CHEMISTRY

SYLLABUS FOR HIGHER SECONDARY COURSE

Rationale :

Higher Secondary is the most crucial stage of school education because at this juncture specialized discipline based, content-oriented courses are introduced. Students reach this stage after 10 years of general education and opt for Chemistry with a purpose of pursuing their career in basic sciences or professional courses like medical, engineering, technology and study courses in applied areas of science and technology at tertiary level. Therefore, there is a need to provide learners with sufficient conceptual background of Chemistry, which will make them competent to meet the challenges of academic and professional courses after the higher secondary stage.

The new and updated curriculum is based on disciplinary approach with rigour and depth taking care that the syllabus is not heavy and at the same time it is comparable to the international level. The knowledge related to the subject of Chemistry has undergone tremendous changes during the past decade: Many new areas like synthetic materials, bio-molecules, natural resources, industrial chemistry are coming in a big way and deserve to be an integral part of chemistry syllabus at senior secondary stage. At international level, new formulations and nomenclature of elements and compounds, symbols and units of physical quantities floated by scientific bodies like IUPAC and CGPM are of immense importance and need to be incorporated in the updated syllabus. The revised syllabus takes care of all these aspects. Greater emphasis has been laid on use of new nomenclature, symbols and formulations, teaching of fundamental concepts, applications of concepts in chemistry to industry/ technology, logical sequencing of units, removal of obsolete content and repetition etc.

Objectives :

The broad objectives of teaching Chemistry at Senior Secondary Stage are to help the learners:

- To promote understanding of basic facts and concepts in chemistry while retaining the excitement of chemistry.
- To make students capable of studying chemistry in academic and professional courses (such as medical, engineering, technology) at tertiary level.
- To expose the students to various emerging new areas of chemi·stry and apprise them with their relevance in their future studies and their application in various spheres of chemical sciences and technology.
- To equip students to face various changes related to health, nutrition, environment, population, weather, industries and agriculture.
- To develop problem solving skills of students.
- To expose the students to different processes used in industries and their technological applications.
- To apprise students with interface of chemistry with other disciplines of science such as physics, biology, geology, engineering etc.
- To acquaint students with different aspects of chemistry used in daily life.
- To develop an interest in students to study chemistry as a discipline.

CHEMISTRY

SYLLABUS FOR HIGHER SECONDARY FINAL YEAR COURSE

One Paper **Three Hours** **Marks 70**

Unitwise distribution of marks and periods :

Unit No.	Title	Marks	Periods
Unit-1	Solid State	4	12
Unit-2	Solutions	5	12
Unit-3	Electrochemishy	5	14
Unit-4	Chemical kinetics	5	12
Unit-5	Surface chemistry	4	8
Unit-6	General principles and processes of Isolation of Elements	3	8
Unit-7	p-Block Elements	8	14
Unit-8	d- and f-Block Elements	5	14
Unit-9	Coordination Compounds	3	12
Unit-10	Haloalkanes and Haloarenes	4	12
Unit-11	Alcohols, Phenols and Ethers	4	12
Unit-12	Aldehydes, Ketones and Carboxylic acids	6	12
Unit-13	Organic Compounds containing Nitrogen	4	10
Unit-14	Biomolecules	4	12
Unit-15	Polymers	3	8
Unit-16	Chemistry in Everyday life	3	8
	Total	70	180

Unitwise Distribution of Course contents :

Unit-1 : Solid State

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.

Unit-2 : Solutions

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 boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass.

Unit-3 : 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, fuel cells; corrosion.

Unit-4 : Chemical kinetics

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).

Unit-5 **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 and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions - types of emulsions.

Unit-6 **General principles and processes of Isolation of Elements**

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

Unit-7 **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); Phosphorous - allotropic forms, compounds of phosphorous : preparation and properties of phosphine, halides (PCl_3, PCl_5) and oxoacids (elementary idea only).

Group 16 elements : General introduction, electronic configuration, oxidation states, occurence, 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 or halogens (structures only).

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

Unit-8 : **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– rnetallic 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.

Actinoids : Electronic configuration, oxidation states.

Unit-9 : **Coordination Compounds**

Coordination compounds : Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding; Werner's theory, VBT, CFT; isomerism, importance of coordination compounds (.in qualitative analysis, extraction of metals and biological systems).

Unit-10 **Haloalkanes and Haloarenes**

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

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

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

Unit-11 : Alcohols, Phenols and Ethers

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

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

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

Unit-12 : Aldehydes, Ketones and Carboxylic acids

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.

Unit-13 : Organic Compounds containing Nitrogen

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-14 Biomolecules

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

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

Hormones-Elementary idea (excluding structures)

Vitamins : Classificacion and functions.

Nucleic Acids : DNA and RNA.

Unit-15 Polymers

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

Unit-16 : Chemistry in Evelyday life

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

SYLLABUS FOR CHEMISTRY PRACTICAL

Total Marks- 30 **Total Periods 60**

Microchemical 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, arsenious sulphide.
(b) Dialysis of sol prepared in (a) above.
(c) 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 iodide ion with hydrogen peroxide at room temperature using different concentration of iodide ions.
(ii) Reaction between potassium iodate (KIO_3) and sodium sulphite (Na_2SO_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 $Zn/Zn^{2+}//Cu^{2+}/Cu$ with change in concentration of electrolytes ($CuSO_4$ or $ZnSO_4$) 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. Preparation of Inorganic Compounds

(a) Preparation of double salt, ferrous ammonium sulphate or potash alum.
(b) Preparation of potassium ferric oxalate.

G. Preparation of Organic Compounds

Preparation of any one of the following compounds :
(a) Acetanilide
(b) Di-benzal acetone
(c) *p*-Nitroacetanilide.
(d) Aniline yellow or 2-Napththol aniline dye.

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 $KMnO_4$ 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).

K. Qualitative Analysis

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

Cations– Pb^{2+}, Cu^{2+}, As^{3+}, Al^{3+}, Fe^{3+}, Mn^{2+}, Ni^{2+}, Zn^{2+}, Co^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, NH^{+}_{4}

Anions– CO_3^{2-}, S^{2-}, SO_3^{2-}, SO_4^{2-}, NO_2^{-}, NO_3^{-}, Cl^{-}, Br^{-}, I^{-}, PO_4^{3-}, $C_2O_4^{2-}CH_3COO^{-}$

(Note : Insoluble salts excluded)

L. Projects

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

- Study of 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, ete.
- Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time ete.)
- 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 ete.
- Extraction of essential oils present in *Saunf* (aniseed), *Ajwain* (carum), *Illaicbi* (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.

Evaluation Scheme for Practical Examination	**Marks**
1. Volumetric analysis	6
(i) Completion of experiment	
(ii) Results and calculation	
2. Qualitative analysis	10
(i) Acid radicals	
(ii) Basic radicals	
3. Content based experiment	4
(One experiment out of F, G, H, I)	
4. Project works	5
Or	
Any three experiments from A to E	
(To be written in separate note book and submit in examination)	
5. Laboratory note book + Viva voce	5

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