Lesson Plan

Name of Assistant Professor: Mr. Hardeep
Class: B.Sc. Semester: 2nd
Subject: PHYSICAL CHEMISTRY-I CHEMICAL ENERGETICS AND EQULIBRIUM
Lesson Plan: 2023-2024

1 January **To** **20 January**	Review of thermodynamics and the law of thermodynamics. Important principles definations of thermochemistry. concept of standered state andstandered enthalpies of formations,integral and differential enthalpies of solution and dilution, calculation of bond energy; bond dissociatin energy and resonance energyfrom thermochemical data, kirchhoffs equation,
22 January To 13Feb.	State of third law of thermodynamic and calculation of absolute entropies of substance, Free energy change in a chemical reaction , thermodynamic derivation of the law of chemical equilibrium, distinction between ΔG and ΔG^0 Le charelier principle, relationship between Kp, Kc and Kx for reaction involving ideal gas
15Feb. To 9March	Strong , moderate and weak electrolytes, degree of ionization , factor affecting degree of ionization , ionization constant and ionic product of water , ionization of weak acids and bases, pH scale , common ion effect
11March To 19 April	Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salt, buffer solutions, solubility and solubility productof sparingly soluble salts-application of solubility product principle

20 April onward	Test , revision

Note: - This lesson plan is tentative.

HOD

Principal

Lesson Plan

Name of Assistant Professor: Mr. Hardeep
Class: B.Sc. Semester: 4th
Subject: PHYSICAL CHEMISTRY-III: STATES OF MATTER & CHEMICAL KINETICS
Lesson Plan: 2023-2024

1 January **To** **20 January**	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 CO2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.
22 January To 13Feb.	Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Liquids: Surface tension and its determination using 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).
15Feb. To 9March	Solids: Forms of solids. Symmetry elements, 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. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only).Defects in crystals. 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).
11March To	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

To	order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.
19 April	Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).
20 April onward	Test, Assignment Revision Revision

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HOD **Principal**

Lesson Plan

Name of Assistant Professor: Mr. Hardeep
Class: B.Sc. Semester: 6th
Subject: SPECTROSCOPY & PHOTOCHEMISTRY and QUANTUM CHEMISTRY
Lesson Plan: 2023-2024.

1 January To 20 January	Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion. Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.
22 January To 13 Feb.	Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spinspin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules. Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals. Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

15Feb. To 9 March	Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy. Angular momentum: Commutation rules, quantization of square of total angular momentum and zcomponent. Rigid rotator model of rotation of diatomic molecule.Schrödinger equation.
11 March To 19 April	Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom). Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals.Qualitative extension to H_2. Comparison of LCAOMO and VB treatments of H_2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB).Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).
20 April onward	Test, Assignment, Revision

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