30.03.26

BHARTIYA SHIKSHA BOARD

Curriculum-Chemistry XI

Subject Code:159

Total Periods=204 (Theory 170 + Practical 34)

Unit No.	Title	No. of periods	Marks
I	Some Basic Concepts of Chemistry	12	4
II	Structure of Atom	10	6
III	Classification of Elements and Periodicity in Properties	10	4
IV	Chemical Bonding and Molecular Structure	16	6
V	States of Matter: - Solids, Liquids and Gases	16	6
VI	Chemical Thermodynamics	18	6
VII	Equilibrium	16	6
VIII	Redox Reactions	8	3
IX	Hydrogen	6	3
X	s-Block Elements	8	4
XI	p-Block Elements	18	6
XII	Organic Chemistry-- Some Basic Principles	14	6
XIII	Hydrocarbons	12	7
XIV	Environmental Chemistry	6	3
		170	70

Unit-1: Some Basic Concepts of Chemistry

Importance and scope of chemistry, Nature of matter, Laws of chemical combination, the concept of anu and parmanu in the Vedic theory of molecular structure, Dalton's atomic theory, concept of elements, Atoms and molecules, Atomic and molecular masses, mole concept and molar mass, % composition, empirical and molecular formula, Writing of chemical equations for the chemical reactions, stoichiometry and calculations based on stoichiometry.

Unit-2: Structure of atom

Rutherford and Bohr Model of atom- Brief discussion including Maharishi Kanad's philosophy, Quantum mechanics (De Broglie equation, Uncertainty principle), Quantum numbers, shapes of s,p,d and f orbitals, rules for filling electrons in orbitals--Aufbau principle, Pauli Exclusion principle, Hund's rule. Contribution of – Sir Homi Jehangir Bhabhaǁ in the field of Quantum Mechanics. Electronic configuration of atoms and stability of configuration.

Unit-3: Classification of elements and periodicity in properties

Elements discovered by Indian Scientists. Brief historical background of Periodic table, Brief introduction, Modern Periodic table its classification, trends in physical and chemical properties. Nomenclature of elements with atomic number greater than 100.

Unit-4: Chemical Bonding and Molecular structure

Brief introduction of various kinds of bonds including ionic, covalent, and coordinate bonds. Octet rule. Formal Charge, Resonance, geometry of covalent molecules, VSEPR theory, sigma & pi Bond, overlapping of orbitals, concept of hybridisation involving s, p and d orbitals and shapes of some simple molecules, Valence Bond theory, Molecular orbital theory (Qualitative idea only) Hydrogen bond.

Unit-5 States of matter: Gases, Liquids, Solids

Definition of solid, liquid and gas and its properties, Gas laws and their applications. Ideal and Real gas, Deviation from Ideal gas behavior, Types of various intermolecular forces. Liquefaction of gases, Kinetic energy and molecular speeds (elementary idea) Vapour pressure, viscosity, and surface tension (qualitative concept only)

Unit-6 Chemical Thermodynamics

Thermodynamic terms (System, Surroundings, Types of System, Change in State ,Standard State , Processes (Isothermal, Isobaric, Isochoric), Cyclic Processes, Reversible & Irreversible, Properties of System (State Function, Path Function, Extensive & Intensive, Heat Energy, Work ,Heat Capacity , and their applications, Internal energy, First law , Enthalpy & Enthalpy of different types of reactions including enthalpy of formation, enthalpy of reaction, enthalpy of phase transition, enthalpy of combustion, enthalpy of solution, thermochemical equations, Hess's law,

bond enthalpy, lattice enthalpy, spontaneity, Entropy, Second Law ,Gibb's energy, criteria for equilibrium. Brief Introduction to Third law of Thermodynamics

Unit-7: Equilibrium

Equilibrium in physical and chemical processes, Types of Equilibria (Homogeneous & Heterogeneous), equilibrium constant, Kp & Kc, factors affecting equilibrium, Le Chatelier's principle.

Ionic equilibrium- Acid, Base concept, ionization of acids and bases, Ionization constant, concept of pH, Hydrolysis of salts (elementary idea), buffer solution, solubility product, common ion effect and its application in qualitative analysis.

Unit-8: Redox Reactions

Concept of redox reaction in terms of Hydrogen, Oxygen, loss and gain of electrons, oxidation number, balancing of redox reaction equations in terms of loss and gain of electrons and change in oxidation number, (direct and indirect redox reactions) and their applications.

Unit -9 Hydrogen

Occurrence, isotopes, preparation, properties, Hydrogen as a fuel uses, hydrides, water its physical and chemical properties, Hard & Soft Water, Removal of Hardness from water, Heavy Water & its applications, Hydrogen Peroxide- Structure & its applications.

Unit- 10 s-block elements

Group 1 and Group 2 Elements—General introduction, configuration, occurrence, anomalous behavior of first element. Diagonal relationship, trends in physical and chemical properties. Some important compounds of Mg and Ca and their importance. (Milk of Magnesia, Calcium Oxide, Bleaching Powder, POP, Gypsum), Biological importance of Sodium, Potassium, Magnesium and calcium.

Unit-11 p- block elements

General introduction to p- block elements

Occurrence, configuration, variation of properties, anomalous behavior of First element of each group, oxidation states, Inert pair effect, trends in chemical reactivity, Structure & applications of some important compounds of 13^{th}, 14^{th} group elements (Borax, Boron Hydride, Boric acid, Aluminium Chloride, Alums, Silicates, Zeolites, Silicon Carbide, Silicones,), Extraction of Al (Historical reference in connection to IKS)

Unit-12 Organic Chemistry—Some Basic principles and Techniques

Ancient History, Origin of organic compounds, Carbon—Hybridization, sigma and pi bond, Structural representation of organic compounds, classification of organic compounds, Homologous series with functional groups also, IUPAC nomenclature, Isomerism (structural and brief introduction of stereoisomerism) Electron displacement effect in covalent bond (electrophile, nucleophile, Inductive effect, Resonance effect, Electromeric and Hyperconjugation, Methods of purification of organic compounds, Qualitative and Quantitative analysis of organic compounds by Spectrophotometry Method (No historical methods like kjeldhal flask)

Unit-13 Hydrocarbons

Aliphatic hydrocarbons—Alkanes, Alkenes and Alkynes including cyclic hydrocarbons

Nomenclature, isomerism, methods of preparation, physical and chemical properties, uses.

Aromatic hydrocarbons—Nomenclature of benzene, preparation, structure, Aromaticity, properties (physical and chemical), Influence of functional groups as substituent benzene.

Carcinogenity and toxicity. Brief knowledge about Judicious use of organic compounds and their impact on human health. Knowledge of plants to absorb harmful vapours of aromatic compounds like benzene and formalin etc.

Unit-14 Environmental Chemistry

Environmental pollution (Air, water and soil) chemical reactions in atmosphere, smog, major atmospheric pollutants, acid rain, ozone and its importance, depletion of ozone layer. Greenhouse effect, Global warming, pollution due to industrial wastes, green chemistry as an alternative tool for reducing pollution, strategies for control of environmental pollution. Waste management and Recycling of waste, Green crackers, E-waste.

Practicals

Laboratory Apparatus used in Ancient time:

1. Musa yantra --- crucible
2. The Kosthi yantra--- for extraction of —Essence of metals
3. The svedaniyantra--- a big earthen vessel
4. The patana yantra--- for sublimation or distillation
5. The dhupa yantra--- for fumigation.

Total Periods= 34

Evaluation Scheme for Examination Volumetric Analysis	**08**
Salt Analysis	**08**
Content Based Experiment Project Work	**08**
Class Record & Viva	**06**
	30

PRACTICAL SYLLABUS

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 rubber cork.
5. **Characterization and Purification of chemical substances**
6. Determination of melting point of an organic compound.
7. Determination of boiling point of an organic compound.
8. Crystallization of impure sample of any one of the following:- Alum, Copper Sulphate, Benzoic acid.

B. Experiments Based on pH.

(a) Any one of the following experiments:

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

   (i) Comparing the pH of solutions of strong and weak acids of same concentration.

   (ii) Study the change in the titration of strong base using universal indicator.

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

(c) Quantitative **Estimation**

1. Using a **digital Balance.**
2. **Preparation of standard solution of oxalic acid.**
3. **Determination of strength of a given solution of Sodium Hydroxide by titrating it against standard solution of oxalic acid.**
4. **Preparation of standard solution of sodium carbonate.**
5. **Determination of strength of a given solution of Hydrochloric acid by** titrating it against standard solution of sodium carbonate solution.

C. Qualitative Analysis

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

Cations-- Pb^{2+}, Cu^{2+}, 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_3^-, Cl^-, Br^-, I^-, PO_4^{3-}, $C_2O_4^{2-}$, CH_3COO^-

(Insoluble salts excluded.)

Project

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

A few suggested projects

1. Checking the bacterial contamination in drinking water by testing sulphide ions.
2. Study of the methods of purification of water.
3. Testing the hardness, presence of iron, Flouride, Chloride etc. depending upon the regional variation in drinking water and study of causes of presence of these ions above permissible limit. (if any).
4. Investigation of the foaming capacity of different washing soaps and the effect of addition of Sodium carbonate on it.
5. Determination of rate of evaporation of different liquids.
6. Study the effect of acids and bases on the tensile strength of fibres.
7. Study of acidity of fruit and vegetable juices.

Note: - Any other investigatory project, which involves about10 periods of work can be chosen with the approval of the teacher