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**Dr. Ajay (Assistant Professor) Lesson plan of Physical Chemistry B.Sc–Non-Medical 1st semester, Session 2023-2024**

# CHAPTER

1. **Gaseousstate:-**Maxwell’sdistribution of velocities and energies, calculation of root mean square velocity, averagevelocity and most probable velocity.
2. Collision diameter,collision frequency and meanfree path, deviation of real gases from ideal behaviour.
3. Derivation of vanderwaals equation of state, its application in the calculation of Boyle’s temperature,

explanation of behaviour of real gases using vander waals equation.

1. **Critical phenomenon:-**critical temperature, critical pressure, critical volume and their determination, PV isotherms of real gases.
2. *Continuity of state,* isotherms of vander waals equation,
3. Relationship between critical constants and vander waals constant, critical compressibility factor, law of

corresponding state.

1. Assignment and test of gaseous state and critical phenomenon.
2. **Liquidstate:-**structure of liquid, properties of liquid-surface tension, viscosity, vapour pressure and optical

rotation and their determination.

1. **Solid state:-** classification of solids, laws of crystallography -law of constancy of interfacial angles, law of rationality of indices, law of symmetry. Symmetry elements of crystal.
2. Definitionofunitcellandspacelattice,bravaislatticecrystalsystem.X- RAY diffraction by crystal.

Derivation of bragg equation. Determination of crystal structure of Nacl and Kcl.

1. **Liquidcrystal:-**difference between solids, liquids and liquid Crystals, types of liquid crystal, application of liquid crystal.
2. Assignment and test of liquid state and solid state

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| **Deepak kumar(Assistant Professor)Lessonplan of Organic Chemistry**  **B.Sc–Non-Medical 1st semester ,Session 2023-2024** | |
| **WEEKS** | **CHAPTER** |
| 1. | **Structure and Bonding**  Localized and delocalized chemical bond, vander Waals interactions, resonance conditions, |
| 2. | Resonance effect and its applications, hyperconjugation, inductive  effect, Electromeric effect & their comparison |
| 3. | **Stereochemistry of Organic Compounds-I**  Concept of isomerism. Types of isomerism. Optical isomerism, elements of symmetry,molecular chirality, enantiomers, stereogenic centre, optical activity |
| 4. | properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers,threo and erythro diastereomers, meso compounds |
| 5. | Resolution of enantiomers, inversion, retention and racemization. |
| 6. | **Stereochemistry of OrganicCompounds-II**  Relative and absolute configuration, sequence rules, R&S systems of nomenclature. Geometric isomerism determination of configuration of geometric isomers. E & Z system of nomenclature, |
| 7. | Conformational isomerism conformation alanalysis of ethane and  n-butane,conformations of cyclohexane,axial and equatorial bonds,. |
| 8. | Newman projection and Sawhorse formulae, Difference between  Configuration and conformation. |
| 9. | **Mechanism of Organic Reactions**  Curved arrow notation, drawing electron movement with arrows (half- headed and double-headed arrows), homolytic and heterolytic bond breaking. |
| 10. | Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions, free radicals, carbenes , arynes and  Nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species. |
| 11. | ***Alkanes and Cycloalkanes***  IUPAC nomenclature of branched and unbranched alkanes , the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbereaction, |
| 12. | Corey-House reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes nomenclature, synthesis of cyclo alkanes and their derivatives–photochemical (2+2) cycloaddition reactions, dehalogenation of dihalides, pyrolysis of calcium or barium salts of dicarboxylicacids, Baeyer's strain theory and its limitations., theory of strainless rings |

**Deepak Kumar (Assistant Professor) Lesson plan of Physical Chemistry**

**B.Sc–Non-Medical 1st semester, Session 2023-2024**

**Weeks Chapter**

1. Idea of de Broglie MatterWaves,Heisenberg Uncertainty Principle
2. Atomic Orbitals, Quantum Numbers
3. Radial andAngularWave Functions,Probability Distribution curves
4. Shapes of s, p, d orbital’s
5. General Principles of PeriodicTable:Aufbau and Pauli Exclusion Principles, Hund's

Multiplicity Rule. Electronic Configurations of the Elements, Effective Nuclear Charge, Slater’s Rules

1. Atomic and Ionic Radii, Ionization Energy, Electron Affinity and Electronegativity **-**

Definition

1. Methods of Determination or Evaluation,Trends in PeriodicTable (in s & p block elements)
2. Valence Bond Theory and Its Limitations, Directional Characteristics of Covalent Bond, Various Types of Hybridization and Shapes of

Simple Inorganic Molecules and Ions (BeF2,BF3,CH4,PF5, SF 6, IF 7 SO 4 2 -, ClO 4 -)

1. Valenceshellelectronpairrepulsion(VSEPR)TheorytoNH3,H3O+,SF

4,CIF3, ICI 2-and H2O. MO Theory of Heteronuclear (CO and NO)

Diatomic. Molecules, BondStrength and bond energy, Percentage Ionic character from Dipole Moment and Electronegativity Difference

1. Ionic Structures (NaCl, CsCl, ZnS ( Zinc Blende), CaF2) Radius Ratio Effect

And Coordination Number, Limitation of Radius Ratio Rule Lattice Defects

1. Semiconductors, Lattice Energy (Mathematical Derivation Excluded) and Born- Haber Cycle
2. Salvation Energy and its Relation With Solubility of Ionic Solids, Polarizing Power and Polarisability of Ions, Fajan's rule.

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| **Deepak kumar(Assistant Professor) Lesson plan of Organic Chemistry**  **B.Sc–Non-Medical, 3rd semester, (Session2023-2024)** | |
| **WEEKS** | **CHAPTER** |
| 1. | **Alcohols** Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. |
| 2. | Hydrogenbonding.Acidicnature.Reactionsofalcohols.Dihydricalcohols  —nomenclature, methods of formation,chemical reactions of vicinal glycols, |
| 3. | Oxidative cleavage [Pb(OAc)4 and HIO4] and pinacol-pinacolone rearrangement. |
| 4. | **Epoxides**  Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides ,orientation of epoxide ring opening, reactions of Grignard and organo lithium reagents with epoxides |
| 5. | **Phenols**  Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. |
| 6. | Reactions of phenols—electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction,Kolbe’sreactionandSchotten and Baumann reactions |
| 7. | **Ultra violet(UV) absorption spectroscopy**  Absorption laws (Beer-Lambert law),molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. |
| 8. | Concept of chromophore and auxochrome. Bathochromic, hypsochromic,  Hyperchromic and hypochromic shifts. UVspectra of conjugated enes and enones,Woodward- Fieser rules, |
| 9. | calculation of lamda max of simple conjugated dienes and , unsaturated ketones. Applications of UVSpectroscopy in structure elucidation of simple organic compounds. |
| 10. | **CarboxylicAcids&AcidDerivatives**  Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. |
| 11. | Preparation of carboxylic  Acids .Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. |
| 12. | Mechanism of decarboxylation. Structure, nomenclature and  Preparation of acidchlorides, esters, amides and acidanhydrides. Relative stability of acyl derivatives. |
| 13. | Physical properties, interconversion of acid derivatives by nucleophilic acylsubstitution. Mechanisms of esterification and hydrolysis (acidic  And basic). |

**Dr.Vikash(AssistantProfessor)LessonplanofPhysicalChemistry**

**B.Sc–Non-Medical 3rd semester,Session2023-2024**

**WEEKS CHAPTER**

1. **Thermodynamics-I: -** Definition of thermodynamic terms: system, surrounding etc.Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process.
2. Thermodynamics scale of temperature.Concept of entropy-Entropy as a state function, entropy as a function of “V”, “T” and “P”, Entropy change in reversible and irreversible process
3. Heatcapacity, heatcapacities at constant volume and pressure and their relationship.
4. Joule’slaw–Joule–Thomson coefficient for ideal gas and real gas and inversion temperature.
5. **Thermodynamics-II**Calculation of w. q. dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process
6. Temperature dependence of enthalpy, Kirchoffs equation. Bond

Energies and applications of bond energies.

1. **Chemical Equilibrium**: - Equilibrium constant and free energy, concept of chemical potential,Thermodynamic derivation of law of chemical equilibrium.
2. Temperature dependence of equilibrium constant;Van’t Hoff reaction isochore, Van’t Hoff reaction isotherm
3. Le-Chatetier’s principle and its applications Clapeyron equation and Clausius – Clapeyron equation its applications.
4. **DistributiolnLaw**:-Nernst distribution law–its thermodynamic

derivation,

1. Modification of distribution law when solute undergoes dissociation, a ssociation and chemical combination. Applications of distribution law:

12 (i)Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride, Determination of equilibrium constant of potassium tri-iodide complex and process of extraction

**Dr.Ajay(AssistantProfessor)LessonplanofPhysicalChemistry B.Sc–Non-Medical 3rd semester, Session 2023-2024**

**Weeks Chapter**

1. **Unit-1**: Chemistry of Elements of Ist transition series: Definition of transition elements, position in the periodic table ,General characteristics & properties of Ist transition elements.
2. Structures & properties of some compounds of transition elements–TiO2,VOCl2, FeCl3 , CuCl2 and Ni (CO)4
3. **Unit-2**:General characteristics and properties of the IInd and IIIrd transition elements.
4. Comparison of properties of 3delements with 4d & 5d elements with reference only to ionic radii,oxidation state, magnetic and Spectral properties and stereochemistry.
5. Revision of Unit-1andUnit-2, ClassTest
6. **Unit-3**:Coordination CompoundsWerner's coordination theory.
7. Effective atomic number concept, chelates, nomenclature of coordination compounds.
8. Isomerism in coordination compounds.
9. Valence bond theory of transition metal complexes.
10. **Unit-4**:Physical properties of a solvent, types of solvents
11. General characteristics of solvent and reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2
12. Revision of Unit-3 and Unit-4, ClassTest

**Dr.Vikash (Assistant Professor) Lesson plan of Physical Chemistry**

**B.Sc–Non-Medical 5th semester, Session2023-2024**

**Weeks Chapters**

Unit-1:QuantumMechanics-IBlack-bodyradiation,Plank’sradiationlaw, photoelectric effect, heat capacity of solids, Compton effect, wave function

and its significance of Postulates of quantum mechanics.

1. Quantum mechanical operator, commutation relations, Hamiltonial operator, Hermitian operator,averagevalueofsquareofHermitianasapositivequantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously.
2. Determinationofwavefunction&energyofaparticleinonedimensionalbox, Pictorial representation and its significance, Doubt discussion
3. Unit-2 :Physical Properties and Molecular Structure Optical activity, polarization – (clausius – Mossotti equation, Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method
4. refractivity method, dipole moment and structure of molecules, Magnetic permeability,magneticsusceptibilityanditsdetermination.Applicationof magnetic susceptibility,
5. magnetic properties – paramagnetism, diamagnetism and ferromagnetics.
6. **Unit-3:**Spectroscopy-II ntroduction: Electromagneticradiation,regionsof spectrum, basic features of spectroscopy, Statement of Born oppenheimer approximation, Degrees of freedom
7. Rotational Spectrum Diatomic molecules.Energy levels of rigid rotator

(semi-classical principles),selectionrules,spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution

1. Determination of bond length,qualitative description of non-rigid rotor,isotope effect.
2. **Unit-4:**Spectroscopy-II Vibrationals pectrum Infraredspectrum: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
3. Effects of anharmonic motion and isotopic effect on the spectra, idea of vibrational frequencies of different functional groups, Raman Spectrum: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules,
4. selection rules, Quantum theory of Raman spectra, Doubt and class test

# WEEK S

**Dr.Ajay (Assistant Professor) Lesson plan of Organic Chemistry B.Sc–Non-Medical 5th semester, Session 2023-2024**

# CHAPTER

* 1. **NMRSpectroscopy** Principle of nuclear magnetic resonance, thePMR spectrum, number of signals, peak areas, equivalent and non equivalent protons positions of signals
  2. Chemical shift, shielding and deshielding of protons, proton counting, splitting of signals and coupling constants, magnetic equivalence of protons.
  3. Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide,1,1-dibromoethane, ethanol, acetaldehyde, ethyl acetate, toluene
  4. Benzaldehyde and acetophenone. Simple problems on PMR spectroscopy for structure determination of organic compounds.
  5. Mechanism of osazone formation,inter conversion of glucose and fructose, chain lengthening and chain shortening of aldoses.
  6. **Carbohydrates**,Classification and nomenclature of Monosaccharides
  7. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides,
  8. Determination of ringsize of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation.
  9. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.
  10. **Organometallic Compounds**, Organo magnesium compounds: the Grignard reagents-formation, structure and chemical reactions.
  11. Organo zinc compounds:formation and chemical reactions
  12. Organo lithium compounds: formation and chemical reactions

# WEEK S

**Dr.Vikash (Assistant Professor) Lesson plan of Inorganic Chemistry B.Sc–Non-Medical 5th semester, Session 2023-2024**

# CHAPTER

1. **Cordination Chemistry,**Metal- Ligand Bonding in Transition Metal complexes Limitations of valence bond theory, an elementary idea of crystal field theory
2. Metal- Ligand Bonding in Transition Metal complexes Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral,
3. Crystal field splitting intetrahedral and square planer complexes, factors affecting the crystal field parameters.
4. **Thermodynamics and KineticAspects** of metal complexes A brief outline of thermodynamic stability of metal complexes and factors affecting the stability
5. Irving William Series, substitution reactions of square planer complexes of Pt[II], Trans effect.
6. Doubts and discussion, Test
7. **Magneticproperties**ofTransitionmetalcomplexesTypesofmagnetic materials, magnetic susceptibility
8. Method of determining magnetic susceptibility, spin only formula
9. L-Scoupling, correlation of µsand µeff values,o rbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.
10. **Electronic spectra** of Transition metal complexes Selection rules for d-d transition, spectroscopic ground states, spectro chemical series,
11. Orgel energy level diagram for d1and d9states,discussion of electronic spectrum of [Ti(H2O)6] +3 complex ion.
12. Doubts and discussion,Test