

## CHEMISTRY (CHEM)

### CLASS - XII

Full Marks 100

THEORY - 70 Marks

		<b>Marks</b>
Unit – I	Solid State	04
Unit – II	Solutions	05
Unit – III	Electrochemistry	05
Unit- IV	Chemical Kinetics	05
Unit – V	Surface Chemistry	04
Unit- VI	General principles and processes of Isolation of Elements	03
Unit- VII	p-Block Elements	08
Unit- VIII	d-and f- Block Elements	05
Unit- IX	Coordination Compounds	03
Unit- X	Haloalkanes and Haloarenes	04
Unit- XI	Alcohols, Phenols and Ethers	04
Unit- XII	Aldehydes, Ketones and Carboxylic acids	06
Unit- XIII	Organic Compounds containing Nitrogen	04
Unit- XIV	Bio molecules	04
Unit-XV	Polymers	03
Unit-XVI	Chemistry in Everyday Life	03
<b>Total-</b>		<b>70</b>

**Unit – I: Solid State**

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solid, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, packing efficiency, 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. Band theory of metals, conductors, semiconductors and insulators and n & p type semiconductors.

**Unit – II: Solutions**

Types of solutions, expression of concentration of solution of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, van't Hoff factor and calculations involving it.

**Unit – III: Electrochemistry**

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. Reaction between Gibbs energy change and emf of a cell, fuel cells: corrosion.

**Unit – IV: Chemical Kinetics**

Rate of a reaction (average and instantaneous), factors affecting rates of reactions; 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), activation energy, Arrhenius equation.

**Unit – V: Surface Chemistry**

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 colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsion – types of emulsions. Elementary idea of nanomaterials.

**Unit – VI: General Principles and Processes of Isolation of Elements**

Principles and methods of extraction – concentration, oxidation, reduction electrolysis method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

**Unit – VII:p- Block Elements**

**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); Phosphorus – allotropic forms; compounds of phosphorus; preparation and properties of phosphine, halides ( $\text{PCl}_3$ ,  $\text{PCl}_5$ ) and oxoacids (elementary idea only).

**Group 16 elements:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen; preparation, properties and uses; classification of oxides; ozone, sulphur – allotropic forms;

Compounds of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, other oxides and 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 (structure only).

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

**Unit – VIII: d and f Block Elements**

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  $\text{KMnO}_4$ .

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

**Actinoids** - Electronic configuration, oxidation states and comparison with lanthanoids.

**Unit – IX: Coordination Compounds**

Coordination compounds – Introduction, Ligands, coordination number, colour, magnetic properties and shape, IUPAC nomenclature of mononuclear coordination compounds. Bonding (Werner's

theory, VBT and CFT); structural and stereo isomerism, importance of coordination compounds (in qualitative inclusion of analysis, extraction of metals and biological systems)

### **Unit – X: Haloalkanes and Haloarenes**

#### **Haloalkanes:**

Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Stability of carbonations, R-S and d-l configurations

#### **Haloarenes:**

Nature of C-X bond, substitutions reactions (directive influence of halogen for monosubstituted compound only, stability of carbocations R-S and d-l configurations)

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

### **Unit – XI: Alcohols, phenols and Ethers**

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

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

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

### **Unit – XII: Aldehydes, Ketones and Carboxylic Acids**

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

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

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

**Nitro compounds:** General methods of preparation and chemical reactions.

**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.

#### **Unit – XIV: Bio molecules**

**Carbohydrates** - Classification (aldoses and Ketoses), monosaccharides (glucose and fructose), D-L configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance.

**Proteins** - Elementary idea of  $\alpha$ - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Lipids and hormones, their classification and functions.

**Vitamins:** Classification and functions.

**Nucleic Acids:** DNA & RNA.

#### **Unit – XV: Polymers**

Classification – natural and synthetic, methods of polymerization (addition and Condensation), copolymerization. Some important polymers: natural and synthetic like poly, nylon, polyesters, Bakelite, rubber, biodegradable and non-biodegradable polymers.

#### **Unit – XVI: Chemistry in Everyday Life**

1. **Chemicals in medicines-** analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, anti fertility drugs, antibiotics, antacids, antihistamines, antioxidants.
2. **Chemicals in food** – preservatives, artificial, sweetening agents.
3. **Cleansing agents** – soaps and detergents, cleansing action.

**Practical****Marks 30**

<b>Evaluation Scheme for Examination</b>	<b>Marks</b>
Volumetric analysis	10
Salt Analysis	08
Content Based Experiment	06
Class Record ,Viva and Project work	06
<b>Total</b>	<b>30</b>

**Practical Syllabus****A. Surface Chemistry.**

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

**B. Chemical kinetics**

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

**C. Thermo chemistry****Any of the following experiments**

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

**D. Electro chemistry**

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

**E. Chromatography**

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

**F. Preparation of Inorganic Components**

- Preparation of double salt of ferrous ammonium sulphate or potash alum
- Preparation of potassium ferric oxalate

**G. Preparation of Organic compounds**

Preparation of any two of the following compounds

- Acetanilide
- Di benzal acetone
- p-Nitroacetanilide
- Aniline yellow or 2- Naphthal aniline dye.
- Iodoform

**H. Tests for the functional groups present in organic compounds:**

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

**I. Characteristic test of carbohydrates, fats and proteins in pure samples and their detection in given food stuffs.**

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

- Oxalic acid
  - Ferrous ammonium sulphate
- (students will be required to prepare standard solution by weighing themselves)

**K. Qualitative analysis**

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

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

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

**(Note; Insoluble salts excluded)**

**Project work-** where feasible may include

- Model preparation
- Investigatory project
- Science exhibits
- Participation in science fairs
- Testing of purity of food articles like butter, pulse and milk etc.