

Bangalore University
Chemistry for B.Sc (Triple Main) Semester Scheme

I Semester: CHEMISTRY PAPER (GENERAL)

55Hrs

Chapter 1: Mathematical Concepts

Logarithmic Relations, curve sketching, linear graphs and calculation of slopes, differentiation of Functions like e^x , $\log x$, $\sin x$, maxima and minima, partial differentiation, integration of some useful, relevant functions; permutations and combinations, probability.

Chapter 2: Quantum Mechanics Atomic Structure

14Hrs

Black body radiation, planks radiation law, Photoelectric Effect. Review of Bohr model, derivation of expressions for radius and energy of hydrogen atom, calculation of wave numbers of spectral lines of different series in the hydrogen spectrum, calculation of ionization energies of hydrogen like atoms. Defects of bohr model. Compton effect. De Broglie matter waves, Heisenberg uncertainly principle. Atomic Orbitals, Sinisidal wave equation, Hamittonian operator, Schrodinger wave equation, particle in a one dimensional box, postulates of quantum mechanics Scrodinger wave equation for M-atom and its separation into three equations (no derivation required), significance numbers, radial and angular wave functions and probability distribution curves, shapes of S, P and d orbitals, Paulis exclusion principle, hund's multiplicity rule, Aufbau principle. Electronic configurations of elements (upto atomic number 80).

Chapter 3 : Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electro negatively – definition, methods of determination or evaluation, trends in the periodic table and applications in predicting and explaining chemical behavior.

Modern periodic law , division of elements in the long form periodic table into s,p,d and f – blocks outer shell configuration of these groups, Comparitive study of groups 1,2, 16 and 17 with respect to electronic configuration, atomic and ionic radionization energy, electronegativity and compounds(halldes and carbonates of groups 1 and 2; diagnol relationship between Li and Mg; hydrides od groups 16 and 17)

Chapter 4 : Oxidation Numbers

Computation of oxidation numbers balancing of reds reactions, calculations of equivalent weight of oxidizing and reducing agents.

Chapter 5: colligative properties

Concept of vapour pressure, boiling point, freezing point and osmotic pressure, Raoult's law, lowering of vapour pressure, determination of the molecular weight of a non-volatile solute using

- 1) Relative lowering of vapour pressure
- 2) Evaluation of boiling point
- 3) Depression in freezing point
- 4) Osmotic pressure of soluble by Berkeley – Harley's method, Osmotic laws and analogy with laws relating ΔT , ΔT , and relative lowering of

Chapter 6 : Classification & Nomenclature of Organic Compounds

Introduction, classification; IUPAC nomenclature of mono and bifunctional organic compounds

Chapter 7: Basics of organic reaction mechanisms

Types of bond cleavage; reactive intermediates—carbocations, carbonions, carbon free radicals and carbanions; assigning formal charges; types of reagents – electrophiles and nucleophiles; types of organic reactions – additions, substitution and elimination with examples; inductive and resonance effects.

Chapter 8 : Aliphatic Hydrocarbons

Alkanes: Nomenclature and isomerism; general methods of preparation – Wurtz reaction, Kolbe's electrolysis, Corey-House reaction and decarboxylation of acids, Halogenation of alkanes – mechanism of free radical substitution, relative stability of free radicals, reactivity and selectivity of chlorination and bromination (3 hrs)

Alkenes: Nomenclature and isomerism; general methods of preparation – dehydration of alcohols, dehydrohalogenation of alkyl halides, regioselectivity, Saytzeff rule, Hofmann elimination, Reactions of alkenes - mechanism of electrophilic addition, relative stability of carbocations, addition of H_2 , HX , H_2O , Markownikoff's Rule, anti-Markownikoff addition (peroxide effect), oxymercuration-demercuration, hydroboration – oxidation, catalytic hydrogenation, epoxidation, oxidation with $KMnO_4$ and ozonolysis, 1,3-Butadiene – structure; 1,2 & 1,4 additions and Diels-Alder reaction (3 hrs)

Alkynes: Nomenclature; general methods of preparation – dehydrohalogenation of vicinal and geminal dihalides and higher alkenes from terminal alkynes; reactions of alkynes – electrophilic nature of terminal alkynes (2 hrs)

Chapter 9 : Alicyclic Compounds

2Hrs

Cycloalkanes – nomenclature, methods of preparation, chemical reactions, Baeyer's strain theory and Sachse-Mohr theory.

Chapter 10 : Conformations of Hydrocarbons

2 Hrs

Conformations of ethane, butane and cyclohexane

II SEMESTER : CHEMISTRY PAPER2 (General)

13hrs

Chapter 1 : Chemical Bonding

Ionic bond – Lattice energy, Born-Haber cycle, Born-Landé equation (derivation not required) calculation of lattice energies of NaCl and MgO, properties of ionic compounds
Covalent bond-valence bond approach, concept of resonance-CO₂, SO₂, CO₃²⁻; hybridization and directional characteristics- sp, sp², sp³, sp³d, sp³d²; shapes of BeCl₂, BCl₃, SiCl₄, PCl₅, SF₆, VSEPR theory – shapes of CH₄, NH₃, H₂O, BF₃, BrF₃, ICl₂, ICl₄; Molecular orbital theory – H₂, He₂⁺, Be₂, N₂, O₂.

Polarization concept, Fajans rules, bond length, bond angle and bond energy, polar and nonpolar molecules, dipole moment.

Weak Interactions : (a) Hydrogen bond-intramolecular and intermolecular types, anomalous properties of HF, H₂O, NH₃, alcohols, carboxylic acids, nitrophenols, biological molecules. (b) van der Waals forces-noble gases, molecular crystals.

Metallic bond-band theory, electrical properties of metals, semiconductors and insulators, superconductors.

Chapter 2: Chemistry of noble gases

3 Hrs

Discovery, separation from liquid air, isolation of helium from natural gas, applications, Preparation, properties and structures of fluorides and oxides of xenon.

Chapter 3 : compounds of some non-metals

7 Hrs

Synthesis, structure and applications of compounds of the following elements: (a) Boron- boranes (classification), diborane, boron trifluoride, borazole (b) Nitrogen- hydrazine, hydroxylamine, hydrazoic acid (c) Sulphur-thionyl chloride, sulphuryl chloride, sulphur hexafluoride (d) Halogens-bleaching powder, interhalogen compounds – ClF₃, BrF₅, IF₇.

Chapter 4 : Silicates

2Hrs

Principles of silicate structure, structure of SiO₄⁴⁻, classification of silicates - zeolite and water soluble silicates.

Chapter 5: Non-aqueous solvents

2Hrs

Liquid ammonia and liquid sulphur dioxide-solvent properties and typical reactions.

Chapter 6 : Aromatic hydrocarbons

10Hrs

Nomenclature of benzene derivatives; Kekulé structure, resonance structure and molecular orbital picture of benzene; Huckel's aromaticity rule (ex: benzene, naphthalene, anthracene and phenanthrene). Aromatic electrophilic substitution – mechanisms of substituents in toluene, chlorobenzene, nitrobenzene and phenol; hyperconjugation and resonance effects of these groups; hydrogenation of aromatic

compounds; side chain oxidation; oxidation of naphthalene, anthracene and phenanthrene.

Chapter 7 : Organic Halides

Alkyl halides : Nomenclature, isomerism and classification; methods of preparation from alcohols and alkenes, Nucleophilic substitution reactions - S_N^2 and S_N^1 mechanisms, Elimination reactions – E_1 and E_2 mechanisms, SaytZeff and Hofmann eliminations.

Aryl halides: Preparation by halogenation; relative reactivity of alkyl, allyl, vinyl and aryl halides towards substitution.

Chapter 8 : Thermodynamics

Definitions of thermodynamic terms – types of variables – intrinsic and extensive, types of systems, open, closed and isolated. Types of processes, isothermal, adiabatic, thermodynamic equilibrium, reversible and irreversible State functions – exact and inexact differentials. Concept of internal energy, heat and work.

First law of thermodynamics, significance of internal energy and enthalpy, work done in isothermal and adiabatic expansion and compression of an ideal gas.

Heat capacity of gas at constant pressure and at constant volume. Relation between the two Kirchoff's equation.

Chapter 9 : Liquid mixtures

Completely miscible, partially miscible and immiscible pair of liquids, Raoult's Law. Ideal and nonideal solutions. Vapour pressure – composition and point – composition and boiling point – composition curves. Principles of fractional distillation, Fractional distillation of completely miscible pair of mixtures azeotropic mixtures, level rule.

Study of partially miscible pair of liquids, concept of upper and lower critical solution temperature Effect of addition of salt on C.S.T. of water and phenol. Steam distillation and applications.

Distribution law, verification, and applications.

Distribution Law, verification, and applications. Henry's law of gas solubility and its applications.

III SEMESTER : CHEMISTRY PAPER 3(GENERAL)

55Hrs

Chapter 1: Gases

Maxwell Boltzmann distribution of molecular velocities, mean free path, collision frequency, derivation of expression for most probable velocity, definitions and expressions and expressions for rms velocity and average velocity (no derivation) relationship between them.

Andrews experiment on CO₂, critical constants and their determination, relationship with derwaals constant, joules-Thomson effect inversion temperature and their applications to the liquefaction of air and hydrogen law of corresponding states.

Chapter 2 : Oraganic and inorganic polymers

Definition, differences between organinc and inorganic polymers Polymerisation, addition, condensation.

Molecular weights of polymers. Determination by viscosity method. Polymer types – homo, hetero, copolymers. Preparation and applications of plastics – thermosetting (Phenol-formaldehyde, polyureihanes) thermodoftening (PVC, Polythene) : Fabrics – natural ad synthetic (acrylic, polyamido, polyester types). Rubbors – natural and synthetic (butadiene), Buna-s, neoprene, vulcanization.

Fluorocarbons, silicones, phosphazenes, Conducting polymers.

Chapter 3 : General study of d – and f – block elements

7 hrs.

Transition elements – electronic configuration, atomic and ionic radii, ionization energy, oxidation states, redox potentials, colour and magnetic properties, catalytic activity, interstitial compound formation.

Lanthanides and actinides – electronic configuration, atomic and ionic sizes, consequences of isnthanide contraction, oxidation states, ion exchange method of separation of lanthanides magnetic and spectral properties. Comparison of oxidation states, complex formation and magnetic properties of d – and f – block elements.

Chapter 4 : Metallurgy

7 hrs

Thermodynamic concept, selection of reducing agent using Ellingham diagrams (b)Refining of metals-electrolytic, vapour phase, zone refining (c) Extraction of Ni from sulphide ore, Cr from chromate ore. Au from native ore (d) Extraction of thorium from monazite sand (e) Extraction of uranium from pitchblende and plutonium from nuclear fuel.

Chapter 5 : Alcohols & Thiols

9hrs

Alcohols : nomenclature, isomerism and classification: methods of preparation – reduction of a aldehydes, ketones and acids/esters, hydroboration-oxidation and hydration of alkenes. Reactions of alcohols – acidic nature, formation of alkoxides, etherification, oxidation, comparison of the reactivity of 1⁰, 2⁰ and 3⁰ alcohols. Preparation of glycols from alkenes using O_sO₄ and KMnO₄

Thiois : Nomenclature, methods of formation and chemical reactions.

Chapter 6 : Phenols

2 hrs

Acidic nature – comparison with alcohols and carboxylic acids; reactivity and substitution reactions; mechanisms of Reimer – Tirmann and Kolbe – Schmitt reactions.

Chapter 7 : Ethers & Thioethers

3 hrs

Ethers : Nomenclature, methods of preparation - dehydration of alcohols and Williamson's synthesis. Reaction – as Lewis bases (complexation with metal ions), cleavage and auto – oxidation.

Epoxides : Preparation and reactions with carbon and nitrogen nucleophiles

Thioethers: Preparation and reactions.

Chapter 8 : Organometallic compounds

2 Hrs

Preparation and synthetic applications of a range of reagents, organolithium compounds & lithium dialkylcuprates.

Chapter : 9 Thermodynamics II

Need for the second law of thermodynamics – different ways of stating second law, Significance of entropy. Heat engine, Carnot cycle and its efficiency, calculations of entropy changes in different processes, free energy, work function and chemical potential. Criteria for equilibrium and spontaneous process.

Variation of free energy with pressure and temperature, van't Hoff Isotherm. Gibbs – Helmholtz equation, van't Hoff isotherm. Clausius – Clapeyron equation and its applications. Zeroth law of thermodynamics.

Qualitative treatment of Nernst heat theorem. Third law of thermodynamics and concept of residual entropy.

Chapter 10 : Chemical kinetics

6 Hrs

Chemical kinetics and its scope, rate of a reaction – concentration, temperature, pressure, solvent, light catalyst, Concentration dependence of rates, mathematical characteristics of simple reactions, zero order, first order, second order, half life and mean life. Determination of the order of reaction – differential method, method of integration, method of half life period and isolation method, Radioactive decay as first order phenomenon.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

IV SEMESTER : CHEMISTRY PAPER 4 (General)

Chapter 1 : Nuclear and Radiochemistry

Nucleus – Structure and Instability, Binding energy calculations, radioactive decay law, half-life, Radioactive equilibrium, radioactive sense, Geiger-Muller and scintillation counters, Artificial radioactivity-nuclear reactors, atomic energy programme in India.

Isotopes – use of Radioisotopes in tracer technique, agriculture, medicine, food preservation and carbon and tritium dating (problems to be worked out)

Chapter 2 : States of Matter & Structure of Ionic Solids

Structural differences between solids, liquids and gases, Definition of space lattice, unit cell laws of crystallography, Symmetry elements in crystals, seven crystal systems; wies and miller indices, X ray diffraction of crystals, derivation of Bragg's equation, Determination of the structure of NaCl and KCl by rotating crystal method.

Elementary discussion of the liquid crystalline state. Classification, structure and applications structures of ionic solids based on radius-ratio rules (calculations not required), crystal coordination number, structures of NaCl, CsCl, ZnS, CaF₂ and CaTO₃, schottky and frenkel defects, F-centers, gemstones, nonstoichiometric solids.

Chapter 3 : Powder Metallurgy

Advantage of powder metallurgy, applications, Techniques in production of metal powders, production of tungsten powder from wolframite.

Chapter 4 : Steel

Iron-Carbon phase diagram : austenite, ferrite, cementite and pearlite phases. Alloy steels influence of Si, Mn, Cr, Ni, Ti and W on the properties of steel, Ferro-alloys-production of ferrochrome, ferromanganese and ferrosilicon. Carbon steel-classification Heat treatment hardening; carbiding and nitriding, tempering, annealing.

Chapter 6 : Aldehydes & Ketones

Nomenclature; synthesis of aldehydes from acid chlorides; synthesis of ketones from nitriles and carboxylic acids Polarity of the carbonyl group; Aldol condensation; perian condensation; Knoevenagel condensation benzoin condensation; condensation with NH₃ , NH₂NH₂ and its derivatives; mechanisms of aldol condensation, cannizzaro reaction benzoin condensation and acetyl formation reduction – Clemmensen and Wolff-Kishner reductions, reduction by LiAlH₄ and NaBH₄

Chapter 7: Carboxylic Acids and their Derivatives

Nomenclature acidic strength effect of substituent on the strength of aliphatic and aromatic acids; preparation – oxidation of alcohols and carbonyl compounds and

hydrolysis of nitriles, Reactions- formation of esters, acid chlorides, amides and anhydrides, Heli-volhard-zelinski reaction, decarboxylation and reduction, Di and tri-carboxylic acids – action of Heat on dicarboxylic acids; reactions at the carbony

Chapter 8 : Tautomerism & Enolates

Tautomerism in carbonyl compounds; acidity of hydrogen atoms; halogenation of enollzable aldehydes and ketones; preparation and synthetic applications of diethyl malonate and ethyl acetoacetate:

Chapter 9 : Adsorption and catalysis

Freundlich's adsorption and Langmunirs isotherms, BET equation (derivation not required) and its application.

Catalysis: characteristics, Types of catalysis-homogenous and heterogeneous with examples.

Chapter 10: Phase rule

Statement and explanation of the terms with examples, one component systems – water and sulphur. Two component systems-KI-water; P8-Ag system Eutectic and freezing mixtures, and their applications.

V SEMESTER : CHEMISTRY PAPER 5 (ORGANIC)

40 Hrs

Chapter 1 : Stereochemistry

Elements of symmetry, molecular chirallty, enantiomers, stereogenic cenire, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, siastereomers, threo and erythro diastereomers, meso compounds, racemisation and resolution Relative and absolute configuration, sequence rules,

D & L and R & S and systems of nomenclature; Optical isomerism due to restricted rotation diphenyl systems.

Geometric isomerism; Determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and allcyclic compounds.

Conformations of mono and disubstituted syslohexanes .

Chapter 2 : Amines

Nomenclature and classification; basic nature; preparation of alkyl and aryl amines – reduction of nitro compounds, nitriles, reductive amination of carbonyl compounds, Gabriel phthalimide synthesis and Homann bromamide reaction. Reactions

of amines as nucleophiles diazotization; distinguishing reactions between 1^o, 2^o and 3^o amines, Synthetic applications of diazonium salts.

Chapter 3 : Heterocyclic Compounds

Structures, resonance and aromatic character of furan, pyrrole, thiophene and pyridine Methods of preparation and reactions of pyrrole, furan, thiophene and pyridine; mechanism of electrophilic substitution; comparison of basicity of pyridine, piperidine and pyrrole. Preparation and reactions of indole, quinoline and isoquinoline.

Chapter 4 : Natural Products

Carbohydrates (4 Hrs) : Introduction, classification, ring structure of glucose in detail; interconversion of glucose and fructose; mechanism of mutarotation; structures of galactose, mannose and fructose, Glycosidic bond, Disaccharides - Structures of maltos, lactose and sucrose.

Terpenoids (3 Hrs) : Occurrence, classification and isoprene rule; elucidation of structures and synthesis of citral and α - terpineol, structures of menthol, camphor, limonene and β -carotene and their uses. Alkaloids (2 Hrs); classification, general characteristics; structure elucidation and synthesis of nicotine, uses of quinine, morphine, strychnine, cocaine, reserpine and nicotine.

Chapter 5 : Spectroscopy Electronic Transitions; chromophores, auxochromes; colour and constitution; Influence of conjugation on absorption.

IR spectroscopy; vibrational transition; stretching and bending modes of vibrations; influence of force constant and atomic weight on IR absorption positions; identification of common functional groups; fingerprint region.

NMR spectroscopy; basic principles of proton magnetic resonance; applications in structural identification of simple organic molecules.

Chapter 6 : Industrial Organic Chemistry

5 Hrs

Dyes: introduction; synthesis of congo red, malachite green, alizarin and indigo.

Drugs: chemotherapy; classification of drugs; synthesis and uses of paracetamol, chloramphenicol, penicillin, ibuprofen and sulphamonomethoxime.

Soaps & Detergents: Comparison of soaps and detergents; synthesis of detergents from benzene mechanism of action of detergents.

V SEMESTER

CHEMISTRY PAPER 6 (PHYSICAL)

40Hrs.

Chapter 1 : Electrochemistry

14Hrs.

Specific, equivalent and molar conductances and their determination, Variation of conductance with concentration, weak and strong electrolytes.

Transport number, determination by moving boundary method, abnormal transference numbers, Kohlrausch law and its applications. Conductometric titrations.

Limitations of Arrhenius theory. Debye-Hückel-Onsager theory (quantitative treatment) Ionic product of water and its determination by conductivity method.

Electrolytic and Galvanic cells, convention of representing cells, reversible and irreversible cells, Standard Weston cadmium cell, EMF of cells and their determination Thermodynamic deduction of Nernst equation. Determination of E° of an electrode.

Equilibrium constant of a cell reaction, free energy of a cell reaction

Types of electrodes (Cation reversible, anion reversible and redox electrode). Electrodes standard Hydrogen Electrode, Calomel electrode, Quinhydrone, and glass electrodes Determination of pH using Hydrogen, quinhydrone and glass electrodes.

Concentration cells, determination of solubility of a sparingly soluble salts. Redox potentials potentiometric titrations.

Chapter 2 chemical & Ionic Equilibria

6hrs

Equilibrium constant & free energy, Le Chatelier's principle and its application to different processes, ionic equilibrium, common ion effect, Hydrolysis of salts, Relationship between K_n , K_w , K_a , K_b Effect of temperature and concentration on degree of hydrolysis, Evaluation of pH at salt solutions.

Solubility product and its applications, buffers and mechanism of buffer action

Chapter 3 Physical Properties and Molecular Structure

5hrs

Polarization – Orientation of dipoles in an electric field, dipole moment and its measurement by temperature and refractivity methods, induced dipole moment, Clausius – Mossotti equation, dipole moment and structures of molecules, magnetic properties-paramagnetic, diamagnetic and ferromagnetic.

Chapter 4 Spectroscopy

Introduction : electromagnetic radiation, regions of the Spectrum, statement of the Born Oppenheimer approximation, degrees of freedom.

Rotational spectroscopy : Diatomic molecules, energy levels of rigid rotor (semi-classical principles) selection rules, Isotope effect

Vibrational Spectroscopy : Infrared spectra: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies.

Raman Spectra : concept of polarizability, pure rotational and our vibrational raman spectra of diatomic molecules, Origin of stokes and anti-stokes lines, selection rules,

Electronic Spectra : Concept of potential energy curves for handling a bonding molecular orbitals , qualitative description of selection rules and Franck-Condon principle.

Qualitative description of σ , π and nonbonding M.Os, their energy

Chapter 5 PHOTOCHEMISTRY

5 hrs

Interaction of radiation with matter, Beer-Lamberts law and its application, difference between thermal and photochemical processes. Laws of photochemistry ; Grotthuss-Draper law, Stark Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence phosphorescence, nonradiative processes(internal conversion, intersystem crossing)

Dimerization of Anthracene, Luminescence, Bioluminescence, Chemical sensors

VI SEMESTER : CHEMISTRY PAPER 7(INORGANIC)

40 Hrs.

Chapter 1

COORDINATION & ORGANOMETALLIC COMPOUNDS

15 Hrs

Coordination compounds, ligands and their classification, coordination number, nomenclature of coordination compounds, Detection of complex formation, Theories of structure and bonding Werners theory, EAN rule, valence bond concept, crystal field theory (octahedral, tetrahedral and square planer complexes) Crystal field splitting and crystal field stabilization energies, Magnetic properties of $[\text{CoF}_4]^{-3}$, $[\text{Co}(\text{NH}_3)_6]^{+3}$, $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$ spectral properties of $[\text{Ti}(\text{H}_2\text{O})_6]^{+3}$, $[\text{Co}(\text{H}_2\text{O})_6]^{+2}$, $[\text{CoCl}_4]^{-3}$ isomerism – structural and stereo types

Organometallic compounds – ligands, classification (hapticity); synthesis and structures of (a) $\text{K}[\text{PtCl}_3(\eta^2\text{-C}_2\text{H}_4)]$ $[\text{Fe}(\eta^5\text{-C}_6\text{H}_6)_2]$, $[(\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2)]$, $[\text{W}(\text{CH}_3)_6]$ (b) metal carbonyls

– $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Cr}(\text{CO})_6$, $\text{Co}_2(\text{CO})_8$, $\text{Mn}_2(\text{CO})_{10}$ Eighteen electron rule as copied to the above complexes.

Applications of coordination /organometallic compounds platinum in cancer therapy Na_2CaEDTA in the treatment of heavy metal (Pb, Hg) poisoning, Wilkinson's catalyst in attend hydrogenation, Monsanto acetic acid process, role of cyanocobalamin in living systems.

Chapter 2 : Bioinorganic Chemistry

Essentials and trace elements in biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin.

Chapter 3 : industrial Materials

Non-ferrous alloys-production, applications

Refractories-properties, classification, determination of PCE values.

Abrasives – Classification, applications, hardness, manufacture and importance of carborundum, alundum, tungsten carbide.

Glass : Properties, types, manufacture of soda, borosilicate and optical glasses, Safety glass, fire-and bullet proof glasses.

Ceramics : raw materials, varieties of clay, production of ceramic ware, glazing, insulators

Cement : raw materials, grades, manufacturer of Portland cement, setting process.

Paints and Varnishers – constituents of oil and emulsion paints and their role, constituents of varnishers.

Pigments-manufacturer and relative merits of white lead, Lithopono and titanium white

Fuels : characteristics, calorific value and its determination using bomb calorimeter. Coal varieties, reserve and production in India, production of coke, Gaseous fuels- advantages, constituents and their significance, production of coal gas and LPG.

Explosives : Classification, preparation of dynamite and TNT.

Propellents- Characteristics, classification and their applications.

Chapter 4: Analytical Chemistry

5 Hrs

Errors : Classification, accuracy and precision, significant figures and computation,

Organic reagents – advantages, use of EDTA, Oxine, DMG and o-Phenanthroline in the estimation of Mg, Ca, Zn, Ni (by gravimetry) and Fe (by colorimetry)

Electrogravimetric estimation of copper, flame photometric determination of sodium and potassium.

VI SEMESTER :

CHEMISTRY PAPER 8 (BIOCHEMISTRY)

Chapter 1 : Introduction to Biochemistry

Development of biochemistry, Elemental and biochemical composition of living organisms. Major functions of cell organelles. Role of water in biological systems.

Chapter 2 Carbohydrates

Classification, biological importance. Derived monosaccharides-amino sugars, sugar acids, sugar phosphates. Oligosaccharides-isomaltose, cellobiose, trehalose. *Polysaccharides* – starch glycogen, cellulose.

Chapter 3 Lipids

Classification- simple and compound lipids. Biological importance, structures of fatty acids triglycerides and phosphoglycerides, properties of triglycerides, Biological importance of triglycerides and phosphoglycerides. Cell membrane – fluid mosaic model, Liposomes.

Chapter 3 Proteins

α - amino acids – classification on the basis of polarity and chemical nature of R-groups, ionic properties and reactions of amino acids, Peptide bond and its planarity.

Proteins – biological importance, classification based on solubility and composition. Levels of Organization of proteins – primary structures, secondary structure (α -helix and β -pleat), tertiary structures and forces stabilizing it, quaternary structure

Chapter 5. Nucleic acids

Types; components of nucleic acids – bases, nucleosides and nucleotides. Polynucleotides. Structure of DNA (Watson-Crick model) and RNA, Biological roles of DNA and RNA

Chapter 6, Enzymes

characteristics features (mention of ribozymes), classification(EC code number not required), active site, specificity, Fisher and Koshland models. Enzyme Kinetics-Factors affecting rate of enzymatic reactions, Michaelis Menten Equation (derivation not required). Competitive and noncompetitive inhibition. Cofactors.

Chapter 7, Biological oxidation

Bioenergetics – ATP and other high energy compounds. Energy coupling in biological reactions stepwise process of biological oxidation-mitochondrial electron transport chain, oxidation phosphorylation, Substrate-level phosphorylation.

Chapter 8, Metabolism

Catabolism and anabolism. *Carbohydrate metabolism* – glycolysis, fates of pyruvate, TCA cycle, energetics. *Fatty acid metabolism* - - oxidation pathway, energetics.

Protein metabolism – general aspects of amino acid degradation – deamination, transamination and decarboxylation, Urea cycle.

Chapter 9, Molecular biology

Central dogma of molecular biology, Replication of DNA – semi conservative mechanism, replication process. Outline of transcription and translation.

Chapter 10, Vitamins and Hormones

Vitamins – definition, classification and deficiency manifestations of water – soluble and fat soluble vitamins. Coenzyme functions of B-complex vitamins.

Harmones – definition, classification into a) amino acid derivatives b) peptide and polypeptide hormones c) steroid hormones, with important examples and functions.

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4. Biochemistry
P.C. Champe and P.A. Harvey, J.B.Lipincott & Co. 1992
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J.L.jain, S. Chand & Co., 1983
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7. Outlines of Biochemistry
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Weil, J.H. Wiley Eastern
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CHEMISTRY PRACTICLES

1 Semester : Practical (General Chemistry)

3 Hrs/Week

1. Calibration of glass ware i) Pipette ii) Burette iii) Volumetric flask
Note: Standard solutions to be prepared for experiments 2 to 6
2. Estimation of potassium permanganate using standard sodium oxalate solution
3. Estimation of ferrous ammonium sulphate using standard potassium dichromate solution using potassium fericyanide as external indicator.
4. Estimation of ferrous ammonium sulphate using standard potassium dichromate solution using potassium ferricyanide as external indicator.
5. Estimation of sodium thiosulphate using standard potassium dichromate solution
6. Estimation of iodine using sodium thiosulphate and standard $K_2Cr_2O_7$ Solution
7. Determination of percentage of available chlorine in the given sample of bleaching powder
8. Determination of percentage of manganese dioxide from pyrolusite ore.
9. Estimation of chloride by Mohr's method (using potassium chromate as an adsorption indicator.
10. Estimation of Chloride by Volhard's method.
11. Estimation of ferrous and ferric iron in a given mixture using standard $K_2Cr_2O_7$ solution
12. Estimation of nitrogen in and ammonium salt (using Naoh solution and standard oxalic acid)
13. Estimation of carbonate and bicarbonate in a given mixture

II Semester : Practical 2 (Physical chemistry)

3 Hrs/ Week

1. Determination of the density and viscosity of a liquid by time of flow method using Ostwaid's viscometer.
2. Determination of the percentage composition of a binary liquid mixture of viscosity method.
3. Determination of density and surface tension of a liquid (by number of drops) using only a stalagmometer
4. Determination of a heat of neutralization of a strong acid with a strong base.
5. Determination of a heat of solution of KNO_3 or NH_4Cl in water.
6. Determination of molar mass of a non electrolyte by Walker – Lumsden Method
7. Determination of the degree of dissociation of an electrolyte by eboscopic method.
8. Determination of the heat of dissociation of weak acid or a weak base by thermo chemical method.
9. Determination of critical solution temperature of phenol – water system
10. Determination of distribution coefficient of H_2 between H_2O and CCL_4
11. Determination of the distribution coefficient of benzoic acid between water and benzene

III Semester : Practical 3 (Organic Chemistry)**3Hrs/Week****Preparation & Purification of organic compounds**

1. Recrystallisation and Determination of melting point of solids
(mixed melting point Determination and its importance may be mentioned)
2. Simple distillation and Determination of boiling points of liquids.
3. Purification of solids by Sublimation
One Stage Preparations
4. Preparation of aspirin
5. Preparation of B-nspthyl acetate
6. Preparation of acelanflde from aniline
7. Preparation of 2,4,6-tribromopjenol
8. Preparation of m -dinitrobenzene
9. Preparation of iodoform from ethanovacetone
10. Preparation of benzoic acid from toluene
11. Preparation of aniline from nitrobenzene

Two Stage Preparation

12. Preparation of p-bromoaniline from acetanilide
13. Preparation of p-nitrosamine from acetanilide
14. Preparation of m-nitro benzoic acid from methyl benzoate
15. Preparation of methyl orange / methyl rad by diezotisation and coupling
Chromatography
16. Thin layer Chromatography – separation of green leaf pigments / separation of a mixture of two organic compounds.
17. Column chromatography – separation of a mixture of two organic compounds.

IV Semester Practical 4 (inorganic chemistry)**3Hrs/Week**

- a) Systematic semimicro qualitative analysis of a mixture of two simple salts (with no interfering radicals)
- b) Effluent and water analysis
- c) Separation of Mg (II) and Fe (II) by solvent extraction technique
- d) Separation of Mg (II) and Fe (II) by ion exchange process.

V Semester : practical 5 (organic chemistry)**3Hrs/Week**

Organic qualitative analysis identification of mono functional organic compounds through functional group analysis, determination of physical constant, Preparation and characterization of a suitable derivative

V Semester : Practical 6 (Physical Chemistry)**3 Hrs/Week**

1. Velocity constant for the acid for the acid hydrolysis of methyl acetate
2. Velocity constant for the saporific of ethyl acetate (a-b method)
3. Effect of concentration and temperature on the rate of oxidation of KI by $K_2S_2O_4$
3. Determination of the equivalent conductivity of 0.1N NaCl
4. Determination of the dissolution constant of monoacetic acid by conductivity method.
5. Determination of the dissolution Constant of monochloroacetic acid by conductivity method.
6. Conducts Metric titration of HCL with NaOH
7. Determination of standard redox potential of an electrodes
8. Preparation of $K_2Cr_2O_7$ with ferrous ammonium sulphate by potentiometry
9. Preparation of a buffer solution and determination of its by potentiometer
10. Determination of the solubility of a sparingly soluble salt (AgCl) by conductivity method.
11. Determination of the percentage of NaCl by miscibility temperature method.
12. Verification of Beer-Lambert's Law (for Iron - o - Phenanthroline system)
13. Determination of transition temperature of a salt hydrate by thermometric method.

VI Semester : Practical 7 (Inorganic Chemistry)

3 Hrs / Week

1. Determination of percentage of iron in hematite using biphenyl Benzidine as an internal indicator
2. Determination of iron using ceric ammonium sulphate
3. Determination of calcium in limestone
4. Determination of copper in brass
5. Determination of zinc using EDTA
6. Determination of magnesium using EDTA
7. Determination of total hardness of water using EDTA
8. Preparation of ferrous oxalate and estimation of ferrous iron
9. Determination of sulphate as $BaSO_4$
10. Determination of nickel as nickel dimethyl glyoximate
11. Determination of magnesium as magnesium oxinate
12. Determination of ferrous iron using ortho-phenanthroline
13. Determination of copper as cuprammonium sulphate

VI Semester : Practical 8 (Biochemistry)

3 Hrs/Week

1. Preparation of buffers and determination of their pH values using pH meter
2. Chemical tests for carbohydrates
3. Chemical tests for amino acids and proteins
4. Estimation of reducing sugars by Hagedorn - Jensen method
5. Estimation of lactose in milk by Nelson- Somyogi's method.
6. Estimation of blood sugar by Folin-Wu method
7. Estimation of Creatinine in urine by Jaffe's method
8. Estimation of inorganic phosphate in food samples by Fiske-Subbarow method
9. Estimation of total reducing sugars in honey by DNS (Dinitrosalicylic acid) method

10. Determination of iodine value of groundnut oil and coconut oil
11. Determination of saponification value of groundnut oil and coconut oil
12. Determination of amylase activity in saliva pancreatin
13. Separation of amino acids by circular ascending paper chromatography
14. Detection of adulterants in food stuffs.

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