Department of Chemistry

Lesson Plan

Name of the Teacher: Dr. ANUP KUMARI

Class: M.Sc Previous (1st Semester)

Subject: 1. Physical chemistry

Session: odd semester, August-November 2025

Month	Physical chemistry	
August	.**Partial Molar Properties:** Recapitulation of thermodynamic laws, Partial molar quantities, chemical potential and Gibbs- Duhem equation, variation of chemical potential with temperature and pressure, chemical potential for an ideal gas, chemical potential of ideal gas mixture(s), determination of partial molar volume, thermodynamic functions of mixing (free energy, entropy, volume and enthalpy), concept of fugacity and activity, dependence of activity on temperature and pressure	Revision Test
September	**Chemical Kinetics:** Collision theory of reaction rates, the steric requirement, Arrhenius equation and Conventional Transition State Theory (CTST), Equilibrium hypothesis, Comparison of Collision theory and CTST, Potential energy surfaces (Only basic Idea), Thermodynamic formulation of activated complex theory, Chain reactions (hydrogen halogen reaction), Unimolecular reactions: Lindemann- Christiansen	Revision Test
October	**Quantum Mechanics-I** The postulates of quantum mechanics, Linear and Hermitian operators Commutation of operators and Uncertainty Principle. Eigen functions Eigenvalues. Schrödinger equation, free particle, Schrödinger equation particle in a box, the	Revision Test

	degeneracy, Schrödinger equation for linear harmonic oscillator and its solution, zero point energy.	
November	**Electrochemistry:** Debye-Hückel theory of ion-ion interaction and activity coefficient, applicability and limitations of Debye-Hückel limiting law, its modification for finite-sized ions, effect of ion-solvent interaction on activity coefficient. Physical significance of activity coefficients, mean activity coefficient of an electrolyte. Debye-Huckel Onsager (D-H-O) theory of electrolytic conductance, Debye Falkenhagen effect, Wein effect. D-H-O equation - its applicability and limitations, Pairwise association of ions (Bjerrum treatment), Modification of D-H-O theory to account for ion-pair formation.	Revision Test
Text Books	**Recommended Books/e-resources/LMS:** 1. An Introduction to Chemical Thermodynamics, R.P. Rastogi and R.R. Misra, Vikas Pub. 2. Physical Chemistry, P.W. Atkins, Oxford University Press. 3. Thermodynamics for Chemists, S. Glasstone, Affiliated East-West Press. 4. Thermodynamics, I.M. Klotz and R.M. Rosenbers, Benzamin. 5. Chemical Kinetics, K.J. Laidler, McGraw Hill.	

6. Kinetics and Mechanism, A. A. Frost and R.G. Pearson, John Wiley and Sons.

7. Electrochemistry, S. Glasstone, Affiliated East-West Press.

8. Physical Chemistry, G.W. Castellan, Narosa.

9. Heterogeneous Catalysis: Fundamentals and Applications, Julian R.H. Ross, Wiley VCH; 2nd, Revised and Enlarged Edition edition (October 1, 2007).

10. Concepts of Modern Catalysis and Kinetics, I. Chorkendorff and J. W. Niemantsverdriet.

11. Physical Chemistry, by Robert J. Silbey, Robert A. Alberty, Moungi G. Bawendi, Wiley India; Fourth edition (1 January 2015)

12. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.

Department of Chemistry

Lesson Plan

Name of the Teacher: Dr. ANUP KUMARI **Class**: B. Sc. 5th semester

Subject: 1. . Organic chemistry

2. Inorganic chemistry

3. 3.Physical chemistry

Session: odd semester, August-November 2025

Month	Organic chemistry	Inorganic chemistry	Physical chemistry
August	NMR Spectroscopy-I Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons.	Metal-ligand Bonding in Transition Metal Complexes Limitations of valence bond theory, an elementary idea of cr ystal-f ield theory, crystal field split ting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-f ield parameters.	Quantum Mechanic s-I Black-body radiation, Plank's radiation law, photoele effect, heat capacity of solids, Compton effect,wave func and its significance of Postulates of quantum mechan quantum mechanical operator, commutation relati Hamiltonial operator, Hermitian operator, average valu square of Hermitian as apositive quantity, Role of opera in quantum mechanics, To show quantum mechanically position and momentum cannot be predic simultaneously, Determination of wave function & energ a partic le in one dimensional box, Pictorial represent and its significance.
September	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..Simple problems on PMR spectroscopy for structure determination of organic compounds.	**Thermodynamic and Kinetic Aspects of Metal Complexe** **A brief outline of thermodynamic stability of metal complexes and factors affec ting . the s tab ility, substitution reac tions of square planar complexes of Pt(II).**	Physical Properties and Molecular Structure Optica l activity, polarization – (clausius – Mossotti equation). Orientation of dipoles in an electric field, dipol moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dip moment and structure of molecules, Magnetic permeabili magnetic susceptibility and its determination. Applica tio magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics.
October	Carbohydrates-I Classification and nomenclature. Monosaccharides, mechanism of osazone	**Magnetic Properties of Transition Metal Complexe** **Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of s and eff values, orbitalcontribution to magnetic moments, application of magnetic moment data**	Spectroscopy-I Introduction: Electromagnetic radiation, regions spectrum, basic features of spectroscopy, statemer Bornoppenheimer approximation, Degrees

	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 glycos ides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose.	**for 3dmetal complexes.**	freedom. Rotational Spectrum Diatomic molecules. Energy levels of rigid rot (semi-classical principles), selection rules, spec intensity distribution using popula distribution(Maxwell-Boltzmann distributi determination of bond length, qualitative descrip of non-rigid rotor, isotope effect.
November	. Carbohydrates-II An introduc tion to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. 2. Organometallic Compounds Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemicalreactions. Organolithium compounds: formation and chemical reactions.	.Electron Spectra of Transition Metal Complexes Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of [Ti(H2O)6]3+ complex ion.	Vibrational spectrum Infrared spectrum: Energy levels of simple harm oscillator, selection rules,pure vibrational spectr intensity, determination of force constant qualitative relation of force constant and b energies, effects of anharmonic motion and isot effect on the spectra., idea of vibrational frequen of different functional groups. Raman Spectrum: Concept of polarizibility, pure rotational and p vibrational Raman spectra of diatomic molecu selectin rules, Quantum theory of Raman spectra.
Text Books	1 Pradeep publication 2 .Laxmi . (Vijiya Publisher) 3 .Modern	1. Pradeep publication 2. R .Chand 3 .Laxmi (Vijiya Publisher) 4. Modern	1. Pradeep publication 2. R .Chand 3 .Laxmi (Vijiya Publisher) 4. Modern