

# UP Board Class 12 Chemistry Syllabus

CLASS XII (2020-21)  
(THEORY)

Time : 3 Hours

| Unit No.  | Title   |
|-----------|---|
| Unit I    | Solid State   |
| Unit II   | Solutions   |
| Unit III  | Electrochemistry  |
| Unit IV   | Chemical Kinetics   |
| Unit V    | Surface Chemistry   |
| Unit VI   | General Principles and Processes of Isolation of Elements |
| Unit VII  | p -Block Elements   |
| Unit VIII | d -and f -Block Elements                                  |
| Unit IX   | Coordination Compounds                                    |
| Unit X    | Haloalkanes and Haloarenes                                |
| Unit XI   | Alcohols, Phenols and Ethers                              |
| Unit XII  | Aldehydes, Ketones and Carboxylic Acids                   |
| Unit XIII | Amines  |
| Unit XIV  | Biomolecules  |
| Unit XV   | Polymers  |
| Unit XVI  | Chemistry in Everyday Life                                |

## Unit I: Solid State

10 Periods

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, packing efficiency, 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  $n$  and  $p$  type semiconductors.

## Unit II: Solutions

10 Periods

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

## Unit III: Electrochemistry

12 Periods

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

**Unit IV: Chemical Kinetics****10 Periods**

Rate of a reaction (Average and instantaneous), factors affecting rate 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), activation energy, Arrhenius equation.

**Unit V: Surface Chemistry****08 Periods**

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

**Unit VI: General Principles and Processes of Isolation of Elements****08 Periods**

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

**Unit VII: p-Block Elements****12 Periods**

**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 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: 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.

**Unit VIII: d and f Block Elements****12 Periods**

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  $K_2Cr_2O_7$  and  $KMnO_4$ .

**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

12 Periods

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

### Unit X: Haloalkanes and Haloarenes.

10 Periods

**Haloalkanes:** Nomenclature, nature of C–X bond, physical and chemical properties, optical rotation mechanism of substitution reactions.

**Haloarenes:** Nature of C–X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only).

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

### Unit XI: Alcohols, Phenols and Ethers

10 Periods

**Alcohols:** Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to 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.

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

10 Periods

**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: Amines

10 Periods

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

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

### Unit XIV: Biomolecules

12 Periods

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

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

**Vitamins** - Classification and functions.

**Nucleic Acids:** DNA and RNA.

**Unit XV: Polymers**

**08 Period**

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization, some important polymers: natural and synthetic like polythene, nylon polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

**Unit XVI: Chemistry in Everyday life**

**06 Periods**

**Chemicals in medicines** - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

**Chemicals in food** - preservatives, artificial sweetening agents, elementary idea of antioxidants.

**Cleansing agents**- soaps and detergents, cleansing action.

**PRACTICALS**

| Evaluation Scheme for Examination | Marks     |
|-----------------------------------|-----------|
| Volumetric Analysis               | 08        |
| Salt Analysis                     | 08        |
| Content Based Experiment          | 06        |
| Project Work                      | 04        |
| Class record and viva             | 04        |
| <b>Total</b>                      | <b>30</b> |

**PRACTICAL SYLLABUS**

**60Periods**

**Micro-chemical methods are available for several of the practical experiments. Wherever possible, such techniques should be used.**

**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, arsenous sulphide.

(b) Dialysis of sol-prepared in (a) above.

(c) Study of the role of emulsifying agents in stabilizing the emulsion 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 Iodide ion with Hydrogen Peroxide at room temperature using different concentration of Iodide ions.
- (ii) Reaction between Potassium Iodate, ( $\text{KIO}_3$ ) and Sodium Sulphite: ( $\text{Na}_2\text{SO}_3$ ) using starch solution as indicator (clock reaction).

### C. Thermochemistry

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 large difference in  $R_f$  values to be provided).

### F. Preparation of Inorganic Compounds

Preparation of double salt of Ferrous Ammonium Sulphate or Potash Alum.  
Preparation of Potassium Ferric Oxalate.

### G. Preparation of Organic Compounds

Preparation of any one of the following compounds

- i) Acetanilide
- ii) Di-benzalacetone
- iii) p-Nitroacetanilide
- iv) Aniline yellow or 2-Naphthol Anilinedye.

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

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

### I. Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given foodstuffs.

### 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.

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

**Anions:**  $(\text{CO}_3)^{2-}$ ,  $\text{S}^{2-}$ ,  $(\text{SO}_3)^{2-}$ ,  $(\text{NO}_2)^-$ ,  $(\text{SO}_4)^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $(\text{C}_2\text{O}_4)^{2-}$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{NO}_3^-$   
**(Note: Insoluble salts excluded)**

## PROJECT

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

**A few suggested Projects.**

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

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