

**CLASS-XI  
CHEMISTRY**

**Time: 3 Hrs**

**Theory: 70 Marks  
Practical: 25 Marks  
INA : 5 Marks  
Total: 100 Marks**

**SYLLBUS (THEORY)**

**Unit I: Some Basic Concepts of Chemistry 12 Periods**

General Introduction: Importance and scope of chemistry.

Nature of matter, laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules.

Atomic and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry.

**Unit II: Structure of Atom 14 Periods**

Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

**Unit III: Classification of Elements and Periodicity in Properties 8 Periods**

Modern periodic law and the present form of periodic table, periodic trends in properties of elements-atomic radii, ionic, inert gas radii, ionization enthalpy, electron gain enthalpy, electronegativity, valency. Nomenclature of elements with atomic number greater than 100

**Unit IV: Chemical Bonding and Molecular Structure 14 Periods**

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only), hydrogen bond.

**Unit V: States of Matter: Gases and Liquids 12 Periods**

Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro's number, ideal gas equation.

Deviation from ideal behaviour, liquefaction of gases, critical temperature, kinetic energy and molecular speeds (elementary idea)

Liquid State: vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations)

**Unit VI: Chemical Thermodynamics 16 Periods**

Concepts of System and types of systems, surroundings, work,

heat, energy, extensive and intensive properties, state functions. First law of thermodynamics

internal energy and enthalpy, heat capacity and specific heat, measurement of

$\Delta U$  and  $\Delta H$ , Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Second law of Thermodynamics (brief introduction). Introduction of entropy as a state function, Gibb's energy change for spontaneous and non-spontaneous processes, criteria for equilibrium.

Third law of thermodynamics (brief introduction).

### **Unit-VII: Equilibrium**

**14 Periods**

Equilibrium in physical and chemical process, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium-Le Chatelier's principle, ionic equilibrium-ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of poly basic acids, acid strength, concept of pH, Henderson Equation, hydrolysis of salts (elementary idea), buffer solution, solubility product, common hydrolysis of salts (elementary idea), buffer solution, solubility product, common ion effect (with illustrative examples).

### **Unit VIII: Redox Reactions**

**06 Periods**

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number, applications of redox reactions.

### **Unit IX : Hydrogen**

**08 Periods**

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen, hydrides-ionic covalent and interstitial; physical and chemical properties of water, heavy water, hydrogen peroxide- preparation, reactions and structure and use; hydrogen as a fuel.

### **Unit X : s-Block Elements (Alkali and Alkaline Earth Metals)**

**10 Periods**

Group 1 and Group 2 Elements General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens, uses. Preparation and Properties of some important Compounds: Sodium Carbonate, Sodium chloride, Sodium Hydroxide and Sodium Hydrogencarbonate, Biological importance of Sodium and Potassium. Calcium Oxide and Calcium Carbonate and their industrial uses, biological importance of Magnesium and Calcium.

### **Unit XI: p-Block Elements**

**14 Periods**

General Introduction to p-Block Elements

Group 13 Elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group, Boron- physical and chemical properties, some important compounds, Borax, Boric acid, Boron Hydrides, Aluminium: Reactions with acids and alkalis, uses

Group 14 Elements: General introduction, electronic, configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first elements. Carbon-catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides. Important compounds of Silicon and a few use: Silicon Tetrachloride, Silicones, Silicates and Zeolites, their uses.

### **Unit XII: Organic Chemistry-Some Basic Principles and Techniques**

**14 Periods**

General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

### **Unit XIII: Hydrocarbons**

**12 Periods**

Classification of Hydrocarbons Aliphatic Hydrocarbons:

Alkanes-Nomenclature, isomerism, conformation (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.

Alkenes-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation, chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markownikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Alkynes-Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of -hydrogen, halogens, hydrogen halides and water.

Aromatic Hydrocarbons: Introduction, IUPAC nomenclature, benzene: resonance, aromaticity, chemical properties: mechanism of electrophilic substitution. Nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation, directive influence of functional group in monosubstituted benzene. Carcinogenicity and toxicity.

### **Unit XIV: Environmental Chemistry**

**06 Periods**

Environmental pollution-air, water and soil pollution, chemical reactions in atmosphere, smog, major atmospheric pollutants, acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes, green chemistry as alternative tool for reducing pollution, strategies for control of environmental pollution.

### **PRACTICALS**

Evaluation Scheme for Examination	Marks
Volumetric Analysis	07
Salt analysis	07
Content Based Experiment	05
Project Work	03
Class record and viva	03
Total	25

### **PRACTICAL SYLLABUS**

Total Periods 60

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

- A. Basic Laboratory Techniques
  1. Cutting glass tube and glass rod
  2. Bending a glass tube

3. Drawing out a glass jet

4. Boring a cork

B. Characterization and Purification of Chemical Substances

1. Determination of melting point of an organic compound.

2. Determination of boiling point of an organic compound.

3. Crystallization of impure sample of any one of the following: Alum, Copper Sulphate, Benzoic Acid.

C. Experiments based on pH

(a) Any one of the following experiments:

- Determination of pH of some solutions obtained from fruit juices, solution of known and varied concentrations of acids, bases and salts using pH paper or universal indicator.
- Comparing the pH of solutions of strong and weak acids of same concentration.
- Study the pH change in the titration of a strong base using universal indicator.

(b) Study the pH change by common-ion in case of weak acids and weak bases.

(d) Chemical Equilibrium

- One of the following experiments:

(a) Study the shift in equilibrium between ferric-ions and thiocyanate ions by increasing/decreasing the concentration of either of the ions.

(b) Study the shift in equilibrium between  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  and chloride ions by changing the concentration of either of the ions.

E. Quantitative Estimation

i) Using a chemical balance.

ii) Preparation of standard solution of Oxalic acid.

iii) Determination of strength of a given solution of Sodium Hydroxide by titrating it against standard solution of Oxalic acid.

iv) Preparation of standard solution of Sodium Carbonate.

v) Determination of strength of a given solution of Hydrochloric acid by titrating it against standard

Sodium Carbonate solution

F. Qualitative Analysis

(a) Determination of one anion and one cation in a given salt

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

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

(Note: Insoluble salts excluded)

(b) Detection of-Nitrogen, Sulphur, Chlorine in organic compounds.

**PROJECT**

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

A few suggested Projects

- checking the bacterial contamination in drinking water by testing sulphide ion.
- Study of the methods of purification of water.
- Testing the hardness, presence of Iron, Fluoride, chloride, etc., depending upon the regional variation in drinking water and study of causes of presence of these ions above permissible limit (if any).
- Investigation of the foaming capacity of different washing soaps and the effect of addition of Sodium Carbonate on it.
- Study the acidity of different samples of tea leaves.
- Determination of the rate of evaporation of different liquids.
- Study the effect of acids and bases on the tensile strength of fibers.
- Study of acidity of fruit and vegetable juices.

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

### **Practical Examination for Visually Impaired Students**

#### **Class XI**

**Note:** Same Evaluation scheme and general guidelines for visually impaired students as given for class XII may be followed.

A. List of apparatus for identification for assessment in practicals (All experiments)

Beaker, Tripod stand, Wire gauze, glass rod, funnel, filter paper, Bunsen burner, test tube, test tube stand, dropper, test tube holder, ignition tube, china dish, tongs, funnel, tripod stand, wire gauze, Bunsen burner, standard flask, pipette, burette, conical flask, funnel, clamp stand, dropper, wash bottle, filter paper.

- Odour detection in qualitative analysis
- Procedure/Setup of the apparatus

#### **B. List of Experiments**

A. Characterization and Purification of Chemical Substances

1. Crystallization of an impure sample of any one of the following: copper sulphate, benzoic acid

B. Experiments based on pH

1. Determination of pH of some solutions obtained from fruit juices, solutions of known and varied concentrations of acids, bases and salts using pH paper

2. Comparing the pH of solutions of strong and weak acids of same concentration.

C. Chemical Equilibrium

1. Study the shift in equilibrium between ferric ions and thiocyanate ions by increasing/decreasing the concentration of either ions.

2. Study the shift in equilibrium between  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  and chloride ions by changing the concentration of either of the ions.

D. Quantitative estimation

1. Preparation of standard solution of oxalic acid.

2. Determination of molarity of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.

E. Qualitative Analysis

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

2. Cations- $[\text{NH}]^+$

Anions- $[\text{CO}_3]^{2-}$ ,  $\text{S}^{2-}$ ,  $[\text{SO}_3]^{2-}$ ,  $\text{Cl}$ ,  $\text{CH}_3\text{COO}$

(Note: insoluble salts excluded)

3. Detection of Nitrogen in the given organic compound.

4. Detection of Halogen in the given organic compound.

STRUCTURE OF QUESTION PAPER (PRACTICAL)

Marks: 25

Evaluation Scheme for Examination	Marks
Volumetric Analysis	07
Salt Analysis	07
Content Based Experiment	05
Project Work	03
Class record and viva	03
Total	25

**PRACTICAL SYLLABUS**

**A. Surface Chemistry**

- a. Preparation of one lyophilic and one lyophobic sol. Lyophilic sol - starch, egg albumin and gum. Lyophobic sol - aluminum hydroxide, ferric hydroxide, arsenious sulphide.
- b. Study of the role of emulsifying 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 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
  - a. Enthalpy of dissolution of copper sulphate or potassium nitrate.
  - b. Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH)
  - c. Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone and chloroform.
- D. **Electrochemistry:** Variation of cell potential in  $\text{Zn}/\text{Zn}^{2+}||\text{Cu}^{2+}/\text{Cu}$  with change in concentration of electrolytes ( $\text{CuSO}_4$  or  $\text{ZnSO}_4$  at room temperature.
- E. **Chromatography**
  - a. Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of  $R_f$  values.
  - b. Separation of constituents present in an inorganic mixture containing two cations only (constituents having wide difference in  $R_f$  values to be provided).
- F. **Determination of concentration/molarity of  $\text{KMnO}_4$ , solution by titrating it against a standard Solution of:**
  - a. Oxalic acid.
  - b. Ferrous ammonium sulphate.  
(Students will be required to prepare standard solutions by weighing themselves).
- G. **Preparation of Inorganic Compounds**
  - a. Preparation of double salt of ferrous ammonium sulphate or potash alum.
  - b. Preparation of potassium ferric oxalate.
- H. **Preparation of Organic Compounds:** Preparation of any two of the following compounds
  - a. Acetanilide
  - b. Di-benzal acetone
  - c. p-Nitroacetanilide,
  - d. Aniline yellow or 2-Naphthol aniline dye.
  - e. Iodoform
- I. **Test for the functional groups present in organic compounds:** Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.

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

**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-** \

(Note: Insoluble salts excluded)

## **PROJECT**

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

### **A few suggested Projects**

1. Study of presence of oxalate ions in guava fruit at different stages of ripening.
2. Study of quantity of casein present in different samples of milk.
3. Preparation of soyabean milk and its comparison with the natural milk with respect to curd formation, effect of temperature etc.
4. Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc.)
5. Study of digestion of starch by salivary amylase and effect of PH and temperature on it.
6. Comparative study of the rate of fermentation of following material wheat flour. gram flour, Potato juice, carrot juice etc.
7. Extraction of essential oils present in saunf (aniseed), Ajwain (carum) illaichi (cardamom).
8. 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.