता है।
 - कॉपर की कणन एन्थैल्पी की अपेक्षा आयरन की कणन एन्थैल्पी उच्चतर होती है।
 - जलीय विलयन में Sc^{3+} रंगहीन होता है जबकि Ti^{3+} रंगीन।

Give reasons :

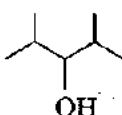
- E^0 value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+} .
- Iron has higher enthalpy of atomization than that of copper.
- Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.

17. (a) निम्नलिखित युग्म में किरल अणु की पहचान कीजिए :



(i)

तथा

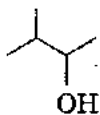


(ii)

- सोडियम धातु और शुष्क ईथर की उपस्थिति में जब क्लोरोबेन्ज़ीन की मेथिल क्लोराइड से अभिक्रिया की जाती है, तो बनने वाले उत्पाद की संरचना लिखिए।
- 1-ब्रोमो-1-मेथिलसाइक्लोहेक्सेन के ऐल्कोहॉली KOH द्वारा विहाइड्रोहैलोजनन से बनने वाले ऐल्कीन की संरचना लिखिए।

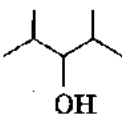
3

- (a) Identify the chiral molecule in the following pair :



(i)

&



(ii)

- Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.
- Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.

18. (A), (B) और (C) आण्विक सूत्र C_4H_8O वाले किसी कार्बोनिल यौगिक के तीन अचक्रीय अभिलक्षकी समावयव हैं। समावयव (A) और (C) सकारात्मक टॉलेन परीक्षण देते हैं जबकि समावयव (B) टॉलेन परीक्षण नहीं देता है लेकिन सकारात्मक आयोडोफॉर्म परीक्षण देता है। समावयव (A) और (B) $Zn(Hg)$ /सान्द्र HCl से अपचयित होकर समान यौगिक (D) देते हैं।

- (A), (B), (C) और (D) की संरचनाएँ लिखिए।
- समावयव (A), (B) और (C) में से कौन-सा HCN के संयोजन के प्रति न्यूनतम अभिक्रियाशील है ?

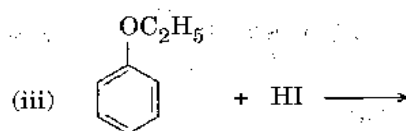
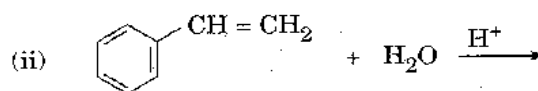
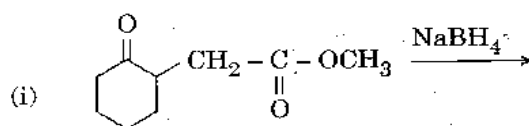
3

(A), (B) and (C) are three non-cyclic functional isomers of a carbonyl compound with molecular formula C_4H_8O . Isomers (A) and (C) give positive Tollens' test whereas isomer (B) does not give Tollens' test but gives positive Iodoform test. Isomers (A) and (B) on reduction with $Zn(Hg)/conc. HCl$ give the same product (D).

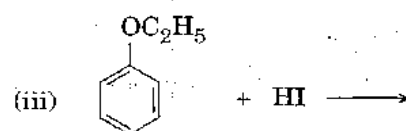
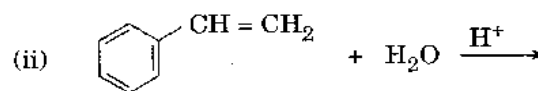
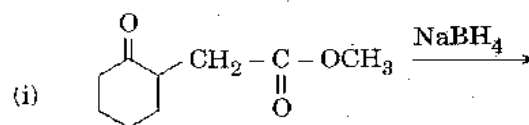
- Write the structures of (A), (B), (C) and (D).
- Out of (A), (B) and (C) isomers, which one is least reactive towards addition of HCN?

19. निम्नलिखित अभिक्रियाओं में मुख्य उत्पादों की संरचनाएँ लिखिए :

3



Write the structures of the main products in the following reactions :



56/1

8

20. (a) बाइथायोनैल को साबुन में क्यों मिलाया जाता है ?
(b) आयोडीन का टिक्चर क्या है ? इसका एक उपयोग लिखिए ।
(c) निम्नलिखित में से कौन-सा एक खाद्य परिरक्षक के रूप में कार्य करता है ?
ऐस्पार्टेम, ऐस्पिरिन, सोडियम बेन्ज़ोएट, पैरासिटैमॉल

3

- (a) Why is bithional added to soap ?
(b) What is tincture of iodine ? Write its one use.
(c) Among the following, which one acts as a food preservative ?
Aspartame, Aspirin, Sodium Benzoate, Paracetamol

21. निम्नलिखित को एक-एक उदाहरण सहित परिभाषित कीजिए :

3

- (a) पॉलिसैकैराइड
(b) विकृतीकृत प्रोटीन
(c) आवश्यक ऐमीनो अम्ल

अथवा

- (a) D-ग्लूकोस की सान्द्र नाइट्रिक अम्ल (HNO_3) के साथ अभिक्रिया करने पर बनने वाले उत्पाद को लिखिए ।
(b) ऐमीनो अम्ल उभयधर्मी व्यवहार दर्शाते हैं । क्यों ?
(c) प्रोटीनों की α -हेलिक्स तथा β -प्लीटेड संरचनाओं में एक अन्तर लिखिए ।

3

Define the following with an example of each :

- (a) Polysaccharides
(b) Denatured protein
(c) Essential amino acids

OR

- (a) Write the product when D-glucose reacts with conc. HNO_3 .
(b) Amino acids show amphoteric behaviour. Why ?
(c) Write one difference between α -helix and β -pleated structures of proteins.

22. (a) निम्नलिखित उपसहसंयोजक यौगिक का सूत्र लिखिए :
आयरन(III) हेक्सासायनोफेरेट(II)
- (b) संकुल $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ किस प्रकार की समावयवता प्रदर्शित करता है ?
- (c) संकुल $[\text{CoF}_6]^{3-}$ में संकरण और अयुग्मित इलेक्ट्रॉनों की संख्या लिखिए ।
(Co का परमाणु क्रमांक = 27)

3

- (a) Write the formula of the following coordination compound :
Iron(III) hexacyanoferrate(II)
- (b) What type of isomerism is exhibited by the complex $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$?
- (c) Write the hybridisation and number of unpaired electrons in the complex $[\text{CoF}_6]^{3-}$. (Atomic No. of Co = 27)

23. कुछ खाद्य पदार्थों को क्रय करने के लिए श्याम एक पन्सारी (किराना) की दुकान पर गया । दुकानदार ने सभी पदार्थों को पॉलिथीन के थैलों में भरकर श्याम को दिया । लेकिन श्याम ने पॉलिथीन के थैलों को स्वीकार करने से मना कर दिया तथा दुकानदार को कहा कि पदार्थों को कागज के थैलों में भरकर दिया जाए । उसने दुकानदार को सूचित किया कि पॉलिथीन के थैलों के प्रयोग पर सरकार द्वारा भारी जुर्माना लगाया जाता है । दुकानदार ने भविष्य में पॉलिथीन के थैलों की जगह कागज के थैले प्रयोग करने का वादा किया ।

निम्नलिखित के उत्तर दीजिए :

4

- (a) श्याम द्वारा दर्शाए गए मूल्यों (कम-से-कम दो) को लिखिए ।
- (b) अल्प घनत्व पॉलिथीन और उच्च घनत्व पॉलिथीन के बीच एक संरचनात्मक अन्तर लिखिए ।
- (c) श्याम ने पदार्थों को पॉलिथीन के थैलों में लेने से क्यों मना कर दिया ?
- (d) जैव-निम्नीकरणीय बहुलक क्या है ? एक उदाहरण दीजिए ।

Shyam went to a grocery shop to purchase some food items. The shopkeeper packed all the items in polythene bags and gave them to Shyam. But Shyam refused to accept the polythene bags and asked the shopkeeper to pack the items in paper bags. He informed the shopkeeper about the heavy penalty imposed by the government for using polythene bags. The shopkeeper promised that he would use paper bags in future in place of polythene bags.

Answer the following :

- (a) Write the values (at least two) shown by Shyam.

56/1

10

- (b) Write one structural difference between low-density polythene and high-density polythene.
- (c) Why did Shyam refuse to accept the items in polythene bags?
- (d) What is a biodegradable polymer? Give an example.

24. (a) कारण दीजिए :

- (i) H_3PO_3 असमानुपातन अभिक्रिया देता है परन्तु H_3PO_4 नहीं देता।
- (ii) जब Cl_2 , F_2 के आधिक्य के साथ अभिक्रिया करती है, तो ClF_3 बनता है न कि $FeCl_3$ ।
- (iii) कक्ष ताप पर डाइऑक्सीजन एक गैस है जबकि सल्फर एक ठोस है।

(b) निम्नलिखित की संरचनाएँ आरेखित कीजिए :

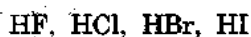
- (i) XeF_4
- (ii) $HClO_3$

5

अथवा

- (a) जब सान्द्र सल्फ्यूरिक अम्ल को किसी परखनली में उपस्थित अज्ञात लवण पर डाला गया तो एक भूरी गैस (A) निकली। इस परखनली में ताँबे की छीलन डालने पर गैस निकलने की तीव्रता में वृद्धि हो गई। ठंडा करने पर गैस (A) एक रंगहीन ठोस (B) में परिवर्तित हो गई।
- (i) (A) और (B) की पहचान कीजिए।
- (ii) (A) और (B) की संरचनाएँ लिखिए।
- (iii) गैस (A) को ठंडा करने पर वह ठोस में क्यों परिवर्तित हो जाती है?

(b) निम्नलिखित को उनके अपचायक लक्षण के घटते हुए क्रम में व्यवस्थित कीजिए :



(c) निम्नलिखित अभिक्रिया को पूर्ण कीजिए :



5

(a) Give reasons :

- (i) H_3PO_3 undergoes disproportionation reaction but H_3PO_4 does not.
- (ii) When Cl_2 reacts with excess of F_2 , ClF_3 is formed and not FCl_3 .
- (iii) Dioxygen is a gas while Sulphur is a solid at room temperature.

(b) Draw the structures of the following :

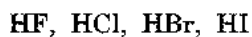
- (i) XeF_4
- (ii) HClO_3

OR

(a) When concentrated sulphuric acid was added to an unknown salt present in a test tube a brown gas (A) was evolved. This gas intensified when copper turnings were added to this test tube. On cooling, the gas (A) changed into a colourless solid (B).

- (i) Identify (A) and (B).
- (ii) Write the structures of (A) and (B).
- (iii) Why does gas (A) change to solid on cooling ?

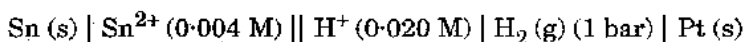
(b) Arrange the following in the decreasing order of their reducing character :



(c) Complete the following reaction :



25. (a) निम्नलिखित सेल के लिए सेल अभिक्रिया लिखिए और 298 K पर विद्युत-वाहक बल (e.m.f.) परिकलित कीजिए :



(दिया गया है : $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14 \text{ V}$)

(b) कारण दीजिए :

- (i) E° मानों के आधार पर, जलीय NaCl के विद्युत-अपघटन में एनोड पर O_2 गैस निकलनी चाहिए परन्तु Cl_2 गैस निकलती है।
- (ii) CH_3COOH की चालकता तनुकरण पर घटती है।

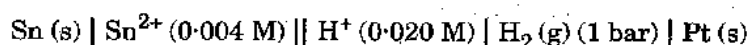
अथवा

- (a) 25°C पर अभिक्रिया

$$2\text{AgCl (s)} + \text{H}_2 \text{ (g)} (1 \text{ atm}) \longrightarrow 2\text{Ag (s)} + 2\text{H}^+ (0.1 \text{ M}) + 2\text{Cl}^- (0.1 \text{ M})$$
 के लिए $\Delta G^\circ = -43600 \text{ J}$ है।
 सेल का विद्युत्-वाहक बल (e.m.f.) परिकलित कीजिए।
 $[\log 10^{-n} = -n]$

- (b) ईंधन सेल को परिभाषित कीजिए और इसके दो लाभ लिखिए। 5

- (a) Write the cell reaction and calculate the e.m.f. of the following cell at 298 K :



(Given : $E^\circ_{\text{Sn}^{2+}/\text{Sn}} = -0.14 \text{ V}$)

- (b) Give reasons :
- On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl .
 - Conductivity of CH_3COOH decreases on dilution.

OR

- (a) For the reaction

$$2\text{AgCl (s)} + \text{H}_2 \text{ (g)} (1 \text{ atm}) \longrightarrow 2\text{Ag (s)} + 2\text{H}^+ (0.1 \text{ M}) + 2\text{Cl}^- (0.1 \text{ M}),$$
 $\Delta G^\circ = -43600 \text{ J at } 25^\circ\text{C}.$
 Calculate the e.m.f. of the cell.
 $[\log 10^{-n} = -n]$
- (b) Define fuel cell and write its two advantages.

26. (a) निम्नलिखित से सम्बद्ध अभिक्रियाएँ लिखिए :

- हॉफमान ब्रोमामाइड निम्नीकरण अभिक्रिया
- डाइऐज़ोटीकरण
- गैब्रियल बैलिमाइड संश्लेषण

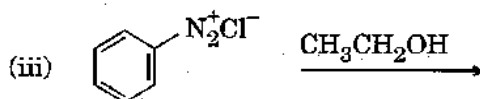
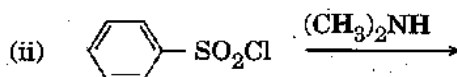
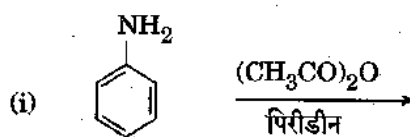
(b) कारण दीजिए :

- (i) जलीय विलयन में $(\text{CH}_3)_3\text{N}$ की तुलना में $(\text{CH}_3)_2\text{NH}$ अधिक क्षारकीय होती है।
- (ii) ऐलिफैटिक डाइएज़ोनियम लवणों की अपेक्षा ऐरोमैटिक डाइएज़ोनियम लवण अधिक स्थायी होते हैं।

3+2=5

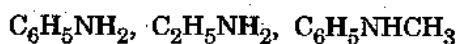
अथवा

(a) निम्नलिखित अभिक्रियाओं के मुख्य उत्पादों की संरचनाएँ लिखिए :



(b) ऐनिलीन और N,N-डाइमेथिलऐनिलीन में विभेद करने के लिए एक सरल रासायनिक परीक्षण दीजिए।

(c) निम्नलिखित को उनके pK_b मानों के बढ़ते हुए क्रम में व्यवस्थित कीजिए :



5

(a) Write the reactions involved in the following :

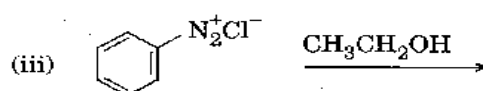
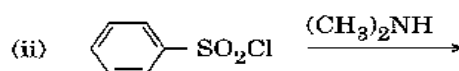
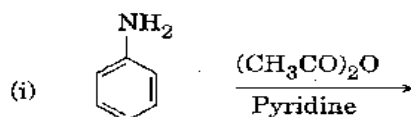
- (i) Hofmann bromamide degradation reaction
- (ii) Diazotisation
- (iii) Gabriel phthalimide synthesis

(b) Give reasons :

- (i) $(\text{CH}_3)_2\text{NH}$ is more basic than $(\text{CH}_3)_3\text{N}$ in an aqueous solution.
- (ii) Aromatic diazonium salts are more stable than aliphatic diazonium salts.

OR

(a) Write the structures of the main products of the following reactions :



(b) Give a simple chemical test to distinguish between Aniline and N,N-dimethylaniline.

(c) Arrange the following in the increasing order of their pK_b values :



CBSE Board Paper – 2018-19

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 15 हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में 27 प्रश्न हैं ।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains 15 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 27 questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

रसायन विज्ञान (सैद्धान्तिक)

CHEMISTRY (Theory)

निर्धारित समय : 3 घण्टे

अधिकतम अंक : 70

Time allowed : 3 hours

Maximum Marks : 70



सामान्य निर्देश:

- (i) सभी प्रश्न अनिवार्य हैं।
- (ii) खण्ड अ : प्रश्न संख्या 1 से 5 तक अति लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 1 अंक है।
- (iii) खण्ड ब : प्रश्न संख्या 6 से 12 तक लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 2 अंक हैं।
- (iv) खण्ड स : प्रश्न संख्या 13 से 24 तक भी लघु-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 3 अंक हैं।
- (v) खण्ड द : प्रश्न संख्या 25 से 27 तक दीर्घ-उत्तरीय प्रश्न हैं और प्रत्येक प्रश्न के लिए 5 अंक हैं।
- (vi) प्रश्न पत्र में समग्र विकल्प नहीं दिया गया है। फिर भी एक अंक वाले दो प्रश्नों में, दो अंकों वाले दो प्रश्नों में, तीन अंकों वाले चार प्रश्नों में तथा पाँच अंकों वाले तीनों प्रश्नों में विकल्प दिया गया है। ऐसे सभी प्रश्नों में से आपको एक ही विकल्प का उत्तर देना है।
- (vii) यदि आवश्यकता हो, तो आप लघुगणकीय सारणियाँ माँग सकते हैं। कैल्कुलेटर्स के प्रयोग की अनुमति नहीं है।

General Instructions :

- (i) All questions are compulsory.
- (ii) Section A : Questions number 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Section B : Questions number 6 to 12 are short answer questions and carry 2 marks each.
- (iv) Section C : Questions number 13 to 24 are also short answer questions and carry 3 marks each.
- (v) Section D : Questions number 25 to 27 are long answer questions and carry 5 marks each.
- (vi) There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- (vii) Use of log tables, if necessary. Use of calculators is **not** allowed.

खण्ड अ

SECTION A

1. (i) एक अंतः-केंद्रित घनीय संरचना और (ii) एक फलक-केंद्रित घनीय संरचना में परमाणुओं की उपसहसंयोजन संख्या क्या होती है ?

1

What is the coordination number of atoms in a (i) bcc structure, and (ii) fcc structure ?



2. अपने क्रिस्टलीय रूपों की तुलना में चूर्णित पदार्थ अधिक प्रभावी अधिशोषक क्यों होते हैं ? 1
Why are powdered substances more effective adsorbents than their crystalline forms ?

3. जब उपसहसंयोजन यौगिक $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ में AgNO_3 मिलाया गया तो प्रति एक मोल यौगिक के लिए दो मोल AgCl के अवक्षेपित हुए। उपसहसंयोजन यौगिक का संरचनात्मक सूत्र क्या है ? 1

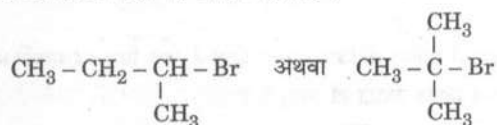
अथवा

संकुल और द्वि लवण में क्या अंतर है ? 1
When a coordination compound $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ is mixed with AgNO_3 , two moles of AgCl are precipitated per mole of the compound. What is the structural formula of the coordination compound ?

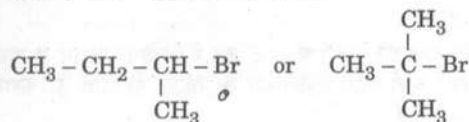
OR

What is the difference between a complex and a double salt ?

4. निम्नलिखित युगल में से आप कौन-से ऐल्किल हैलाइड द्वारा $\text{S}_\text{N}2$ क्रियाविधि से अधिक तीव्रता से अभिक्रिया करने की अपेक्षा करते हैं ? 1



Which alkyl halide from the following pair would you expect to react more rapidly by an $\text{S}_\text{N}2$ mechanism ?



5. हॉफमान ब्रोमामाइड निम्नीकरण अभिक्रिया से सम्बद्ध अभिक्रिया लिखिए। 1

अथवा

प्रोपेनेमीन और N,N-डाइमेथिलमेथेनेमीन में कार्बन परमाणुओं की संख्या समान होते हुए भी N,N-डाइमेथिलमेथेनेमीन की तुलना में प्रोपेनेमीन का क्वथनांक उच्चतर होता है। क्यों ? 1

Write the reaction involved in the Hoffmann bromamide degradation reaction.

OR

Propanamine and N,N-dimethylmethanamine contain the same number of carbon atoms, even though Propanamine has higher boiling point than N,N-dimethylmethanamine. Why ?



खण्ड ब

SECTION B

6. जब किसी नाइट्रेट आयन युक्त जलीय विलयन में तनु फेरस सल्फेट विलयन मिलाने के पश्चात् सावधानीपूर्वक परखनली की दीवार के सहारे सांद्र सल्फ्यूरिक अम्ल मिलाया जाता है, तो विलयन तथा सल्फ्यूरिक अम्ल अंतरापृष्ठ पर एक भूरी वलय बन जाती है। भूरी वलय का बनना किस ऋणायन की उपस्थिति सुनिश्चित करता है। भूरी वलय का संघटन क्या है ? 2

अथवा

आप HCl से Cl_2 का विरचन और Cl_2 से HCl का विरचन कैसे कर सकते हैं ? केवल अभिक्रियाएँ लिखिए। 2

When dilute ferrous sulphate solution is added to an aqueous solution containing nitrate ion followed by careful addition of concentrated sulphuric acid along the sides of test tube, a brown ring is formed at the interface between the solution and sulphuric acid layers. Which anion is confirmed by the appearance of brown ring ? What is the composition of the brown ring ?

OR

How can you prepare Cl_2 from HCl and HCl from Cl_2 ? Write reactions only.

7. विद्युत्-रासायनिक सेल को परिभाषित कीजिए। क्या होता है जब विद्युत्-रासायनिक सेल के E_{cell}^0 से लगाया गया बाह्य विभव ज्यादा हो जाता है ? 2

Define electrochemical cell. What happens when applied external potential becomes greater than E_{cell}^0 of electrochemical cell ?

8. निम्नलिखित के लिए कारण दीजिए : 2

- (a) जलीय स्पीशीज़ कोष्ण जल की तुलना में ठण्डे जल में अधिक आराम से रहती हैं।
(b) अधिक ऊँचाई पर रहने वाले लोग ऐनॉक्सिया से पीड़ित हो जाते हैं, फलस्वरूप वे स्पष्टतया सोच नहीं पाते हैं।

अथवा

ऐसीटोन एवं क्लोरोफॉर्म विलयन से किस प्रकार का स्थिरकवाथी मिश्रण बनेगा ? विलयन में विकसित अंतराअणुक बलों के सामर्थ्य के आधार पर पुष्टि कीजिए। 2

Give reasons for the following :

- (a) Aquatic species are more comfortable in cold water than warm water.
(b) At higher altitudes people suffer from anoxia resulting in inability to think.

OR

What type of azeotropic mixture will be formed by a solution of acetone and chloroform ? Justify on the basis of strength of intermolecular interactions that develop in the solution.



9. निम्नलिखित अभिक्रियाओं में होने वाले समीकरण लिखिए :

2

- (a) कोल्बे अभिक्रिया
(b) ऐनिसोल की फ्रीडेल-क्राफ्ट्स ऐल्किलीकरण

Write the equations involved in the following reactions :

- (a) Kolbe's reaction
(b) Friedel-Crafts alkylation of anisole

10. आँकड़ों का उपयोग करके निम्नलिखित के उत्तर दीजिए और कारण देते हुए पुष्टि भी कीजिए : 1×2=2

	Cr	Mn	Fe	Co
$E^{\circ}_{M^{2+}/M}$	-0.91	-1.18	-0.44	-0.28
$E^{\circ}_{M^{3+}/M^{2+}}$	-0.41	+1.57	+0.77	+1.97

- (a) जलीय माध्यम में कौन प्रबलतर अपचायक है, Cr^{2+} अथवा Fe^{2+} और क्यों ?
(b) +2 ऑक्सीकरण अवस्था में कौन-सा सबसे अधिक स्थायी आयन है और क्यों ?

Use the data to answer the following and also justify giving reason :

	Cr	Mn	Fe	Co
$E^{\circ}_{M^{2+}/M}$	-0.91	-1.18	-0.44	-0.28
$E^{\circ}_{M^{3+}/M^{2+}}$	-0.41	+1.57	+0.77	+1.97

- (a) Which is a stronger reducing agent in aqueous medium, Cr^{2+} or Fe^{2+} and why ?
(b) Which is the most stable ion in +2 oxidation and why ?

11. कारण देते हुए निम्नलिखित को योगज एवं संघनन बहुलकों में वर्गीकृत कीजिए : 1×2=2

- (a) टेफ्लॉन
(b) PHBV

Classify the following as addition and condensation polymers giving reason :

- (a) Teflon
(b) PHBV

12. निम्नलिखित बहुलकों के एकलकों की संरचनाएँ लिखिए : 1×2=2

- (a) टेरिलीन
(b) ब्यूना-N

Write the structures of monomers of the following polymers :

- (a) Terylene
(b) Buna-N

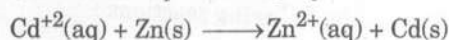


खण्ड स

SECTION C

13. निम्नलिखित अभिक्रिया का $\Delta_r G^\circ$ और $\log K_c$ परिकलित कीजिए :

3

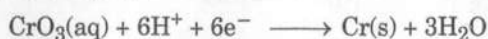


दिया है : $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.403 \text{ V}$

$E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.763 \text{ V}$

अथवा

CrO_3 वाले अम्लीय विलयन से क्रोमियम धातु का निम्नलिखित समीकरण के अनुसार विद्युत्-लेपन किया जाता है :



परिकलित कीजिए कि 24,000 कूलॉम से क्रोमियम के कितने ग्राम विद्युत्-लेपित होंगे तथा 12.5 A की विद्युत् धारा प्रयुक्त करने पर 1.5 g क्रोमियम विद्युत्-लेपित करने में कितना समय लगेगा ? [Cr का परमाणु भार = 52 g mol^{-1} , $1 \text{ F} = 96500 \text{ C mol}^{-1}$]

3

Calculate $\Delta_r G^\circ$ and $\log K_c$ for the following reaction :

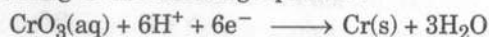


Given : $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.403 \text{ V}$

$E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.763 \text{ V}$

OR

Chromium metal is electroplated using an acidic solution containing CrO_3 according to the following equation :



Calculate how many grams of chromium will be electroplated by 24,000 coulombs. How long will it take to electroplate 1.5 g chromium using 12.5 A current ?

[Atomic mass of Cr = 52 g mol^{-1} , $1 \text{ F} = 96500 \text{ C mol}^{-1}$]

14. 300 K पर 30 g प्रति लीटर सांद्रता वाले ग्लूकोस के विलयन का परासरण दाब 4.98 bar है। यदि इसी ताप पर ग्लूकोस विलयन का परासरण दाब 1.52 bar है, तो उसकी सांद्रता क्या होगी ?

3

At 300 K, 30 g of glucose present in a litre of its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of a glucose solution is 1.52 bar at the same temperature, what would be its concentration ?



15. क्रोमियम bcc संरचना में क्रिस्टलीकृत होता है। यदि इसके कोर की लंबाई 300 pm है, तो इसका घनत्व परिकलित कीजिए। क्रोमियम का परमाण्विक द्रव्यमान 52 u है।
[$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$] 3

Chromium crystallises in bcc structure. If its edge length is 300 pm, find its density. Atomic mass of chromium is 52 u. [$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$]

16. निम्नलिखित के लिए कारण दीजिए : 1×3=3

- ब्राउनियन संचलन कोलॉइडी विलयन को स्थिरता देता है।
- सच्चा विलयन टिन्डल प्रभाव को नहीं दर्शाता है।
- फिटकरी के डालने से जल का शुद्धिकरण होता है।

Give reasons for the following :

- Brownian movement provides stability to the colloidal solution.
- True solution does not show Tyndall effect.
- Addition of alum purifies the water.

17. क्रोमाइट अयस्क से सोडियम डाइक्रोमेट की विरचन विधि की व्याख्या कीजिए। डाइक्रोमेट आयन द्वारा फेरस लवणों के ऑक्सीकरण को निरूपित करने के लिए समीकरण दीजिए। 1×3=3

अथवा

निम्नलिखित अभिक्रियाओं को पूर्ण कीजिए :

1×3=3

- $\text{MnO}_2 + \text{KOH} + \text{O}_2 \longrightarrow$
- $\text{I}^- + \text{MnO}_4^- + \text{H}^+ \longrightarrow$
- $\text{Cr}_2\text{O}_7^{2-} + \text{Sn}^{2+} + \text{H}^+ \longrightarrow$

Explain the method of preparation of sodium dichromate from chromite ore. Give the equation representing oxidation of ferrous salts by dichromate ion.

OR

Complete the following reactions :

- $\text{MnO}_2 + \text{KOH} + \text{O}_2 \longrightarrow$
- $\text{I}^- + \text{MnO}_4^- + \text{H}^+ \longrightarrow$
- $\text{Cr}_2\text{O}_7^{2-} + \text{Sn}^{2+} + \text{H}^+ \longrightarrow$



18. निम्नलिखित की क्या भूमिका है :

1×3=3

- (a) फेन प्लवन विधि में अवनमक की
- (b) मॉन्ड प्रक्रम में कार्बन मोनॉक्साइड की
- (c) बॉक्साइट से ऐलुमिना के निक्षालन में सान्द्र सोडियम हाइड्रॉक्साइड की

अथवा

बॉक्साइट अयस्क से ऐलुमिनियम के निष्कर्षण में होने वाली रासायनिक अभिक्रियाएँ लिखिए । 3

What is the role of

- (a) Depressants in froth floatation ?
- (b) Carbon monoxide in Mond's process ?
- (c) Concentrated sodium hydroxide in leaching of alumina from bauxite ?

OR

Write chemical reactions taking place in the extraction of Aluminium from Bauxite ore.

19. निम्नलिखित के लिए कारण दीजिए :

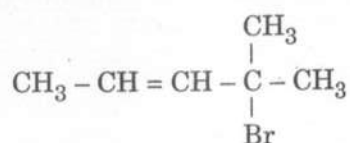
1×3=3

- (a) ऑर्थो अथवा पैरा स्थिति पर $-\text{NO}_2$ समूह की उपस्थिति हैलोऐरीनों की नाभिकरागी प्रतिस्थापन अभिक्रियाओं के प्रति क्रियाशीलता बढ़ा देती है ।
- (b) ऑर्थो अथवा मेटा समावयव की तुलना में p-डाइक्लोरोबेन्ज़ीन का गलनांक उच्चतर होता है ।
- (c) ऐल्कोहॉलों से एल्किल क्लोराइड विरचन के लिए थायोनिल क्लोराइड विधि को वरीयता दी जाती है ।

अथवा

- (a) 1-क्लोरोब्यूटेन से 1-आयोडोब्यूटेन के विरचन का समीकरण लिखिए ।
- (b) 2-ब्रोमोपेन्टेन, 2-ब्रोमो-2-मेथिलब्यूटेन और 1-ब्रोमोपेन्टेन में से कौन-सा यौगिक विलोपन अभिक्रिया के प्रति अधिक क्रियाशील है और क्यों ?
- (c) IUPAC नाम लिखिए :

1×3=3



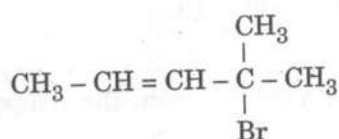


Give reasons for the following :

- The presence of $-\text{NO}_2$ group at ortho or para position increases the reactivity of haloarenes towards nucleophilic substitution reactions.
- p-dichlorobenzene has higher melting point than that of ortho or meta isomer.
- Thionyl chloride method is preferred for preparing alkyl chloride from alcohols.

OR

- Write equation for preparation of 1-iodobutane from 1-chlorobutane.
- Out of 2-bromopentane, 2-bromo-2-methylbutane and 1-bromopentane, which compound is most reactive towards elimination reaction and why?
- Give IUPAC name of



20. निम्नलिखित संकुलों की संकरण अवस्था और चुंबकीय गुण लिखिए :

3

- $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- $[\text{Ni}(\text{CN})_4]^{2-}$

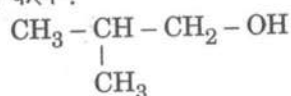
[परमाणु क्रमांक : Fe = 26, Ni = 28]

Write the hybridization and magnetic character of the following complexes :

- $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- $[\text{Ni}(\text{CN})_4]^{2-}$

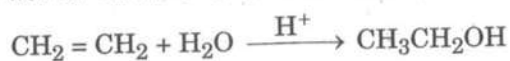
[Atomic number : Fe = 26, Ni = 28]

21. (a) दर्शाइए कि मेथेनैल पर उपयुक्त ग्रीन्यार अभिकर्मक द्वारा निम्नलिखित ऐल्कोहॉल कैसे विरचित करेंगे ?



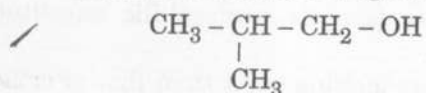
(b) निम्नलिखित अभिक्रिया की क्रियाविधि लिखिए :

3

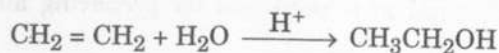




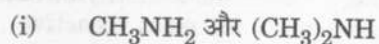
- (a) Show how you will synthesise the following alcohol prepared by the reaction of a suitable Grignard reagent on methanal ?



- (b) Write the mechanism of the following reaction :



22. (a) निम्नलिखित यौगिक युगलों में विभेद के लिए एक-एक रासायनिक परीक्षण दीजिए :

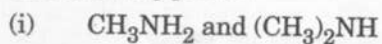


(ii) ऐनिलीन और एथेनेमीन

- (b) ऐनिलीन फ्रीडेल-क्राफ्ट्स अभिक्रिया क्यों नहीं देती है ?

3

- (a) Give one chemical test to distinguish between the compounds of the following pairs :



(ii) Aniline and Ethanamine

- (b) Why aniline does not undergo Friedel-Crafts reaction ?

23. क्या होता है जब D-ग्लूकोस की अभिक्रिया निम्नलिखित अभिकर्मकों से करते हैं :

3

(a) Br_2 जल

(b) HCN

(c) $(\text{CH}_3\text{CO})_2\text{O}$

What happens when D-Glucose is treated with the following reagents :

(a) Br_2 water

(b) HCN

(c) $(\text{CH}_3\text{CO})_2\text{O}$



24. प्रत्येक का एक उचित उदाहरण देते हुए निम्नलिखित को परिभाषित कीजिए :

3

- (a) प्रतिअम्ल
- (b) कृत्रिम मधुरक
- (c) ऋणात्मक अपमार्जक

Define the following terms with a suitable example of each :

- (a) Antacids
- (b) Artificial sweeteners
- (c) Anionic detergents

खण्ड द

SECTION D

25. (a) निम्नलिखित रूपान्तरण निष्पादित कीजिए :

- (i) p-नाइट्रो टॉलूईन से 2-ब्रोमोबेन्ज़ोइक अम्ल
- (ii) प्रोपेनोइक अम्ल से ऐसीटिक अम्ल

(b) C_5H_{10} अणुसूत्र वाला कोई ऐल्कीन ओज़ोनी-अपघटन द्वारा B और C, दो यौगिकों का मिश्रण देता है। यौगिक B धनात्मक फेलिंग परीक्षण देता है तथा आयोडीन और NaOH विलयन से भी अभिक्रिया करता है। यौगिक C फेलिंग परीक्षण नहीं देता परन्तु आयोडोफॉर्म बनाता है। यौगिक A, B और C को पहचानिए।

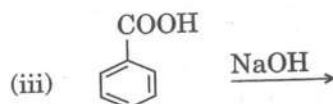
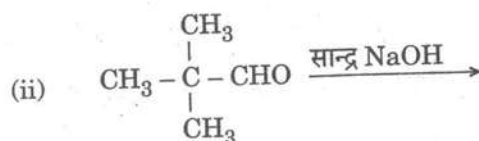
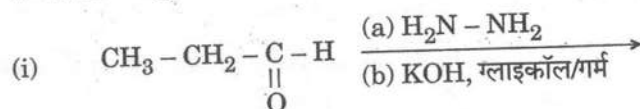
2+3=5

अथवा

(a) निम्नलिखित रूपान्तरण निष्पादित कीजिए :

- (i) बेन्ज़ोइक अम्ल से ऐनिलीन
- (ii) ब्रोमोमेथेन से एथेनॉल

(b) निम्नलिखित में मुख्य उत्पाद/उत्पादों की संरचना लिखिए :



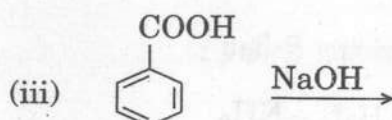
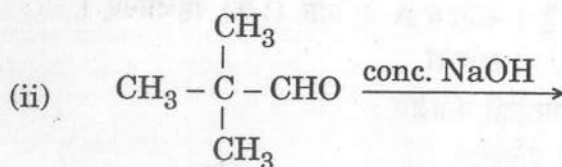
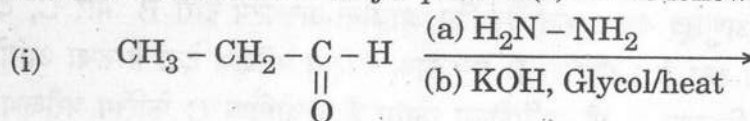
2+3=5



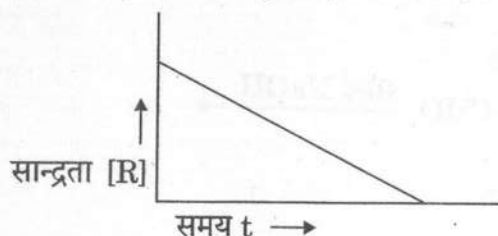
- (a) Carry out the following conversions :
- P-nitrotoluene to 2-bromobenzoic acid
 - Propanoic acid to acetic acid
- (b) An alkene with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, B and C. Compound B gives positive Fehling test and also reacts with iodine and NaOH solution. Compound C does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C.

OR

- (a) Carry out the following conversions :
- Benzoic acid to aniline
 - Bromomethane to ethanol
- (b) Write the structure of major product(s) in the following :



26. (a) अभिक्रिया $R \rightarrow P$ पर विचार कीजिए जिसमें R की सान्द्रता में समय के साथ परिवर्तन निम्नलिखित आलेख द्वारा दर्शाया गया है :



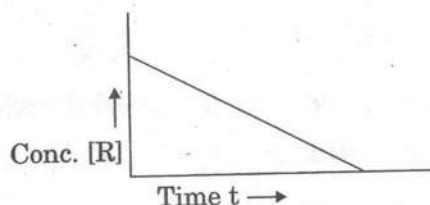
- अभिक्रिया की कोटि की प्रागुक्ति कीजिए ।
- वक्र की ढाल (प्रवणता) क्या इंगित करती है ?



- (b) ताप में 293 K से 313 K तक वृद्धि करने पर किसी अभिक्रिया का वेग चार गुना हो जाता है। E_a की गणना यह मानते हुए कीजिए कि इसका मान ताप के साथ परिवर्तित नहीं होता है। 1+2+2=5
[$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$]

अथवा

- (a) किसी रासायनिक अभिक्रिया के लिए $\ln k$ और $1/T$ के बीच एक ग्राफ खींचिए। अंतःखंड क्या निरूपित करता है? ढाल एवं E_a के मध्य संबंध क्या है?
- (b) एक प्रथम कोटि की अभिक्रिया में 20% वियोजन होने में 30 मिनट लगते हैं। $t_{1/2}$ की गणना कीजिए। [$\log 2 = 0.3010$] 2+3=5
- (a) Consider the reaction $R \rightarrow P$ for which the change in concentration of R with time is shown by the following graph :



- (i) Predict the order of reaction.
(ii) What does the slope of the curve indicate?
- (b) The rate of reaction quadruples when temperature changes from 293 K to 313 K. Calculate E_a assuming that it does not change with time. [$R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$]

OR

- (a) Draw the plot of $\ln k$ vs $1/T$ for a chemical reaction. What does the intercept represent? What is the relation between slope and E_a ?
- (b) A first order reaction takes 30 minutes for 20% decomposition. Calculate $t_{1/2}$. [$\log 2 = 0.3010$]



27. (a) निम्नलिखित की संरचना खींचिए :
- HClO_3
 - $\text{H}_2\text{S}_2\text{O}_8$
- (b) निम्नलिखित के लिए कारण दीजिए :
- सल्फर 1000 K के ऊपर अनुचुम्बकत्व दर्शाता है ।
 - यद्यपि फ्लुओरीन की इलेक्ट्रॉन लब्धि एन्थैल्पी क्लोरीन की तुलना में कम ऋणात्मक है, लेकिन फ्लुओरीन, क्लोरीन की अपेक्षा प्रबल ऑक्सीकारक है ।
 - ठोस अवस्था में PCl_5 का अस्तित्व आयनिक यौगिक की भाँति होता है । $2+3=5$

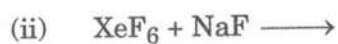
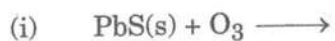
अथवा

- (a) निम्नलिखित अभिक्रियाओं को पूर्ण कीजिए :
- $\text{PbS(s)} + \text{O}_3 \longrightarrow$
 - $\text{XeF}_6 + \text{NaF} \longrightarrow$
- (b) कारण देते हुए निम्नलिखित को इंगित गुणधर्म के बढ़ते क्रम में व्यवस्थित कीजिए :
- वर्ग 15 के हाइड्राइड – क्वथनांक
 - वर्ग 17 के हाइड्राइड – अम्लीय सामर्थ्य
 - वर्ग 16 के हाइड्राइड – अपचायक गुण
- $2+3=5$
- (a) Draw the structure of the following :
- HClO_3
 - $\text{H}_2\text{S}_2\text{O}_8$
- (b) Give reasons for the following :
- Above 1000 K sulphur shows paramagnetism.
 - Although electron gain enthalpy of fluorine is less negative than that of chlorine, yet fluorine is a better oxidising agent than chlorine.
 - In solid state PCl_5 exists as an ionic compound.

OR



(a) Complete the following reactions :



(b) Arrange the following in increasing order of property indicated, giving reason :

(i) Hydrides of group 15 – boiling points

(ii) Hydrides of group 17 – acidic strength

(iii) Hydrides of group 16 – reducing character