

CHEMISTRY

Rationale :-

Education of chemistry is very relevant for need of today and tomorrow. Students reach this stage after 10 years of general education therefore subject oriented education is essential for the higher secondary level. At this stage, there is a need to provide conceptual background of Chemistry, which will make them competent to meet the challenges of academic and professional courses after the higher secondary stage. Chemistry is important for pursuing their career in basic sciences, professional courses or vocational courses like medicines, engineering, technology and studying courses in applied areas of science and technology. At this stage conceptual knowledge of chemistry develops problem solving attitude and helps to remove the obstruction in their future life and to develops their capacity.

Present Curriculum Framework for School Education (2005) has a disciplinary approach. It is reflected that syllabus is must not heavy and at the same time it is comparable to the international level. It emphasizes a coherent focus on important ideas within the discipline that are properly sequenced to optimize learning. Therefore content is not only burdenless but also with the new experiments and adjectives of science.

Salient Features of the present syllabus are thus:

- Promote understanding of basic principles in Chemistry;
- Provides logical sequencing of the 'Units' with proper placement of concepts with their linkages for better understanding.
- Develop an interest in students to study Chemistry as discipline;
- Develop positive scientific attitude, and appreciate contribution of Chemistry in quality of human life;
- Develop problem solving skills and nurture curiosity, aesthetic sense and creativity;
- Emphasis has been on promoting process – skills, problem solving abilities and applications of chemistry concepts useful in real life situation for making learning of Chemistry more relevant, meaningful and interesting.
- To realize the interface of Chemistry with other disciplines of science such as Physics, Biology, Geology, etc.
- To understand the use of chemistry in biology and realize its value in quality of life.
- Equip students to face challenges related to health, nutrition, environment, population, whether, industries and agriculture.
- Equip students to develop the decision making capacity on scientific systems.
- Inculcate values of honesty, integrity, cooperation, concern for life and preservation of the environment;



Class-XI

CHEMISTRY

Theory

UNIT-I :



Some basic concepts of Chemistry :

General Introduction : Importance and scope of chemistry, Historical approach to particulate 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 :

Discovery of electron, proton and neutron and their characteristics; atomic number, Isotopes & Isobars, Thomson's model and its limitation, Rutherford's model and its limitations, 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.P. and d orbitals, rules for filling electrons in orbitals – Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.



Total Periods : 180

(Periods -14)

(Periods -16)

- UNIT-III : Radioactivity :** (Periods -10)
Artificial and natural radioactivity, α , β and γ rays, cause of radioactivity, disintegration law, group displacement law, half life period, average life, mass defect, binding energy, balancing of nuclear reactions, fission and fusion, isotopes, isobars and isotones.
- UNIT-IV : Classification of Elements and Periodicity in Properties :** (Periods -12)
Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements – atomic radii, ionic radii, inert gas radii, ionization enthalpy, electron gain enthalpy, electro negativity, valency, classification of elements in terms of s, p, d and f-block and their characteristics, Normal and transition elements, lanthanides, metal, non metal and metalloids, oxidation states, stability, colour, magnetic properties, complexing properties and catalytic properties of transition elements.
- UNIT-V : Chemical Bonding and Molecular Structure :** (Periods -16)
Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, Covalent characters 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 bonding, shapes of ions and molecules (CH_4 , NH_3 , H_2O , SO_4^{2-} , NO_3^-).
- UNIT-VI : States of Matter : gases and liquids :** (Periods -14)
Three states of matter, Intermolecular interactions, type of bonding, melting and boiling points. Role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, Ideal behaviour, empirical derivation of gas equation. Avogadro's number. Ideal gas equation. Derivation from ideal behaviour, liquification of gases, critical temperature.
Liquid State – Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).
- UNIT-VII : Thermodynamics :** (Periods -16)
Concepts of system, 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 ΔU and ΔH , Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization and dilution.
Introduction of entropy as a state function, free energy change for spontaneous and non-spontaneous process, equilibrium.
- UNIT-VIII : Equilibrium :** (Periods -20)
Equilibrium in physical and chemical processes 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, concept of pH and its application – also with reference to human health, diseases, food, drinks, medicine, soil fertility and in fertilizer. Hydrolysis of salts (elementary idea), buffer solutions, solubility product, common ion effect (with illustrative examples).
- UNIT-IX : Redox Reactions :** (Periods -8)
Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, applications of redox reactions.
- UNIT-X : Hydrogen :** (Periods -4)
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; hydrogen as a fuel.
- UNIT-XI : s-Block Elements (Alkali and Alkaline earth metals):** (Periods -14)
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 hydrogen carbonate, biological importance of sodium and potassium..

CaO, CaCO₃ and industrial use, Special characteristics and use of Borax, Boric acid, Boron hydride, silicon, silicates and zeolite.

UNIT-XII :

Some p-Block Elements

(Periods -16)

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 acids, boron hydrides. Aluminium : uses, reactions with acids and alkalis.

Group 14 elements : General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element, Carbon - catenation, allotropic forms, physical and chemical properties; uses of some important compounds : oxides.

Preparation of some important compounds, their characteristics and uses : (Periods -4)

Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogen carbonate, biological importance of sodium, potassium, calcium, magnesium and iron.

CaO, CaCO₃ – industrial use, special characteristics and use of Borax, Boric acid, Boron hydride, silicon, silicates and zeolite.

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UNIT-XIII :

Organic Chemistry – Some Basic Principles and Techniques :

(Periods -13)

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, carboanions; electrophiles and nucleophiles, types of organic reactions.

UNIT-XIV :

Hydrocarbons :

(Periods -16)

Classification of hydrocarbons :

Alkanes – Nomenclature, isomerism, conformations (ethane only), methods of preparation, physical properties, chemical reactions, including free radical mechanism of halogenation, combustion and pyrolysis.

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

Alkynes – Nomenclature, structure of triple bond (ethyne), methods of preparation, physical properties, chemical reactions; acidic character of alkynes, some nucleophilic addition reactions.

Aromatic hydrocarbons – Introduction, IUPAC nomenclature, Benzene : resonance, aromaticity : methods of preparation, chemical properties, orientation.

Mechanism of electrophilic substitution – nitration, sulphonation, halogenation, Friedal Craft's alkylation and acylation; Aldol and cannizaro condensation, directive influence or functional group in mono-substituted benzene; carcinogenicity and toxicity.



UNIT-XV :



Environmental Chemistry :

(Periods -6)

Concept on environment and ecology, general concept of pollution – air, water and soil pollution, smogs (mixture of smoke and fogs), 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, over population, modernization, ecological imbalance, green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

CLASS-XI

PRACTICAL



Total Periods : 50
(Periods -4)

A. BASIC LABORATORY TECHNIQUES

1. Cutting glass tube & glass rod
2. Bending a glass tube
3. Boring a cork
4. Study of flame
5. Detection of elements like Na, K, Ca, Ba on the basis of flame test.

B. TEST FOR ORGANIC COMPOUNDS

Ethanol, Glycerol, Acetone, Acetate, Formate and Glucose..

(Periods -8)

C. CHARACTERIZATION AND PURIFICATION OF CHEMICAL SUBSTANCE :

(Periods -2)

Crystallization involving impure sample of any one of the following : Alum, copper sulphate, Benzoic acid.

D. Qualitative analysis : Dry and wet test for one anion and one cation in a salt :

(Periods -16)

Cation : Pb^{2+} , Cu^{2+} , Al^{3+} , Fe^{3+} , Mn^{2+} , NH_4^+ , CO_3^{2-} , Ca^{2+} , Ba^{2+} , Mg^{2+}

Anions : CO_3^{2-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , I^- , Br^- , Cl^- .

E. Quantitative Estimation

(Periods -16)

- (i) Preparation of standard solution of Sodium carbonate oxalic acid.
- (ii) Preparation of N/10 and NaOH and N/10 HCl solution from benz solution.
- (iii) Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.
- (iv) Determination of strength of a given solution of hydrochloric acid by titrating it against standard sodium carbonate solution.

F. Experiments related to pH change

(Periods -4)

- * Determination and comparison of pH of four solutions (like fruit and vegetables juices, tea etc.) using pH paper to litmus paper.
- * Know the pH of solution of weak acid and weak base of two and study of pH change by common-ion effect.

PROJECTS

(Periods -10)

1. Checking the bacterial contamination in drinking water by testing sulphide ions.
2. Methods of purification of water.
3. Testing the hardness, presence of iron, chloride etc. depending upon the regional variation in drinking water and the study of causes of presence of these ions.
4. Determination of the rate of evaporation of water, alcohol and kerosene oil.
5. Testing of temporary hardness of locally available water.
6. Determine the percentage purity of Bazar sods.
7. (a) To detect and tabulate the pH of pineapple juice, orange juice, lemon juice cucumber juice with the help of pH paper and litmus paper.
(b) To detect and tabulate the pH of china rose, harsingar, marigold and rose flower with the help of pH paper and litmus paper.
(c) Find pH of Soda water and any other soft drink like coca cola, pepsi, limca etc.
(d) To find out the insoluble impurities present in samples of water at your surroundings.

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

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Class-XII

CHEMISTRY

Theory

Total Periods : 180

UNIT-I :

Solid State :

(Periods -12)

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-II :

Solutions :

(Periods -12)

Types of solutions, expression of concentration of solutions of solids in liquids, 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-III :

Electrochemistry :

(Periods -14)

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, and fuel cells corrosion.

UNIT-IV :

Chemical Kinetics :

(Periods -12)

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

UNIT-V :

Surface Chemistry :

(Periods -8)

Adsorption – Physisorption and chemisorption; factor affecting adsorption of gases on solids; catalysis, homogeneous 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.

UNIT-VI :

General principles and process of Isolation of elements :

(Periods -8)

Principles and methods of extraction – concentration, oxidation, reduction, electrolytic and refining.

UNIT-VII :

Group I & II elements :

(Periods -8)

Abnormal properties of first element of group-13 and group-14 elements, Diagonal relationship and different properties of groups I & group-II elements like chemical reactivities, atomic and Ionic radii, enthalpy of ionization etc.

UNIT-VIII :

P-block elements :

(Periods -14)

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 of phosphorous (PCl_3 and 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 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 (structure 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-IX : *d- and f- block elements :* (Periods -14)

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 $KMnO_4$.

Lanthanides : Electronic configuration, oxidation states, chemical reactivity and lanthanide contraction.

Actinides : Electronic configuration, oxidation states.

UNIT-X : *Co-ordination Compounds :* (Periods -12)

Coordination compounds – Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding, isomerism, importance of coordination (in qualitative analysis, extraction of metals and biological systems).

UNIT-XI : *Haloalkanes and Haloarenes :* (Periods -12)

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

Haloarenes : Nature of C-X bond, methods of preparation, substitution reactions (directive influence of halogen for mono substitute compounds only) uses and environmental effects of dichloromethane, trichloro methane, tetra chloromethane, iodoform, freons, DDT.

UNIT-XII : *Alcohols, Phenols and Ethers :* (Periods -12)

Alcohol : Nomenclature, methods of preparation, physical and chemical properties (of primary alcohol 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.

UNIT-XIII : *Aldehydes, Ketones and Carboxylic Acids :* (Periods -12)

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 aldehyde, uses.

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

UNIT-XIV : *Organic compounds containing Nitrogen :* (Periods -)

Amines, nitriles and Isocyanides: 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-XV : *Biomolecules :* (Periods -12)

Carbohydrates : Classification (aldoses and ketoses), mono saccharides (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogens), importance.

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

Vitamins : Classification and functions :

Nucleic acid : DNA and RNA

- UNIT-XVI: Polymers :** (Periods -8)
Classification : natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers; natural and synthetic like polythene, nylon, polyesters, bakelite, rubber.
- UNIT-XVII: Chemistry in everyday life :** (Periods -8)
- 1. Chemical in medicines** – Analgesics, tranquilizers, antiseptic, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
 - 2. Chemicals in food** – Preservatives, artificial sweetening agents.
 - 3. Cleansing agents** – Soaps and detergents, cleansing action.

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CLASS-XII PRACTICAL

Total Periods : 60

1. (a) Preparation of two lyophilic sol and describe their characteristics. (Periods - 6)
 Lyophilic sol – Starch, egg albumin and gum.
 (b) Preparation of two lyophobic sol and describe their characteristics.
 Lyophobic sol – aluminium hydroxide, ferric hydroxide, arsenious sulphide.
 (c) Study of the role of emulsifying agent in stabilizing the emulsions of different oils and describe them in tabular form.
2. (a) Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid. (Periods - 5)
 (b) Study of reaction rates of reaction between potassium iodate., KIO_3 and sodium sulphite : (Na_2SO_3) using starch solution as indicator.
3. (i) Enthalpy of neutralization of HCl and strong basic NaOH. (Periods - 5)
 (ii) Enthalpy of neutralization of NaOH and CH_3COOH .
 (iii) Determination of enthalpy of ionization on the basis of (i) and (ii).
4. Variation of cell potential in $\text{Zn}/\text{Zn}^{2+} // \text{Cu}^{2+}/\text{Cu}$ with change in concentration of electrolytes (CuSO_4 or ZnSO_4) at room temperature. (Periods - 3)
5. **Qualitative analysis :** Dry and wet test for one anion and one cation in a given salt : (Periods - 20)
Cations – Pb^{2+} , Cu^{2+} , Ca^{2+} , Ba^{2+} , Fe^{3+} , Fe^{2+} , Zn^{2+} , Co^{2+} , Mg^{2+} , NH_4^+
Anions – CO_3^{2-} , S^{2-} , SO_3^{2-} , NO_2^- , NO_3^- , I^- , Br^- , Cl^- ,
 Detection of nitrogen, sulphur, chlorine, bromine and iodine in an organic compound.
6. **Test for the functional groups present in Organic compounds :** (Periods - 10)
 Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.
7. **Preparation of Inorganic Compounds:** (Periods - 4)
 (i) Preparation of double salt of ferrous ammonium sulphate or Potash alum. (ii) Preparation of Soap.
8. **Titration : Determination of concentration / molarity of KMnO_4 solution by titrating it against a standard solution of :** (Periods - 7)
 (i) Oxalic acid (ii) Ferrous ammonium sulphate (Periods -)



PROJECTS



1 Study of presence of carbohydrate, fat and protein in the given material.



1 Preparation of soyabean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.



1 Study of the effect of potassium bisulphate / lemon as food preservative under various conditions (temperature, concentration, time etc.)



1 Comparative study of the rate of fermentation of following materials : wheat flour, gram flour, potato juice, carrot juice etc.

1 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 help of the teacher.

COURSE STRUCTURE

Class-XI (Theory)

Three Hours

Max. Marks : 70

One Paper

Unit No.	Title	Marks
Unit-I	Some Basic concepts of Chemistry	03
Unit-II	Structure of Atom	05
Unit-III	Radioactivity	03
Unit-IV	Classification of Elements and Periodicity in Properties	04
Unit-V	Chemical Bonding and molecular Structure	05
Unit-VI	States of Matter : Gases and Liquids	04
Unit-VII	Thermodynamics	05
Unit-VIII	Equilibrium	05
Unit-IX	Redox Reactions	03
Unit-X	Hydrogen	03
Unit-XI	S-Block Elements	05
Unit-XII	Some P-Block Elements	07
Unit-XIII	Organic Chemistry : Some basic Principles and Techniques	07
Unit-XIV	Hydrocarbons	08
Unit-XV	Environmental Chemistry	03
	Total	70

