TEACHING LESSON PLAN

Class:BSc. Subject:Chemistry Semester:1st

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JULY	**Chemical Bonding and Molecular Structure** Ionic bond, lattice energy, Born-Haber cycle and its applications
AUGUST	Hydration energy, bond moment, dipole moment and percentage ionic character. Resonance and resonance energy: study of some inorganic and organic compounds. Molecular Orbital Approach: LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combination of atomic orbitals, non- bonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as O2 - , O_2 2- , N2 - , CO, NO+ , CN- . Comparison of VB and MO approaches
SEPTEMBER	**p-Block Elements:**Oxides – structures of oxides of N, P. Oxyacids – structure and relative acid strengths of oxyacids of nitrogen and phosphorus. Structure of white, yellow and red phosphorus. Oxyacids of sulphur – structures and acidic strength, H2O2–structure, properties and uses. Basic properties of halogen, interhalogen compounds-types and properties, halogen-acids and oxyacids of chlorine – structure and comparison of acidic strength. **Acids and Bases**: Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept.
OCTOBER	**Gaseous States:** Maxwell's distribution of velocities and energies (derivation excluded), calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path, deviation of real gases from ideal behaviour, derivation of Van der Waals Equation of state and its applications in the calculation of Boyle's temperature (compression factor), explanation of behaviour of real gases using Vander Waals equation. **Critical Phenomenon:** Critical temperature, critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, isotherms of Van der Waals equation, relationship between critical constants and Van der Waals constants, compressibility factor. Law of corresponding states.
NOVEMBER	**Basics of Organic Chemistry and Stereochemistry:** Electronic displacements and its applications, reaction intermediates and concept of aromaticity. Concept of isomerism, types of isomerism, optical isomerism, optical activity, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization, relative and absolute configuration, sequence rules, R & S system of nomenclature. **REVISION + TEST**

Principal

TEACHING LESSON PLAN

Class:BSc. Subject:Chemistry Semester:2nd

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JANUARY	**Non-aqueous Solvents** Physical properties of a solvent, types of solvents and their general characteristics, solvent system concept, reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2. Hard and soft acids and bases (HSAB concept), applications of HSAB principle. **Noble Gases** Occurrence and uses, rationalization of inertness of noble gases, clathrates, preparation and properties, chemical properties of the noble gases, chemistry of xenon: structure and bonding in xenon fluorides, oxides and oxyfluorides (XeF2, XeF4, XeF6, XeO3, XeO4, XeOF2, XeO2F2, XeOF4, XeF5+, XeF5-), nature of bonding in noble gas compounds (valence bond treatment and MO treatment for XeF2 and XeF4), molecular shapes of noble gas compounds (VSEPR theory).
FEBRUARY	**Thermodynamics** Brief discussion upto first law of thermodynamics, heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule–Thomson coefficient for ideal gases and real gases and inversion temperature, calculation of work and heat, dU & dH for the expansion of ideal gases and real gases under isothermal and adiabatic conditions for reversible and irreversible processes, enthalpy and internal energy change at constant P, V &T, Kirchhoff's equation. Second law of thermodynamics and its limitations, different statements of the law, Carnot's cycle and its efficiency, Carnot's theorem, thermodynamics scale of temperature. Concept of entropy– entropy as a state function, entropy change in ideal gases, entropy as a function of V & T, entropy as a function of P & T, entropy as a function of P & V, entropy as a criterion of spontaneity and equilibrium.
MARCH	**Hydrocarbons Alkanes**: Physical and chemical properties of alkanes, free radical substitutions, halogenation, concept of relative reactivity v/s selectivity. Alkenes: Structure and isomerism, general methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1cb reactions, Saytzeff and Hoffmann elimination, electrophilic addition (mechanism with suitable examples), Markownikoff rule, syn and anti-addition, addition of H2, X2 oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, hydroxylation. Alkynes: General methods of preparation, reactions of alkynes: acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, alkylation of terminal alkynes.
APRIL	**Aromatic Hydrocarbons and Dienes** Concept of aromaticity, Huckel's rule, aromatic character of arenes, cyclic carbocations and carbanions with suitable examples and heterocyclic compounds with suitable examples, electrophilic aromatic substitution: halogenation, nitration, sulphonation, Friedel Crafts alkylation/ acylation with their mechanism, directing effects of groups in electrophilic substitution, nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene, chemical reactions- 1, 2 and 1, 4 additions (electrophilic and free radical mechanism), Diels – Alder reaction.
MAY	**REVISION+TEST**

Principal

TEACHING LESSON PLAN

Class:BSc. Subject:Chemistry Semester:3rd

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JULY	**Chemistry of Transition series elements** General characteristics of transition metals,
AUGUST	brief discussion of differences between the first, second and third transition series, stability of various oxidation states, magnetic and spectral properties. Binary compounds and complexes illustrating relative stability of their oxidation states. Chemistry of Ti, V, Cr, Mn, Fe, Co, Mo and W in various oxidation states, some important compounds as laboratory reagents: potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.
SEPTEMBER	**Thermodynamics-II** Third law of thermodynamics: Nernst heat theorem, concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for spontaneity, thermodynamic equilibrium and their advantage over entropy change. Variation of G and A with P, V and T. Partial molar quantities.
OCTOBER	**Electrochemistry** Arrhenius theory of ionization, Ostwald's Dilution Law. Debye-Huckel–Onsager's equation for strong electrolytes (elementary treatment only), transport number, definition and determination by Hittorf's methods. Electrolytic conduction, factors affecting electrolytic conduction. Applications of conductivity measurements: determination of dissociation constant (Ka) and degree of dissociation, determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pKa, buffer solution, buffer action, Henderson – Hasselbalch equation, buffer mechanism of buffer action. **Reversible electrodes** – Metal- metal ion gas electrode, metal – metal insoluble salt- anion electrode and redox electrode.
NOVEMBER	**Alkyl and aryl halides Alkyl halide:** Nomenclature and classes of alkyl halides, general methods of preparation, physical properties and chemical reactions, mechanisms (SN1, SN2, E1, E2 and E1cb) and stereochemistry of nucleophilic substitution reactions of alkyl halides with energy profile diagrams, elimination vs substitution reactions. Aryl halides: Methods of preparation, Reactions: Aromatic nucleophilic substitution and effect of substituents on reactivity. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3), reactivity and relative strength of C-halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. **REVISION + TEST**

Principal

TEACHING LESSON PLAN

Class:BSc. Subject:Chemistry Semester:4th

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JANUARY	**Coordination Compounds** Coordination compounds, ligands, coordination number, oxidation states, coordination entity, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds with coordination numbers 4 and 6. Chelates and chelate effect, Valence bond theory and its application to complexes of coordination numbers 4 and 6. Examples of inner and outer orbital complexes, limitations of VBT. Basic idea of Crystal field theory.
FEBRUARY	**Magnetic Properties of Transition Metal** Complexes Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, applications of magnetic moment data for 3d metal complexes. **41 Thermodynamic and Kinetic Aspects of Metal Complexes:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt (II).
MARCH	**Kinetics and Chemical Equilibrium** Integrated rate expression for first, second and third order reaction and their half-life period. Methods of determination of order of reaction. Effect of temperature on the rate of reaction – Arrhenius equation. Theories of reaction rate–Simple collision theory for unimolecular and bimolecular collision. Transition state theory of bimolecular reactions. Equilibrium constant and free energy, concept of chemical potential, thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant, Van't Hoff reaction isochores, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications, Clapeyron equation and Clausius – Clapeyron equation & its applications.
APRIL	**Alcohols, Phenols and Ethers Alcohols:** General methods of preparation using Grignard reagent, ester hydrolysis, reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: with sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acid. dichromate, con. HNO_3). Oppeneauer oxidation. Diols: Oxidation of diols. Pinacol Pinacolone rearrangement. **Phenols:** Methods of preparation, physical properties and acidic character. Reactions: electrophilic substitution (nitration, halogenation and sulphonation). Reimer-Tiemann reaction, Gattermann-Koch reaction, Houben-Hoesch condensation, Schotten-Baumann reaction. **Ethers (aliphatic and aromatic):** Cleavage of ethers with HI.
MAY	**REVISION + TEST**

Principal

TEACHING LESSON PLAN

Class:BSc. Subject: Chemistry Semester:5th

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JULY	**NMR Spectroscopy-I** Principle of nuclear magnetic resonance, the PMR spectrum,number of signals
AUGUST	peak areas, equivalent and non equivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons. **NMR Spectroscopy-II** Discuss ion of PMR spectra of the molecules: ethyl bromide, npropyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone
SEPTEMBER	Simple problems on PMR spectroscopy for structure determination of organic compounds **Carbohydrates-I** Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inte rconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycosides, ethers and esters.
OCTOBER	Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose. **Carbohydrates-II** An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. **Organometallic Compounds** Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions
NOVEMBER	Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions **REVISION + TEST**

Principal

TEACHING LESSON PLAN

Class:BSc. Subject:Chemistry Semester:6th

Name Of Faculty: Dr.Sanju Agrawal Session:2025-26

MONTH	
JANUARY	**Organosulphur Compounds** Nomenclature, structural features Methods of formation, chemical reactions of thiols, thioethers, sulphonic acids
FEBRUARY	sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates. **Heterocyclic Compounds** Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution Mechanism of nucleophilie substitution, reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrole Introduction to condensed five and six- membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis
MARCH	Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of quinoline and isoquinoline **Organic Synthesis via Enolates** Acidity of a-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate Synthesis of ethyl acetoacetate: the Claisen condensation Keto-enol tautomerism of ethyl Acetoacetate **Amino Acids, Peptides& Proteins** Classification ofamino acids. Acid-base behaviour, isoelectric point and electrophoresis, Preparation of a-amino acids. Structure and nomenclature peptides and proteins. Classification of proteins
APRIL	Peptide structure determination. end group analysis, selective hydrolysis of peptides. Classical) peptide synthesis, solid- phase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure **Synthetic Polymers** Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization. Ziegler-Natta polymerization and vinyl polymers, condensation or step Growth polymerization Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers
MAY	**REVISION+TEST**

Principal