CHEMISTRY

OVERALL AIM OF THE SYLLABUS

- To update the learner about the development in the area of Chemistry.
- To educate students to identify the social relevance of Chemistry in day-to-day affairs.
- To empower students to understand and learn the skill of conducting experiments and arriving at facts.
- To highlight students to appreciate the facts of nature and their interpretation.
- To present Chemistry as an intellectual adventure with scintillating ideas.

I P.U.C.

Total 75 hrs

(Note: 1.Only SI units to be used through out.
2.IUPAC nomenclature to be followed)

I. METALLURGY - 1 — 4 hrs

Occurrence of metals - minerals and ores.

General principles of metallurgy.

a. Concentration of ore by gravity process, magnetic separation and froth flotation.
b. Calcination and roasting.
c. Smelting. Concept of flux and slag to be introduced.
d. Refining - liquation, poling, electrolytic and zone refining.

Pyrometallurgy: extraction of Zinc from Zinc blende.

Hydrometallurgy: extraction of Gold by the cyanide process. Electrometallurgy: extraction of Magnesium from seawater.

II. ATOMIC STRUCTURE — 6 hrs

Introduction – constituents of atoms, their charge and mass.
Atomic number and atomic mass.
Wave nature of light, Electromagnetic spectrum – emission spectrum of hydrogen – Lyman series, Balmer series, Paschen series, Brackett series and Pfund series. Rydberg's equation. Numerical problems involving calculation of wavelength and wave numbers of lines in the Hydrogen spectrum. Atomic model – Bohr's theory, (derivation of equation for energy and radius not required). Explanation of origin of lines in hydrogen spectrum.

Limitations of Bohr's theory. Dual nature of electron – distinction between a particle and a wave. de Broglie's theory. Matter–wave equation (to be derived). Heisenberg's uncertainty principle (Qualitative). Quantum numbers – *n, l, m* and *s* and their significance and inter relationship. Concept of orbital – shapes of s, p and d orbitals. Pauli's exclusion principle and aufbau principle. Energy level diagram and (n+l) rule. Electronic configuration of elements with atomic numbers from 1 to 54. Hund's rule of maximum multiplicity.

General electronic configurations of s, p, and d block elements.

III. PERIODIC PROPERTIES OF ELEMENTS IN MODERN PERIODIC TABLE:

4hrs

Periodic table with 18 groups to be used.

Atomic radii (Van der Waal and covalent) and ionic radii: Comparison of size of cation and anion with the parent atom, size of isoelectronic ions. Ionization energy, electron affinity, electronegativity – Definition with illustrations. Variation patterns in atomic radius, ionization energy, electron affinity, electronegativity down the group and along the period and their interpretation.

IV. OXIDATION NUMBER

3 hrs

Oxidation and reduction – Electronic interpretation.

Oxidation number: definition, rules for computing oxidation number. Calculation of the oxidation number of an atom in a compound/ion.

Balancing redox equations using oxidation number method, calculation of equivalent masses of oxidising and reducing agents.

V. s - BLOCK ELEMENTS

3 hrs

Group I - Alkali metals

General properties: size, electronic configuration, density, ionization potential, electropositive character, oxidation state, metallic properties, flame test, reducing property, reactions with air and water. Diagonal relationship between Lithium and Magnesium.

VI. p - BLOCK ELEMENTS

3 hrs

Group 14 - General properties: size, electronic configuration, ionization potential, nonmetallic properties, oxidation state, melting point and boiling point, catenation and allotropy.

Correlation of the physical properties (hardness, thermal and electrical conductance, brilliance and melting point) of diamond and graphite with their structures. Structure of Fullerene and its applications. Silicon and Germanium as semi conductors – intrinsic and extrinsic.

VII. CHEMICAL BONDING - 1

7 hrs

Ionic bond: definition, factors favouring ionic bond. Lattice energy, Born-Haber cycle for the formation of NaCl. (Calculation of lattice energy not required)

Covalent bond. Definition. Factors favouring covalent bond. Valence Bond Theory. (Orbital concept of covalency). Types of overlapping of orbitals - s-s, s-p and p-p. σ and π

bonds, differences between σ and π bonds. Hybridisation: Definition. Types of hybridisation - sp^3, sp^2 and sp taking CH_4, C_2H_4, BF_3 and C_2H_2 as examples. VSEPR theory taking the structures of H_2O and NH_3 molecules as examples.

Polar and non-polar bonds taking HCl, H_2O, Cl_2, CH_4, and CO_2 as examples. Hydration of ions in aqueous solution.

Dipole moment: Definition. Units. Dipole moment and shapes of molecules – CO_2, H_2O, BF_3 and NH_3.

Coordinate bond: Definition. Explanation using NH_4^+ and $H_3N \rightarrow BF_3$ adduct as examples.

Hydrogen bond: Definition, inter and intra molecular hydrogen bonds taking H_2O, HF and nitrophenols as examples. Anamalous properties of water.

Van der Waal's force: Examples, dependence on molecular mass and physical state.

VIII. STOICHIOMETRY **8 hrs**

Equivalent mass of elements – definition, principles involved in the determination of equivalent masses of elements by hydrogen displacement method, oxide method, chloride method and inter-conversion method (experimental determination not needed). Numerical problems.

Equivalent masses of acids, bases and salts.

Atomic mass, Molecular mass, vapour density – definitions. Relationship between molecular mass and vapour density. Concept of STP conditions. Gram molar volume. Experimental determination of molecular mass of a volatile substance by Victor Meyer's method. Numerical problems.

Mole concept and Avogadro number; numerical problems involving calculation of -

i) number of moles when the mass of substance is given.
ii) the mass of a substance when number of moles are given.
iii) number of particles from the mass of the substance.

Numerical problems involving mass–mass, mass–volume relationship in chemical reactions.

Expression of concentration of solutions – ppm, normality, molarity and mole fraction. Principles of volumetric analysis – standard solution, titrations and indicators - acid – base (phenolphthalein and methyl orange) and redox (Diphenylamine). Numerical problems.

IX. STATES OF MATTER – THE GASEOUS STATE **5 hrs**

GAS LAWS: Boyle's Law, Charle's Law, Avogadro's hypothesis, Dalton's law of partial pressures, Graham's law of diffusion and Gay Lussac's law of combining volumes. Combined gas equation. Kinetic molecular theory of gases – postulates, root mean square velocity, derivation of an equation for the pressure exerted by a gas. Expressions for r.m.s.velocity and kinetic energy from the kinetic gas equation. Numerical problems. Ideal and real gases, Ideal gas equation, value of R (SI units). Deviation of real gases from the ideal behaviour. PV-P curves. Causes for the deviation of real gases from ideal behaviour. Derivation of Van der Waal's equation and interpretation of PV – P curves.

X. CHEMICAL THERMODYNAMICS –1 5 hrs

Introduction. System and surroundings. Types of systems and processes. Intensive and extensive properties and Internal energy. First law of thermodynamics – mathematical form of first law $\Delta U = q + w$ (SI convention to be used). Expressions for mechanical work done in isothermal and adiabatic changes (equations to be assumed). Numerical problems.

Thermo chemistry – Thermo chemical equations. Concept of enthalpy. Exothermic and endothermic reactions. Enthalpy of reaction – factors affecting enthalpy of a reaction – physical state, allotropic forms, temperature and pressure (qualitative treatment). Enthalpy of formation and stability. Relation between enthalpy and internal energy, ΔH and ΔE (derivation not needed). Enthalpy of combustion, solution, transition and neutralisation. Constancy of enthalpy of neutralisation of a strong acid by a strong base. Lavoisier and Laplace law, Hess's law of constant heat summation. Numerical problems involving calculation of enthalpy of formation, enthalpy of combustion and enthalpy of neutralisation.

XI. CHEMICAL EQUILIBRIUM 5 hrs

Rate of a chemical reaction – definition and unit. Factors affecting the rate of a reaction. Reversible and irreversible reactions – illustrations.
Chemical equilibrium – dynamic equilibrium, equilibrium constants (Kp and Kc) of a reversible reaction. Characteristics of equilibrium constant.
Law of mass action, application of the law of mass action to derive an expression for Kp of the following equilibria:

1. $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$
2. $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$
3. $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

Relationship between Kp and Kc. (Derivation not needed). Numerical problems involving Kp and Kc to be worked out for the above reactions.
LeChatelier's principle – its application to:

a) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO(g)$; $\Delta H = + QKJ$
b) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$; $\Delta H = - QKJ$

XII. SURFACE CHEMISTRY 3 hrs

Adsorption : Definition, differences between adsorption and absorption. Types of adsorption – differences. Factors which influence adsorption of gases on solids. Freundlich and Langmuir's adsorption isotherm. (equations to be assumed – numerical problems not included)

Catalysis: Homogeneous and heterogeneous catalysis. Positive and negative catalysis – characteristics of catalysis. Mechanism of catalysis – adsorption theory, active centres, catalytic poisons and promoters. Autocatalysis and enzyme catalysis (brief account only) with examples. Industrial applications of catalysis.

XIII. AIM AND SCOPE OF ORGANIC CHEMISTRY 1 hr

Practical applications of Organic Compounds – in food, fuel (power and transportation), propellants, explosives, dyes and detergents. (Introductory approach only). Chemotherapy.

XIV. COMPOSITION OF ORGANIC COMPOUNDS 3 hrs

Detection of elements: Carbon and Hydrogen by the copper oxide test.
Nitrogen, Sulphur and Halogens by Lassaigne's test.
Estimation of:

1. Carbon and Hydrogen – by Leibig's method.
2. Nitrogen by the Kjeldahl's method (Numerical problems not included).

Empirical and molecular formulae - definition and determination Numerical problems.

XV. CLASSIFICATION AND NOMENCLATURE OF ORGANIC COMPOUNDS. 3 hrs

Classification into aliphatic, aromatic, alicyclic and heterocyclic compounds.
Functional groups and Homologous Series.
IUPAC nomenclature of bi functional aliphatic compounds.
Isomerism: Structural –chain, position, functional.

XVI. HYDROCARBONS – 1 6 hrs

Saturated and unsaturated hydrocarbons.
Uses of methane, ethene and ethyne.
Alkanes, alkenes and alkynes:

General methods of preparation of

(a) Alkanes – by Kolbe's reaction;
(b) Alkenes – from haloalkanes and
(c) Alkynes – from dihalo alkanes.

Homolysis and Heterolysis.
Substitution reactions of Alkanes – halogenation. Free radical mechanism of chlorination of methane.
Addition reactions of alkenes and alkynes with -

a) Hydrogen b) Halogen and c) Hydrogen halide.

Markownikoff's rule – mechanism of the addition of hydrogen halide to propene.
Cycloalkanes: Nomenclature and representation of cycloalkanes.
General methods of preparation from

1. dihalogen derivatives of alkanes .
2. calcium salts of dicarboxylic acids.

General properties.

1. substitution reaction (Halogenation)
2. ring opening reaction by hydrogen.

Aromatic hydrocarbons-
Uses of Benzene and Toluene
Benzene and Toluene - Isolation from coal tar.

Properties – a) addition of Hydrogen, b) Nitration, Chlorination, sulphonation and Friedel - Craft's reaction.

Unique features – addition reactions of cycloalkanes and substitution reactions of aromatic hydrocarbons.

Polymers

Synthetic polymer as a better substitute for natural polymer.

Addition polymers. Preparation and uses of polythene (HDPE and LDPE) and polystyrene. Natural rubber – monomer units. Synthetic rubber (Buna –S) – monomer units, structural similarity of monomers.

XVII. ORGANIC COMPOUNDS CONTAINING OXYGEN – 1 6 hrs

Alcohols and ethers

Alcohols:

Uses of methanol and ethanol.

Nomenclature of alcohols. Classification into mono, di and trihydric alcohols.

Monohydric Alcohols: Classification into primary, secondary and tertiary.

General methods of preparation from mono haloalkanes and alkenes.

Manufacture of absolute alcohol from Molasses.

General properties of monohydric alcohols:

Reaction with -

i) Sodium.
ii) halides of Phosphorus (PCl_3, PCl_5).
iii) Conc. H_2SO_4(formation of alkenes and ethers).
iv) P_2O_5.
v) carboxylic acids.
vi) acidified permanganate.

Tests to distinguish between primary, secondary and tertiary alcohols -

1) Lucas Test and 2) Dichromate Test.

Ethers:

Uses of ethoxy ethane.

Nomenclature.

General methods of preparation –

a) Williamson's ether synthesis.
b) From mono haloalkanes with silver oxide.

Chemical properties-

i) Halogenation.
ii) Reactions involving C-O bond cleavage
-with dil. H_2SO_4, PCl_5 and HI

I PUC PRACTICALS

1. a). Use of chemical balance.

   b). To determine the mass of the sulphur/charcoal up to 4th decimal using chemical balance and calculating the number of atoms in the weighed sample.

   c). To determine the mass of the sugar/ up to 4th decimal using chemical balance and calculating the number of molecules in the weighed sample.

2. Equivalent mass of Magnesium/Aluminium by aspirator method.
3. Equivalent mass of Copper by oxide method.
4. Molecular weight of Oxygen by aspirator method using $KClO_3$, MnO_2 mixture.
5. Preparation of standard solution of sodium carbonate using anhydrous sodium carbonate and standardisation of approximately decinormal HCl prepared from concentrated HCl (Student also has to prepare the ≈ 0.1N HCl).
6. Determination of the amount of NaOH in the given solution using 0.05 N HCl provided.
7. Preparation of standard decinormal solution of oxalic acid and estimation of approximately decinormal NaOH provided.
8. Determination of heat of neutralization of strong acid with strong base.
9. Determination of heat of solution of potassium nitrate or NH_4NO_3.
10. Study of Bunsen burner and glasswork.
11. (a) Preliminary analysis of organic compounds: (i)Tests to distinguish between aliphatic and aromatic compounds. (ii) Study of saturated and unsaturated compounds.

    (b) Detection of elements in organic compounds.

    Lessaigne's test: sulphur, nitrogen, chlorine, bromine

    (c) Study the reactions of ethyl alcohol

14. Study of chemical reactions along with chemical equations for the following acid radicals: CO_3^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, PO_4^{3-}, SO_4^{2-} (2 units)

DEMONSTRATION EXPERIMENTS

15. Study of exothermic and endothermic process.
    (a) solubility of ammonium chloride in water
    (b) solubility of quick lime in water
    (c) solubility of sugar in water
    (d) solubility of chloroform in acetone

16. Study of effect of concentration, temperature, catalyst and physical state of the reactants c the rate of reaction.

    (a) To observe and interpret the effect of temperature on the equilibriu

    $$2NO_2 \bullet N_2O_4$$

    (b) Study of shift in equilibrium, $Fe^{+++} + 3CNS^- \bullet Fe(CNS)_3$

    Increase or decrease of colour by varying the concentration of either ions.

17. Identification of household chemicals using principles of qualitative analysis, Following c be analysed: Common salt, baking soda, washing soda, sugar, starch, bleaching powder, ur camphor, kerosene, vinegar, honey.

CHEMISTRY

II P.U.C.

Total 75 hrs

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I. METALLURGY – 2 — 4 hrs

Physico- chemical concepts involved in the following metallurgical operations.

a) Desilverisation of lead by Parke's process- Distribution law.
b) Reduction of metal oxides - Ellingham diagrams - Relative tendency to undergo oxidation in case of elements Fe, Ag, Hg, Al, C, Cr, and Mg.
c) Blast furnace – metallurgy of iron.
   i. Reactions involved and their role.
   ii. Maintenance of the temperature gradient.
   iii. Role of each ingredient.
   iv. Energetics.

II. INDUSTRIALLY IMPORTANT COMPOUNDS: — 4 hrs

Manufacture of a) Caustic soda by Nelson's cell Method,
b) Ammonia by Haber's process,
c) Sulphuric acid by Contact process and
d) Potassium dichromate from chromite.

Uses of the above compounds.

Chemical properties of Sulphuric acid:
1. Action with metals.
2. Dehydrating nature.
3. Oxidation reactions.
4. Reaction with PCl_5

Chemical properties of Potassium dichromate:
1. With KOH.
2. Oxidation reactions.
3. Formation of chromyl chloride.

III. GROUP 18, NOBLE GASES — 2 hrs

Applications of noble gases.
Isolation of rare gases from Ramsay and Raleigh's method and separation of individual gases from noble gas mixture (Dewar's charcoal adsorption method).
Preparation of Pt XeF_6, by Neil Bartlett.

IV. d - BLOCK ELEMENTS (TRANSITION ELEMENTS) — 2 hrs

Definition. 3d series: electronic configurations, size, variable oxidation states, colour, magnetic properties, catalytic behaviour, complex formation and their interpretations.

V. CO-ORDINATION COMPOUNDS. — 5 hrs

Co-ordination compound: Definition, complex ion, ligands, types of ligands – mono, bi, tri and polydentate ligands. Co-ordination number, isomerism (ionisation, linkage,

hydrate), Werner's theory, Sigdwick's theory and EAN rule, Nomenclature of coordination compounds.
Valance Bond Theory: sp^3, dsp^2 and d^2sp^3 hybridisation taking $[Ni(CO)_4]$, $[Cu(NH_3)_4]SO_4$, $K_4[Fe(CN)_6]$ respectively as examples.

VI. CHEMICAL BONDING – 2 — 4 hrs

Covalent bonding - Molecular orbital theory: linear combination of atomic orbitals (Qualitative approach), energy level diagram, rules for filling molecular orbitals, bonding and anti bonding orbitals, bond order, electronic configuration of H_2, Li_2 and O_2. Non-existence of He_2 and paramagnetism of O_2.
Metallic bond: Electron gas theory (Electron Sea model), definition of metallic bond, correlation of metallic properties with nature of metallic bond using electron gas theory.

VII. CHEMICAL KINETICS — 5 hrs

Introduction. Commercial importance of rate studies. Order of a reaction. Factors deciding the order of a reaction – relative concentrations of the reactants and mechanism of the reaction. Derivation of equation for the rate constant of a first order reaction. Unit for the rate constant of a first order reaction. Half-life period. Relation between half – life period and order of a reaction. Numerical problems.
Determination of the order of a reaction by the graphical and the Ostwald's isolation method. Zero order, fractional order and pseudo first order reactions with illustrations. Effect of temperature on the rate of a reaction - temperature coefficient of a reaction. Arrhenius' interpretation of the energy of activation and temperature dependence of the rate of reaction. Arrhenius' equation. Influence of catalyst on energy profile. Numerical problems on energy of activation.

VIII. ELECTRO CHEMISTRY — 12 hrs

Electrolytes and non-electrolytes. Electrolysis – Faraday's laws of electrolysis. Numerical problems. Arrhenius theory of electrolytic dissociation, merits and limitations. Specific conductivity and molar conductivity –definitions and units. Strong and weak electrolytes - examples. Factors affecting conductivity.

Acids and Bases: Arrhenius' concept, limitations. Bronsted and Lowry's concept, merits and limitations. Lewis' concept. Strengths of acids and bases - dissociation constants of weak acids and weak bases. Ostwald's dilution law for a weak electrolytes -(equation to be derived)- expression for hydrogen ion concentration of weak acid and hydroxyl ion concentration of a weak base - numerical problems.

Ionic product of water. pH concept and pH scale. pK_a and pK_b values- numerical problems. Buffers. Buffer action, mechanism of buffer action in case of acetate buffer and ammonia buffer. Henderson's equation for pH of a buffer (to be derived). Principle involved in the preparation of buffer of required pH - numerical problems. Ionic equilibrium: common ion effect, solubility product, expression for K_{sp} of sparingly soluble salts of types AB, A_2B and AB_2

Relatioship between solubility and solubility product of salts of types AB, A_2B and AB_2. Applications of common ion effect and solubility product in inorganic qualitative analysis. Numerical problems.

Electrode potential: Definition, factors affecting single electrode potential. Standard electrode potential. Nernst's equation for calculating single electrode potential (to be assumed). Construction of electrochemical cells - illustration using Daniel cell. Cell representation, cell reaction, e.m.f of a cell and its relation to standard free energy change [$\bullet G^0 = -nFE^0$ (to be assumed)]. Reference electrode: Standard Hydrogen Electrode – construction, use of SHE for determination of SRP of other single electrodes. Limitations of SHE.

Electrochemical series and its applications. Corrosion as an electrochemical phenomenon, methods of prevention of corrosion.

K THEORY OF DILUTE SOLUTIONS 3 hrs

Vant Hoff's theory of dilute solutions. Colligative property. Examples of colligative properties - lowering of vapour pressure, elevation in boiling points, depression in freezing point and osmotic pressure.

Lowering of vapour pressure- Raoult's law (mathematical form to be assumed). Ideal and non-ideal solutions (elementary idea)– measurement of relative lowering of vapour pressure - Ostwald and Walker's dynamic method. Determination of molecular mass by lowering of vapour pressure). Numerical problems.

. CHEMICAL THERMODYNAMICS–2 3 hrs

Spontaneous and non-spontaneous processes. Criteria for spontaneity – tendency to attain a state of minimum energy and maximum randomness. Entropy. Entropy as a measure of randomness, change in entropy, unit of entropy. Entropy and spontaneity. Second law of thermodynamics. Gibbs' free energy as a driving force of a reaction. Gibbs' equation. Prediction of feasibility of a process in terms of $\bullet G$ using Gibbs' equation. Standard free energy change and its relation to K_p (equation to be assumed). Numerical problems.

I. COLLOIDS 3 hrs

Introduction. Colloidal system and particle size. Types of colloidal systems. Lyophilic and lyophobic sols, examples and differences. Preparation of sols by Bredig's arc method and peptisation. Purification of sols – dialysis and electro dialysis. Properties of sols – Tyndall effect, Brownian movement, electrophoresis, origin of charge, coagulation, Hardy and Schulze rule. Protective action of sols.

Gold number. Gold number of gelatin and starch. Applications of colloids: Electrical precipitation of smoke, clarification of drinking water and formation of delta.

XII. SOLID STATE 2 hrs

Crystalline and amorphous solids, differences. Types of crystalline solids – covalent, ionic, molecular and metallic solids with suitable examples. Space lattice, lattice points, unit cell and Co - ordination number.

Types of cubic lattice – simple cubic, body centred cubic, face centred cubic and their coordination numbers. Calculation of number of particles in cubic unit cells. Ionic crystals – ionic radius, radius ratio and its relation to co-ordination number and shape. Structures of NaCl and CsCl crystals.

XIII. CONCEPTS IN ORGANIC CHEMISTRY. 1 hr

Inductive effect, Mesomeric effect and Electromeric effect with illustrations.

XIV. SYNTHETIC ORGANIC CHEMISTRY 1 hr

Conversion of -

1. Methane to ethane and vice versa.
2. Methanol to ethanol and vice versa.

XV. ISOMERISM – 2 1 hr

Stereo isomerism-geometrical and optical isomerism.
Geometrical Isomerism: Illustration using
a) 2-butene b) maleic acid and fumaric acid as examples.

Optical Isomerism : Chirality, optical activity - Dextro and Laevo rotation (D and L notations).

XVI. HYDROCARBONS - 2 4 hrs

Stability of Cycloalkanes – Baeyer's Strain theory – interpretation of the properties of Cycloalkanes, strain less rings. Elucidation of the structure of Benzene – Valence Bond Theory and Molecular Orbital Theory. Mechanism of electrophilic substitution reactions of Benzene – halogenation, nitration, sulphonation and Friedel – Craft's reaction.

XVII. HALOALKANES 3 hrs

Monohalogen derivaties:
Nomenclature and General methods of preparation from –
a) alcohols and b) alkenes.

General properties of monohalogen derivatives:
a) Reduction
b) With alcoholic KOH
c) Nucleophilic substitution reactions with alcoholic NH_3, KCN, AgCN and aqueous KOH.
d) With Magnesium
e) Wurtz reaction
f) Wurtz – Fittig's reaction
g) Friedel – Craft's reaction

Mechanism of Nucleophilic Substitution reactions –
i) SN_1 mechanism of Hydrolysis of tertiary butyl bromide.
ii) SN_2 mechanism of Hydrolysis of methyl bromide.

XVIII. ORGANIC COMPOUNDS CONTAINING OXYGEN – 2 8 hrs

PHENOLS.

Uses of phenol.
Classification: Mono, di and tri-hydric Phenols.

Isolation from coal tar and manufacture by Cumene process.
Methods of preparation of Phenol from –
a) Sodium benzene sulphonate.
b) Diazonium salts

Chemical Properties-
a) Acidity of Phenols: explanation using resonance– Effect of substituents on Acidity (methyl group and nitro group as substituents)
b) Ring substitution reactions:
i) Bromination
ii) Nitration
iii) Friedel - Craft's methylation
c) Kolbe's reaction.
d) Reimer - Tiemann reaction.

ALDEHYDES AND KETONES:

Uses of methanal, benzaldehyde and acetophenone.
Nomenclature.
General methods of preparation of aliphatic and aromatic aldehydes and ketones from a) Alcohols b) Calcium salts of carboxylic acids.

Common Properties of aldehydes and ketones.
a) Addition reactions with-
i)Hydrogen cyanide
and ii)sodium bisulphite.

b) Condensation reactions with-
   i) Hydroxylamine
   ii) Hydrazine
   iii) Phenyl hydrazine
   iv) Semicarbazide

c) Oxidation.

Special reactions of aldehydes:

1. Cannizzaro's reaction- mechanism to be discussed
2. Aldol condensation.
3. Perkin's reaction.
4. Reducing properties – with Tollen's and Fehling's reagents.

Special reaction of ketones- Clemmensen's reduction.

MONOCARBOXYLIC ACIDS

Uses of methanoic acid and ethanoic acid.

Nomenclature and general methods of preparation of aliphatic acids from: a) Alcohols b) Cyanoalkanes and c) Grignard reagent.

General properties of aliphatic acids:
Reactions with -
a) Sodium bicarbonate b) alcohols c) Ammonia d) Phosphorus pentachloride and e) soda lime.
Strength of acids- explanation using resonance.
Effect of substituents (alkyl group and halogen as substituents).

XIX. AMINES **2 hrs**

Uses of Aniline.

Nomenclature. Classification – Primary, Secondary, Tertiary – aliphatic and aromatic.
General methods of preparation of primary amines from -

a. Nitro hydrocarbons.
b. Nitriles (cyano hydrocarbons)
c. Amides (Hoffmann's degradation)

General Properties:

a. Alkylation
b. Nitrous acid
c. Carbyl amine reaction
d. Acylation

Tests to distinguish between – Primary, Secondary, Tertiary amines – Methylation method.
Interpretation of Relative Basicity of – Methylamine, Ammonia and Aniline using inductive effect.

XX. CARBOHYDRATES — 2 hrs

Biological importance of carbohydrates.

Classification into mono, oligo and poly saccharides. Elucidation of the open chain structure of Glucose. Haworth's structures of Glucose, Fructose, Maltose and Sucrose. (elucidation not required)

XXI OILS AND FATS — 2 hrs

Biological importance of oils and fats.

Fatty acids – Saturated, unsaturated, formation of triglycerides. Generic formula of triglycerides.

Chemical nature of oils and fats - saponification, acid hydrolysis, rancidity, refining of oils, hydrogenation of oils, drying oils, iodine value.

XXII. AMINO ACIDS AND PROTEINS — 2 hrs

Biological importance of proteins.

α - Aminoacids – General formula .
Formulae and unique features of glycine, alanine, serine, cysteine, aspartic acid, lysine, tyrosine and proline. Zwitter ion, amphiprotic nature, isoelectric point, peptide bond, polypeptides and proteins. Denaturation of proteins.

Structural features of Insulin – a natural polypeptide.

II P.U.C. PRACTICALS

1. Semi-micro qualitative analysis of an inorganic salt containing the following anions and cations. (8 units)

   CO_3^{2-}, Cl^-, Br^-, NO_3^-, SO_4^{2-}, BO_3^{3-} and NH_4^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, Ba^{2+}, Zn^{2+}, Mn^{2+}, Al^{3+}.

   (The salt given should be soluble in water/ dilute HCl.)

2. Qualitative analysis of the following organic compounds (5 units)

   (a) Ethanoic acid, propanone, phenol, aniline, benzoic acid, salicylic acid, trichloromethane/tetrachloro methane, acetophenone & benzaldehyde.

3. Preparation, recrystallisation and melting point determination of the following compounds (2 units)

   (i) Di-nitrobenzene from nitrobenzene

   (ii) p-bromoacetanilide from acetanilide

4. Determination of velocity constant of acid hydrolysis of methyl ethanoate. (1 unit)

5. To determine the amount of ferrous ammonium sulphate crystals dissolved in 250 cm^3 of the given solution using standard potassium dichromate solution (internal indicator). (1 unit)

6. To determine the amount of potassium permanganate present in 250 cm^3 of the given solution using standard oxalic acid solution. (1 unit)

7. To determine the amount of potassium permanganate present in 250 cm^3 of the given solution using standard ferrous ammonium sulphate solution. (1 unit)

8. Study of the effect of concentration on the rate of reaction of potassium persulphate with potassium iodide. (1 unit)

9. Study of the effect of temperature on the rate of reaction of potassium persulphate with potassium iodide. (1 unit)

DEMONSTRATION EXPERIMENTS

10. Qualitative tests for carbohydrates, oils and proteins. (1 unit)

11. Determination of total hardness of water using standard EDTA solution (1 unit)

12. Construction of Daniel cell and measurement of e.m.f. using potentiometer (using Weston cadmium cell). (1 unit)