B.Sc (GENERAL) PART II (1+1+1 Pattern) SYLLABUS DISTRIBUTION 2017-18

CHEMISTRY (General)

Course: B.Sc (Part II Gen)
Name of the Teacher: Dr. Pradipta Kumar Basu

Group B
Physical Chemistry (Full Marks: 50)

1. Kinetic Theory of Gases

Ideal gas equation, derivation of gas laws, Maxwell's speed and energy distributions (derivation excluded); distribution curves; different types of speeds and their significance, concept of equipartition principle, van der Waals equation, Virial equation, continuity of state, Boyle temperature, critical constants, specific heats and specific ratios, laws of partial pressure, vapour density and density method of determination of molecular weights, limiting density, abnormal vapour density, frequency of binary collisions; mean free path

2. Thermodynamics

Thermal equilibrium and zeroth law, First law, reversible and irreversible work, criteria of perfect gas, isothermal and adiabatic expansions, Joule-Thomson effect (derivation excluded); Thermochemistry: Hess's law and its application

Second law and its elementary interpretation, Carnot's cycle and theorems, Clausius inequality, criteria of spontaneity, free energy and entropy

3. Equilibrium

Conditions of spontaneity and equilibrium, degree of advancement and Le Chatelier principle; Van't Hoff isotherm, isobar and isochore

4. Phase Equilibria and Colligative Properties

Phase rule equation (derivation excluded); phase diagram of water system, Miscibility (phenol-water) and distillation of completely miscible binary liquid mixtures; azeotropes, Steam distillation

Graphical approach of Raoult's law of vapour pressure and colligative properties: osmosis, lowering of freezing point, elevation of boiling point, experimental methods of determination of molecular weights of substances in dilute solutions, van't Hoff 'i' factor and abnormal behaviour of electrolytic solutions

5. Properties of Matter

Viscosity of fluids, temperature and pressure dependence, Surface energy and surface tension of liquids: temperature dependence

Unit cell, Bravais lattice; crystal system, Miller indices; Bragg's equation and its applications

6. Electrochemistry

Electrolytic conduction, transport number (experimental determination excluded), velocity of ions: specific, equivalent and molar conductances, determination of equivalent conductivity of solutions, Kohlrausch's law, strong and weak electrolytes, Ion atmosphere; electrophoretic and relaxation effects, Debye-Huckel theory (qualitative) and the limiting law.

Electrochemical cells, half-cells (with types and examples), Nernst equation and standard electrode potentials, standard cells

7. Chemical Kinetics

Order and molecularity of reactions, integrated rate laws (first and second order), average life period, concept of Arrhenius activation energy

Catalysis, autocatalysis, enzyme catalyst, catalyst poisons, promoters, elementary treatment of mechanism of catalysis

8. Photochemistry and Spectroscopy

Absorption, Lambert-Beer's law, photochemical laws, primary photophysical processes, potential energy diagram, Franck-Condon principle, fluorescence and phosphorescence, Jablonsky diagram, Laws of photochemistry, quantum yield, kinetics of HI decomposition, H_2-Br_2 reactions

Elementary idea of rotational and vibrational spectra

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Name of the Teacher: Dr. Debasish Kundu

Paper II

Group A

Inorganic Chemistry (Full Marks: 50)

1. **Coordination Chemistry**

Double and complex salts, Werner's theory, ligands, coordination number, inner metallic complexes, chelate effect, different types of isomerism, IUPAC nomenclature.

2. **Group Chemistry**

A **comparative study** of the elements belonging to a particular group to be made in brief on the basis of their electron distribution and position in the periodic table. Structures (excluding stereochemistry) and properties of important compounds mentioned to be explained.

Group 1: Hydrogen – isotopes and binary hydrides, lithium and its similarities and differences from other alkali metals, diagonal relationship with magnesium, lithium aluminium hydrides.

Group 2: Calcium, stroncium and barium, hydrolith, calcium cyanamide, gypsum and plaster of paris.

Group 12: Zinc, cadmium and mercury. Nesslar's reagent, Millon's base.

Group 13: Diborane, boron trifluoride, sodium borohydride, inorganic benzene.

Group 14: Carbon, silicon, tin and lead, carbide, silicon carbide, silica, sodium silicate. Silica gel, hydrofluorosilicic acid, silicon tetra chloride, glass, fullerene.

Group 15: Nitrogen, phosphorus, arsenic, antimony and bismuth, hydrazine, hydrazoic acid, hydroxyl amine, hyponitrous acid, phosphorus oxyacids (H_3PO_2, H_3PO_3, H_3PO_4, $H_4P_2O_7$ and HPO_3), sodium bismuthate.

Group 16: Oxygen and sulphur, composition and structure of ozone, oxyacids of sulphur (H_2SO_3, H_2SO_4, $H_2S_2O_3$, $H_2S_2O_8$), persulphate

Group 17: Fluorine, chlorine, bromine and iodine, oxides and oxyacids of chlorine, isolation of fluorine.

Group 18: Rare gases (isolation and uses) with special reference to general fluorides (structure)

3. Transition Metals

Groups 6 and **7:** Chromium, manganese, K_2CrO_4, $K_2Cr_2O_7$, CrO_2Cl_2, $KMnO_4$, chrome alum.
Groups 8, 9 and **10:** Iron, cobalt and nickel, principles of isolation of Ni (excluding details), composition and uses of alloys, steels, rusting of iron, galvanization and tin plating
Group 11: Cu, Ag, Au, principles of Ag and Au isolation, different valency states

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B.Sc (GENERAL) SEMESTER I SYLLABUS DISTRIBUTION 2017-18

CHEMISTRY (General)

Name of the Teacher: Dr. Pradipta Kumar Basu

Organic Chemistry

1. Fundamentals of Organic Chemistry

Electronic displacements: inductive effect, resonance and hyperconjugation; cleavage of bonds: homolytic and heterolytic; structure of organic molecules on the basis of VBT; nucleophiles electrophiles; reactive intermediates: carbocations, carbanions and free radicals.

2. Stereochemistry

   Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (upto 2 chiral carbon atoms) and E/Z nomenclature.

3. Nucleophilic Substitution and Elimination Reactions

   Nucleophilic substitutions: SN1 and SN2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.

4. Aliphatic Hydrocarbons

   Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures.

5. Alkanes: (up to 5 Carbons). Preparation: catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: mechanism for free radical substitution: halogenation.
6. Alkenes: (up to 5 Carbons). Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; cis alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alkaline KMnO4) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.
7. Alkynes: (up to 5 Carbons). Preparation: acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.
8. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$.

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Course: B.Sc (Semester I)

Name of the Teacher: Dr. Debasish Kundu

Inorganic Chemistry

1. Atomic Structure

   Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations.

2. Chemical Periodicity

   Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.

3. Acids and bases

   Brönsted-Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

4. Redox reactions

   Balancing of equations by oxidation number and ion-electron method oxidimetry and reductimetry.

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