

MAGADH UNIVERSITY

BODH-GAYA



COURSES OF STUDIES

FOR

B. S. Honours, Subsidiary & General

Examination 1998 onwards

in

CHEMISTRY

PRICE Rs. 10/-

Magadh University

COURSES OF STUDY

FOR

B. Sc. Honours Subsidiary and General

EXAMINATIONS, 1998 & 1999

IN

CHEMISTRY

B. Sc. Honours Part—1

Paper I—A (Physical Chemistry)

Five questions will have to be answered selecting at least one question and not more than two from each group. Four questions will be set from each of the three group.

GROUP—A

THE STATES

1. Gaseous State :

Kinetic theory of gases, derivation of kinetic gas equation, deduction of gas laws, calculation of gas constant and kinetic energy, Maxwell-Boltzmann distribution law of velocities (derivation not needed) and energy, distribution curves at different temperatures, calculation of most probable, average and root mean square velocities of molecules.

Real gases, compressibility factor, derivation from ideality, various equations of state for real gases with special emphasis on vander Waal equation of state and its application to the calculation of Boyle's temperature.

2 Liquid State :

Qualitative treatment of the structure of the liquid state including various approaches to the structure of liquids, radial distribution function, physical properties of liquids (molar volume, vapour pressure, surface tension, parachor).

3 Solid State :

Types of solid, crystal forces, law of constancy of angles, seven crystal systems, law of rational indices, labelling the planes, Miller indices, qualitative idea of point and space groups, elementary idea of symmetry, symmetry elements.

4 Colloidal State :

Definitions, classification, preparation of colloidal solution and their purification, properties of colloids, protection of colloids, application of colloids.

GROUP - B

LIBRIUM

1 Chemical Equilibrium :

Reversible and irreversible reaction, statement of law

of mass action and its kinetic derivation, equilibrium constant for homogeneous and heterogeneous reactions, relationship between K_c , K_p and K_x . Le chatelier Principle and its applications.

2 (a) The First Law In Action : Thermochemistry :

Heats in chemical reactions, reaction enthalpy, standard enthalpy changes, Hess Law, Kirchoff's Law, Relation between H and U , bond energies and their determination enthalpies of ions in solutions.

(b) Thermodynamics—I.

Thermodynamic terms : systems, extensive and intensive properties, thermodynamic process, state functions and exact differentials.

3 Thermodynamics—II.

Work done in a system, internal energy, first law of thermodynamics, heat capacities, relation between C_p and C_v , isothermal and adiabatic processes for ideal gas, relation between P - V , V - T and P - T for ideal gas, adiabatic processes for ideal gas, adiabatic reversible expansion of ideal gas. elementary idea of entropy and clausius inequality.

4 Ionic Equilibrium

Ionic product of water, pH , pK_a , pK_b , and pK_h , buffer solution, buffer index, buffer capacity, buffer range, pH of buffer solution, Idea of role of buffer solutions in day to day life, Dissociation constant of acids and bases, solubility product and its applications in salt analysis, Common ion effect, HSAB concept.

**GROUP-C
CHANGES**

1 Chemical Kinetics

Rate of reaction, order and molecularity, expression for specific rate constant of first order reaction, half life period, unit, experimental determination of order of reaction.

2 Dilute Solutions and Changes of State -I

Colligative properties, Osmosis, osmotic pressure and its experimental determination, van't Hoff factor, vapour pressure, Roul't's Law of lowering of vapour pressure.

Experimental determination of relative lowering of vapour pressure and molecular weight determination, relation between osmotic pressure and lowering of vapour pressure.

3 Dilute Solutions and Changes of States - II

Elevation of boiling point of solution, depression of freezing point of solutions, experimental determination of colligative properties, abnormal colligative properties of solutions.

4 Processes at Solid Surface :

Elementary idea of crystal growths, Adsorption : Physisorption and chemisorption, chemisorbed species. Idea of catalytic activity at surfaces and catalytic processes such as hydrogenation, Oxidation, cracking and reforming.

APER—I B

Five questions will have to be answered covering at least one question and not more than two questions from each group. Four questions will be set from each of the three groups.

Group—A

FOUNDATION

1 Atomic Structure.

- (a) Features of H-spectra and Bohr's interpretation of H-spectra and limitations, refinement to Bohr theory, Bohr-Sommerfeld theory.
- (b) Shapes of orbitals and their labellings, idea of quantum numbers, Pauli's exclusion principle, Hund's rules, Aufbau principle, Electronic configuration of elements.

2 Bonding Models in Inorganic Chemistry.

- (a) **Ionic bond** : Energetics involved in ionic bond formation. Born Haber cycle, Radius ratio rule, different types of crystal lattices, Fajan's rule, I.P., Inert pair effect.
- (b) **Covalent bond** : Exceptions to the octet rule, idea of orbital overlap, hybridization of orbitals.
- (c) **Vander Waal's forces, H-bonding.**

3 (a) Nomenclature of Inorganic Compounds.

Acquaintance with IUPAC use of multiplying

affixes, enclosing marks, numbers and letters. Names for ions and radicals, hetero and isopoly-anions.

(b) Acid-Base Chemistry :

Bronsted-Lowry definition, solvent system definition, Lowry's concept, aqua acids, periodic trends in aqua acid strength, HSAB concept.

4 Periodicity :

Pauli's exclusion principle and periodic table. Fundamental trends of atomic/ionic radii, ionisation energy, E. A., electronegativity hardness and softness. First and second row anomalies, Idea of d-orbital participation by non-metals and its influence on their reactivity. Periodic anomalies of non-metals and post transition metals.

GROUP - B

SYSTEMATIC CHEMISTRY OF THE ELEMENTS.

1 Hydrogen and hydrides :

Position in P. T., isotopes of hydrogen, ortho and para hydrogen. Hydrides : ionic, covalent, metallic and intermediate. Hydrogen ion. H_2O_2 : preparation, properties, structure and uses.

2 Principles of metallurgy :

(a) Idea of Moh's scale of hardness of minerals, Holme's classification of metals into five groups,

general methods of extraction, their position in electrochemical series and extraction, Gibbs free energy.

- (b) Principles of various concentration methods : Calcination, roasting and smelting, Role of carbon and other reducing agents. Electrolytic reduction, hydrometallurgy, methods of refining and purification, electrolytic, chromatographic, ion exchange, solvent extraction, oxidative refinings. Zone refining, Kroll's process, Van Arkel de Boer method, Mond's process.

3 Chemistry of the following metals :

(a) Li , Be , Ra (b) Sn , Pb .

- 4 Chemistry of halogens with reference to extraction, oxidation states and halides.**

GROUP—D

MISCELLANEOUS TOPICS

- 1 (a) Molecular Symmetry : An introduction.**

Symmetry elements and symmetry operations, centre of symmetry, axis of symmetry and plane of symmetry (definitions).

- (b) Elementary Magnetochemistry :**

Types of magnetic behaviours, para, dia and ferromagnetism, dependence of paramagnetism on S & L.

- 2 Principles involved in the volumetric estimations of Ag^+ , Cu^{++} , iron and Ca^{++} ,.
- 3 Principles involved in the gravimetric estimation of Cu^{++} , iron, Ni^{++} , Mg^{++} , Ba^{++} , SO_4 .
- 4 Isotopes : detection and separation. Tracer techniques and applications, radiocarbon dating.

PAPER—I C (ORGANIC CHEMISTRY)

There shall be three groups of 4 questions each. The candidate shall be asked to answer five questions taking at least one question and not more than two from each group.

GROUP—A

FOUNDATION

1 Shapes and Structure of Organic Molecules :

Hybridisation, Bond angle, bond length and bond energy. Idea of σ and π bonds. Shapes/structures of methane, ethane, acetylene and benzene molecules.

2 Nomenclature of organic compounds : Acquaintance with I U P A C nomenclature of aliphatic and aromatic compounds.

3 Introductory Organic Reaction Mechanism :

Elementary idea of electronic distribution, inductive effect, electromeric effect and mesomeric effect, resonance. Bond fission and fission products. Elementary idea of the reagents and types of reactions.

4 Elementary Stereochemistry : Brief idea of geometrical and optical isomerism.

GROUP—B

DETAILED STUDY OF THE DIFFERENT
CLASSES OF COMPOUNDS.

- 1 (a) Alcohol : Monohydric, dihydric, trihydric and unsaturated alcohols
- (b) Aldehydes and ketones.
- 2 (a) Carboxylic acids : mono and dicarboxylic acids.
- (b) Organometallic compounds of Mg and Li.
- 3 (a) Amines and urea : classification, preparation, separation, distinction identification and estimation.
- (b) Organosulfur compounds.
- 4 **Aromaticity and Structure of Benzene.**

Monosubstituted benzene derivatives. Orientation and directive influence of different groups in benzene.

GROUP—C

APPLICATION TECHNIQUES

1 **Analytical Organic Chemistry-I :**

Qualitative and quantitative estimation of C, H, N, S, P and Halogens in Organic compounds.

2 **Analytical Organic Chemistry-II :**

Molecular weight determination of organic acids by silver salt method and of organic bases by platinum chloride method.

(10)

3 Purification of Organic Compounds :

Purification of organic compounds and criteria of purity, chromatography.

4 (a) Synthetic fibres and plastics

(b) Soaps and detergents including chemistry of their actions.

CHEMISTRY PRACTICAL

PAPER – II

Full Marks—50

Time—6 hours.

1 Volumetric analysis :

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(a) Acidimetry and alkalimetry

(b) Use of potassium permanganate potassium dichromate and sodium thiosulphate.

2 Detection of nitrogen sulphur and halogen in organic compounds and identification of organic compounds containing one functional group including monosaccharides.

—15

3 Note book and Viva-Voce

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