

**MAGADH UNIVERSITY**  
**BODH GAYA**



**Study Raw.Com**

**SYLLABUS**  
**OF**  
**PRE- Ph. D. REGISTRATION**  
**ENTRANCE TEST**

**PAT Chemistry Syllabus**

**2014 onwards**

**FACULTY OF SCIENCES**

**Study Raw.Com**

*Price Rs. 100/-*

- (b) *Dicrocoelium dendriticum* (c) *Paragonimus wastermani* (d) *Echinococcus granulosus*, (e) *Diphyllobothrium latum* (f) *Wuchereria bancrofti*.
5. Larval forms of trematodes or Cestodes.
  5. Host specificity and Host parasite - Interactions with effect of parasite on host.
  7. Parasitic adaptations with special reference to infection and transmission.
  8. Life cycle patterns in Trematodes Cestode, and Nematodes.
  9. Resistance and Immunity with reference to helminthic infection.
  10. Parasitic crustaceans.

**CHEMISTRY**

*There will be two papers of 100 marks each. Paper I will be aimed at testing general awareness of the candidate in Chemistry. In this paper there will be 50 questions of objective type carrying 2 marks each. The candidate will be required to attempt all questions in this paper in 3 hours.*

**1. Atomic Structure and Bonding :**

Photoelectric effect, H. Spectra, Bohr model, Vector model of atoms. Concept of angular momentum of an electron, quantum numbers, Schrodinger equation, Eigen function and Eigen values, shapes of orbitals, radial and angular probability curves. Uncertainty principle, Hund's rules, Aufbau principle, Pauli's exclusion principle, Electronic configuration of atoms, Term symbols (Ground State), L.S. coupling, jj coupling schemes.

Hybridization, VSEPR theory, shapes of simple molecules with and without lone pairs. General features of V.B. theory, Variation principle,  $H_2$  molecule, Resonance, M.O. theory, treatments of simple homonuclear and heteronuclear diatomic molecules Born - Haber Cycle, Lattice Energy, Band theory, Crystal defects.

**2. Thermodynamics :**

Concepts of thermodynamic quantities and their functions, free energy & entropy calculations, Carnot cycle, Gibb's Helmholtz eqn, Clausius-Clapeyron eqn., Maxwell equations, chemical potential, van't Hoff isotherm and isochore, Nernst Heat theorem and its application to solid systems, Third law of thermodynamics.

### 3. **Chemical Kinetics :**

Rate of reaction, factors influencing the rate of a reaction-concentration, T.P. Solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life period. Determination of order of reaction-differential method, method of integration, method of half life period and isolation method. Arrhenius eqn., concept of activation energy. Simple collision theory, expression for rate constant based on equilibrium constant and thermodynamic aspects. Catalysis-characteristics, classification, acid-base catalysis, enzyme catalysis.

### 4. **Electrochemistry :**

Conductance - equivalent, specific and molar. Variations with dilution. Migration of ions, Kohlrausch law, Ostwald's dilution law, limitations. Debye-Huckel-Onsager eqn, for strong electrolytes (elementary treatment only), Transport no., Hittorf and Moving Boundary Methods, Application of conductivity measurements, measurements of  $K_a$  of acids, determination of solubility product of a sparingly soluble salt. Types of reversible electrodes. Electrode reactions. Nernst equation, Derivation of cell EMF and single electrode potential, standard electrodes. EMF of a cell. Calculation of  $\Delta G$ ,  $\Delta H$ ,  $K$  of cell reaction. Over voltage, liquid junction potential. Concentration cells with and without transference.

## 5. Chemistry of p-block elements and Chemistry of 1st Transition Series :

Comparative study of group 13-17 elements. Compounds like hydrides, oxides, oxyacids and halides of group 13-16 elements. Hydrides of boron and diborane and higher boranes, borazine, borohydrides, fullerene, carbides, inter halogen compounds, polyhalides.

Characteristics of Transition Metals, Properties of elements of the first series, relative stability of oxidation states. Catalytic properties of the metals and their compounds. Colouration and magnetic properties.

## 6. Coordination Chemistry :

Werner's theory, EAN concept, Chelates, Isomerism, VBT applications on coordination compounds. CFT : splitting in different environments. Metal carbonyls. Idea of roles of metals in biomacromolecules and metalloenzymes.

## 7. Analytical Chemistry :

General idea of the principles of inorganic mixture analysis. Principles of quantitative estimations of  $\text{SO}_4^{2-}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ag}^+$ ,  $\text{Ni}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Mg}^{2+}$ . Idea of TGA, DSC, polarography, potentiometric titrations.

## 8. General Organic Chemistry :

a. Chemical methods of purification of organic compounds including chromatography. Qualitative

analysis of an organic compound including bifunctional group. Quantitative analysis of an org. compd.

- b. IUPAC nomenclature of branched chain hydrocarbon, cycloalkane, bicyclic compounds, spiro cyclic compounds, compounds containing polyfunctional groups, Aromatic hydrocarbons. Benzenoid and non Benzenoid systems.

### 9. Stereo Chemistry of Organic Compounds :

Structural isomerism, optical isomerism (complete), Geometrical isomerism, conformational isomerism, Wedge and dash structures, Sawhorse projection and Newman projection formulae. Dihedral angle, Antiform, gauche form, eclipsed form, staggered form, stability of cyclohexane. Boat form and chair form and their relative stability.

### 10. Organic Reaction Mechanisms:

- a. Dipole moment in Org. Compds, Acidic and basic nature of Org. compounds, Homolytic & Heterolytic fission, free radicals, carbanions, carbocations and their stability, carbene (Singlet and triplet), nitrene, benzyne. Inductive effect and its consequences, Electromeric effect, conjugation effect or mesomeric effect or Resonance effect and its consequences, Hyper conjugation and its effect, steric hindrance.

- b) Mechanism of substitution reactions,  $S_N2$ ,  $S_N1$  CB mechanisms. Trans effect square planar complexes.
- c) Electronic spectra, selection rules for d-d transition and its break down, electronic spectra of  $d^2$  system.
- d) Biomolecules containing metal center transport proteins, idea of different bioinorganic enzymes and their structural features.
- e) Organometallics - Organometallic chemistry of Fe, Co Rh and Pd.

### 3. Chemistry of f-block elements :

Position in periodic table oxidation states and their stability. Lanthanide and actinide contraction. Magnetic and spectral properties, Separation technique (Ion exchange and Solvent extraction)

Transuranic elements, synthesis and chemistry of Np and Pu, Separation of Pu, from spent fuel.

### 4. Analytical Chemistry :

DTA - Basic principles, instrumental method, quantitative consideration of DTA curve, application of TGA. Basic principles, instrumentation, application of DTG, MDTA, DSC.

Colourimetry - Basic principles, Beer-Lambert law, photoelectric colourimeter, its application for estimation of carbohydrates ascorbic acid and proteins.

Chromatography- Classification chromatography terminology ( $R_f$  - value) Development of chromatograph.

### 5. Stereochemistry :

Conformational analysis of cycloalkanes, decalins, effects of conformation on reactivity, steric strain due to unavoidable crowding.

Elements of symmetry, chirality, molecules with more than one chiral centre, threo and erythro isomers, methods of resolution, optical purity, enantiotropic and diastereotropic synthesis. Optical activity in the absence of chirality in helical phenathrene.

Stereochemistry of the compounds containing nitrogen sulphur and phosphorus.

Elementary idea of optical rotatory dispersion and circular dichroism.

### 6. Reaction Mechanism : Structure and Reactivity

Types of mechanism, types of reactions thermodynamic and kinetic requirements, kinetic and thermodynamic. Hammond's postulate, Curtin-Hammett principle. Potential energy diagram, transition states and intermediates, methods of determining mechanism, isotope effect. Hard and Soft acids and base, Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrene. Effect of structure on reactivity, resonance



**Pre-Ph.D. Syllabus**

and field effects, stereo effect. The Hammett equation and linear free energy relationship, substituent and reaction constants.

**7. Chemistry of Natural Products :**

a) Carbohydrates : Conformation of monosaccharides, structure and functions of important derivatives of monosaccharides, glycosides, deoxysugar, aminosugar, N-acetylmuramic acid. Disaccharides. Structure determination and chemical synthesis (Sucrose, Lactose, Maltose and Cellobiose).

b) Terpenoids : Introduction, classification, Isoprene rule, and special isoprene rule. Structure determination and synthesis of the following compounds : Citral,  $\alpha$ -terpineol, and camphor.

c) Alkaloids Introduction, classifications, general methods of structural determination, structure determination and synthesis of the following compounds-Nicotine, papaverine, atropine.

**8. Chemical Thermodynamics :**

a) Partial molar properties-free energy, entropy, enthalpy, volume etc. In ideal gas mixture. Variation of chemical potential with temperature and pressure. Determination

chemical potential. Gibbs-Duhem equation. Fugacity and activity the variation with T and P. Fugacity of a gas mixture. Lewis Randell rule and its significance.

- b) Thermodynamics of ideal and non-ideal solutions. Duhem-Morgules equations and its application. Colligative properties using the concept of chemical potential.
- c) Thermodynamic derivation of phase rule. Application of phase rule to 3-component systems, e.g.
- i)  $\text{NaCl-Na}_2\text{SO}_4$  - water system
  - ii)  $\text{CH}_3\text{COOH-CHCl}_3$  - water system
- d) Entropy and Thermodynamic probability-Boltzmann-Planck equation, concept of energy distribution. Boltzmann distribution law. Partition functions and its significance, Relationship btween Thermodynamic functions and partition function. Sackur-Tetrode equation.

### Electro Chemistry :

- a) Electrode potential in terms of chemical potential and activity, thermodynamics of cell reactions.

**Pre-Ph.D. Syllabus**

- b) Debye-Hückel-Onsager treatment and extension, ion-solvent interactions. Debye-Hückel-Jerum mode.
- c) Over potential, exchange current density. Derivation of Butler-Volmer equation, Tafel Plot.
- d) Polarography theory, Ilkovic equation half wave potential and its significance.

**10. Quantum Chemistry :**

- a) Postulates of Quantum Mechanics, operator linear and hermitian operators, properties of operators. Angular momentum, operator their Eigen function and Eigen value Theorems of operators.
- b) Linear Harmonic Oscillator :  
Harmonic vibrations, Hermite differential equation and its solution through recursive relation, Hermite Polynomials. Rigid rotors.
- c) H - like atoms :  
Separation of  $r$ ,  $\theta$  and  $\phi$  equations, Laguerre and associate Laguerre polynomial Legendary polynomials, Probability density atomic orbitals and spin orbitals.