

B.B.M.K. University, Dhanbad, (Jharkhand)

Ref No.

Date

Syllabus of Ph.D.In Chemistry Entrance Examination

Inorganic Chemistry

- **1.Chemical Periodicity**
- Structure and bonding in homo-and hetero nuclear molecules, including shapes of molecules (VSEPR Theory)
- 3.Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents.
- Transition elements and coordination compounds: Structure, Bonding theories, spectral and magnetic properties, reaction mechanisms.
- Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
- 6.Organometallic compounds: synthesis, bonding and structure, and reactivity. organometallics in homogeneous catalysis.
- 7. Analytical chemistry-separation, spectroscopic, electro- and thermoanalytical methods.
- Bioinorganic Chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron-transfer reactions; nitrogen fixation, metal complexes in medicine

Physical chemistry:

- 1.Basic principles of quantum mechanics: Postulates; operator algebra; exactly solvable systems: particle- in- a- box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals, orbital and spin angular momenta: tunneling
- Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy: applications
- Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle
- Chemical bonding in diatomics; elementary concept of MO and VB theories; Huckel theory for conjugated ∏-electron systems.
- Chemical applications of group theory; symmetry elements; point groups; character tables; selection rules.
- 3.Molecular spectroscopy: rotational; and vibrational spectra of diatomic molecules: electronic spectra; IR and Raman activities-selection rules; basic principles of magnetic

Department of Chemistry, PKRM College, Dhanbad-826004 (Jharkhand) Mob. 9471714411, E-mail: birendra2004@gmail.com



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resonance.

- 4. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontanelty and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chateller principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.
- Statistical thermodynamics : Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities-calculation for model systems.
- 6.Electrochemistry : Nernst equation, redox systems, electrochemical cells; Debye- Huckel theory; electrolytic conductance -Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
- 7.Chemical kinetics : Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanism; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
- 8.Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

Organic Chemistry

- 1.Aromaticity : Benzenoid and non-benzenoid compounds-generation and reactions.
- Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions free radicals, carbenes, benzynes and nitrenes.
- Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
- 4. Common named reactions and rearrangements-applications in organic synthesis.
- 5.Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysis and reagents
 - (organic, inorganic, organometallic and enzymatic) Chemo, regio and stereoselective transformations.
- 6.Asymmetric synthesis : Chiral auxiliaries, methods of asymmetric induction-substrate, reagent and catalyst controlled reactions, determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution-optical and kinetic
- Pericyclic reactions- electrocyclization, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
- 8. Structure determination of organic compounds by UV-Vis, ¹H & ¹³C NMR and Mass spectroscopic techniques.

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