

Dr. Dinesh Kumar
B.Sc. 1st Year (1st Semester)

Chemistry (Theory)

SR.NO	DATE	
1	4/08/23 to 25/08/23	Atomic Structure Idea of de Broglie matter waves, Heisenberg's uncertainty principle, atomic orbitals, quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ^2 , probability distribution curves, shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rules, Electronic configuration of elements, effective nuclear charge, Slater's rules.
2	26/08/23 to 10/09/23	Periodic table and atomic properties Classification of periodic table into s, p, d, f blocks, atomic and ionic radii, ionisation energy, electron affinity and electronegativity definition, methods of determination or evaluation, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio.
3	11/9/23 to 23/09/23	Kinetic Theory of Gases Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation, Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation, Van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from Van der Waals equation. Andrews isotherms of CO ₂ . Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation - derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision number, collision frequency, collision diameter and mean free path of molecules.
4	25/09/23 to 8/10/23	Liquids Structure of liquids, Surface tension and its determination using a stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only). Forms of solids. Unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. Elementary idea of symmetry and symmetry elements, X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and

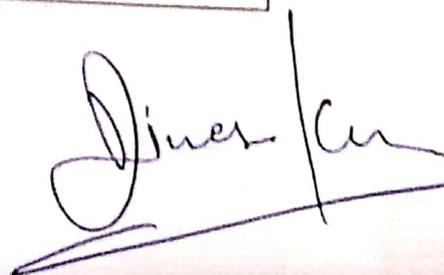


		liquid crystals.
5	9/10/23 to 23/10/23	Alkanes and Cycloalkanes IUPAC nomenclature of branched and unbranched alkanes, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation: Wurtz reaction, Kolbe reaction, 5747 Corey-House reaction and decarboxylation of carboxylic acids, physical properties. Mechanism of free radical halogenation of alkanes: reactivity and selectivity. Nomenclature, Baeyer's strain theory and its limitations, theory of strainless rings.
6	23/10/23 to 10/11/23	Alkenes and Dienes: Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes, mechanisms involved in halogenations and halohydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration, reduction, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 . Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene. Chemical reactions: 1,2 and 1,4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction

Dr. Dinesh Kumar
B.Sc. 2nd Year (IV Semester)

Chemistry (Theory)

SR NO	DATE	
1	01/01/24 to 25/01/24	Arenes and Aromaticity Nomenclature of benzene derivatives: Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti-aromatic and non-aromatic compounds. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Activating, deactivating substituents. Orientation in monosubstituted benzenes.
2	27/01/24 to 10/02/24	Alkyl and Aryl Halides Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry (inversion and racemization) of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Methods of formation and reactions of aryl halides, The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides
3	11/2/24 to 24/02/24	Chemical Kinetics The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).
4	25/02/24 to 8/3/24	Physical Properties and Molecular Structure Optical activity, polarization – (Clausius – Mossotti equation derivation excluded). Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment -temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism.
5	9/3/24 to 23/03/24	Hydrogen Bonding and Vander Waals forces Hydrogen Bonding – Definition, types, effects of hydrogen bonding on properties of substances, application Brief discussion of



		<p>various types of Van der Waals forces. Metallic Bond and semiconductors. Metallic bond - Qualitative idea of valence band and band theories of metallic bond (conductors, semiconductors, insulators). Semiconductors - Introduction, types and applications.</p>
6	24/3/24 to 20/4/24	<p>Oxyacids - Structure and relative acid strength of oxyacids of nitrogen and phosphorus, structure of white and Red phosphorus. Oxygen family (16th group): Oxy acids of sulphur - structure and acidic strength, Hydrogen Peroxide - properties and uses. Interhalogen compounds (their properties and structures), Hydra and oxy acids of chlorine - structure and comparison of acid strength, cationic nature of iodine.</p>

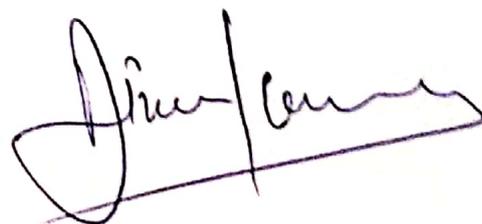
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Dr. Dinesh Kumar

B.Sc. IInd Year (3rd Semester)

Chemistry (Theory)

SR.NO	DATE	
1	4/08/23 to 25/08/23	Chemistry of d-Block elements Definition of transition elements, position in the periodic table, General characteristic properties of d-Block elements, Comparison of properties of 3d elements with 4d and 5d elements with reference only to ionic radii, oxidation state, magnetic and spectral properties and stereochemistry. Stability of various oxidation states and e.m.f (Latimer and Frost diagrams), Structure and properties of some compounds of transition elements- TiO_2 , $VOCl_2$, $FeCl_3$, $CuCl_2$ and $Ni(CO)_4$. Coordination Compounds Werner's theory of coordination compounds, effective atomic number, chelates, nomenclature of coordination compounds, Isomerism in coordination compounds, valence bond theory of transition metal complexes.
2	26/08/23 to 10/09/23	Chemistry of f-Block elements Lanthanides: Electronic structure, oxidation states, magnetic properties, complex formation, colour, ionic radii and lanthanide contraction, occurrence, separation of lanthanides, Lanthanide compounds. Actinides: General characteristics of actinides, chemistry of separation of Np, Pu and Am from uranium, Transuranic elements, comparison of properties of Lanthanides and actinides with transition elements.
3	11/9/23 to 23/09/23	Chemical Equilibrium Equilibrium constant and free energy, concept of chemical potential. Thermodynamic derivation of the law of chemical equilibrium. Temperature dependence of equilibrium constant. Distinction between ΔG and ΔG° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases. Clausius-Clapeyron equation and its applications. Nernst distribution law and its applications.
4	25/09/23 to 8/10/23	Ultraviolet (UV) absorption spectroscopy Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones, Woodward-Fieser rules, calculation of λ_{max} of simple conjugated dienes and $\alpha\beta$ unsaturated ketones (upto one DB extension).
5	9/10/23 to	Amines Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of



	23/10/23	amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel phthalimide reaction, Hofmann bromamide reaction. Electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.
6	23/10/23 to 10/11/23	Theory of Qualitative and Quantitative Analysis Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combination, chemistry of interference of acid radicals including their removal in the analysis of basic radicals, common ion effect, solubility product, theory of precipitation, co-precipitation, post precipitation, purification of precipitates.

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B.Sc. 2nd Year (IV Semester)

Chemistry (Theory)

SR.NO	DATE	
1	01/01/24 to 25/01/24	THERMODYNAMICS : Second Law Of Thermodynamics, Need For The Law, Different Statements Of The Law, Carnot's Cycle And Its Efficiency, Carnot's Theorem, Thermodynamic Scale Of Temperature. CONCEPT OF ENTROPY - Entropy As A State Function, Entropy As A Function Of V And T, Entropy As A Function Of P And T. Entropy Change In Physical Change, Entropy As A Criteria Of Spontaneity And Equilibrium THIRD LAW OF THERMODYNAMICS : Nernst Heat Theorem, Statement And Concept Of Residual Entropy, Evaluation Of Absolute Entropy From Heat Capacity Data. Gibbs Function (G) And Helmholtz Function (A) As Thermodynamic Quantities, G As Criteria For Thermodynamic Equilibrium And Spontaneity, Its Advantage Over Entropy Change. Variation Of G With P, V And T.
2	27/01/24 to 10/02/24	ELECTROCHEMISTRY ELECTROLYTIC AND GALVANIC CELLS - Reversible And Irreversible Cells, Conventional Representation Of Electrochemical Cells. Calculation Of Thermodynamic Quantities Of Cell Reaction (ΔG , ΔH And K). TYPES OF REVERSIBLE ELECTRODES : Metal-Metal Ion, Gas Electrode, Metal - Insoluble Salt-Anion And Redox Electrodes. Electrode Reactions, Nernst Equations, Derivation Of Cell EMF And Single Electrode Potential. Standard Hydrogen Electrode, Reference Electrodes, Standard Electrode Potential, Sign Conventions. Concentration Cells With And Without Transference, Liquid Junction Potential And Its Measurement. Applications Of EMF Measurement In Solubility Product And Potentiometric Titrations Using Glass Electrode. More Stress On Numerical Problems.
3	11/2/24 to 24/02/24	Chemistry of f-Block elements : Lanthanoids : Electronic Structure. Oxidation States, Magnetic Properties, Complex Formation, Colour, Ionic Radii And Lanthanoid Contraction, Occurrence, Separation Of Lanthanoids, Lanthanoid Compounds. Actinoids : General Characteristics Of Actinoids, Chemistry Of Separation Of Np, Pu And Am From Uranium. Transuranic Elements, Comparison Of Properties Of Lanthanoids And Actinoids With Transition Elements

4	25/02/24 to 8/3/24	<p>Theory of Qualitative and Quantitative Analysis: Chemistry Of Analysis Of Various Groups Of Basic And Acidic Radicals, Chemistry Of Identification Of Acid Radicals In Typical Combination. Chemistry Of Interference Of Acid Radicals Including Their Removal In The Analysis Of Basic Radical. common ion effect, solubility product, theory of precipitation, co-precipitation post precipitation, purification of precipitates</p>
5	9/3/24 to 23/03/24	<p>Infrared (IR) absorption spectroscopy: Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region. Characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Applications of IR spectroscopy in structure elucidation of simple organic compounds. AMINES Structure and nomenclature of amines, physical properties. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles Diazonium salts: Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO, and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application.</p>
6	24/3/24 to 10/4/24	<p>Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantages of oxidation of alcohols with chromium trioxide (Sarett reagent), pyridinium chlorochromate (PCC) and pyridinium dichromate. Physical properties, comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LiAlH₄, and NaBH₄, reductions.</p>

Dr. Dinesh Kumar

Subject : Inorganic Chemistry

Class : B. Sc. (VIth Semester)

Sr. No	Date	Syllabus
1.	1/1/24 to 18/1/24	Definition, nomenclature and classification of organometallic compounds, preparation, properties and bonding of alkyls of Li, Al, Hg and Sn. Brief account of metal ethylenic complexes, mononuclear carbonyls and the nature of bonding in metal carbonyls, Arrhenius, Bronsted-Lowry. The Lux-flor, solvent system and Lewis concept of acid and base.
2.	19/1/24 to 26/2/24	Concept of hard and soft acids and bases, symbiosis, electronegativity and hardness and softness. Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to Ca ²⁺ . Nitrogen fixation, silicones and phosphazenes, their preparation, properties, structures and uses.
3.	27/2/24 to 3/3/24	Organic Synthesis:- acidity of alpha hydrogens, alkylation of diethyl malonate and ethyl acetoacetate, Claisen-condensation, Keto-enol tautomerism of ethyl acetoacetate. Heterocyclic compounds:- Introduction, Molecular orbital picture, aromatic character of pyrrole, furan, thiophene and pyridine. Chemical synthesis and reactions involved, mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole. Condensed five and six membered heterocycles, Fischer indole synthesis
4.	4/3/24 to 11/3/24	Sakurai, Bischler-Napieralski synthesis, classification of amino acids, acid-base behavior, isoelectric point and electrophoresis, preparation of alpha-amino acids. Structure (Primary and secondary), classification, determination and nomenclature of peptides and proteins with their structures, end group analysis, selective hydrolysis of peptides, synthesis of solid phase and classical peptides. Synthetic polymers:- addition/chain growth, free radical vinyl,