



UG TRB Chemistry Syllabus

INORGANIC CHEMISTRY

UNIT – I A. ATOMIC STRUCTURE AND PERIODIC CLASSIFICATION

I) Atomic models: Rutherford, Bohr and Sommerfeld-Origin of hydrogen spectrum-Electromagnetic radiation- Dualism of light-Black body radiation- Planck's quantum theory-Photoelectric effect-Compton effect-de Broglie equation-Heisenberg uncertainty principle. II) Periodic properties of elements: Atomic ionic radii, Ionization potential, electron affinity, electronegativity (Pauling and Mulliken's scale) of elements along period and groups, -Effective nuclear charge, screening effect, Slater rule III) Postulates of quantum mechanics-operators: linear, non-linear, commutator- Schrodinger wave equation and derivation)-6LJQLILFDQFHRIzDQGz2 , wave mechanical concept of atomic orbitals.

B. CHEMICAL BONDING

I) Ionic bond-Factors influencing the ionic bond-Lattice energy- Inert pair effect-Fajan's rules-Born-Haber cycle-Born-Lande equation (derivation not required) II) Covalent bond-Lewis theory-VSEPR theory-Shapes of BeF_2 , BCl_3 , SnCl_2 , CCl_4 , PF_5 , Valence bond theory-Coordinate bond-Hybridization: sp^3 , dsp^2 , $sp^3 d^2$, $d^2 sp^3$ III) Shapes of orbitals,-quantum numbers-Zeeman effect-Pauling's exclusion principle, Hund, rule, Aufbau Principle, Electronic configuration of elements- MO theory, MO diagrams of O_2 , N_2 IV) Intermolecular forces: hydrogen bond, van der Waals forces V) Dipole moment

UNIT II

C. p-Block elements

i) General characteristic of p-block elements- Diborane-borax, borazine, mAlums, alloys of aluminium, allotropes of carbon ii) Chemistry of oxides of carbon, silicon iii) Compound of N and P- $\text{NH}_2\text{-NH}_2$, NH_2OH , Fixation of N_2 , PH_3 , P_2O_5 D. d-BLOCK & f-BLOCK ELEMENTS i) General characteristics of d-block elements: Melting points, Ionization energies, oxidation states, magnetic properties ii) Alloys of iron, copper, Nickel, chromium- Gemstones: Ruby, Emerald, Sapphire iii) General characteristics of f-block elements iv) Lanthanide, actinide contraction- consequences- UV spectra v) Separation and applications of lanthanides and actinides

UNIT III

E. COORDINATION CHEMISTRY



i) Classification of ligands, Complexes- IUPAC nomenclature, Isomerism. Mono and bidentate ligands and their complexes- outer orbital inner orbital complexes ii) Theories of coordination compounds: Werner's theory, VB theory, Crystal field theory, EAN rule iii) Applications of coordination compounds

F. NUCLEAR CHEMISTRY

i) Theory of nuclear reactions- alpha, beta and gamma rays- n/p ratio, isotopes. Isobars, isotones- Laws of radio activity- Radioactive equilibrium ii) Types of nuclear reactions: Fission, fusion and spallation-Nuclear reactors iii) Applications of radio isotopes in industry, medicine and agriculture

G. ANALYTICAL CHEMISTRY

Principles of volumetric analysis, gravimetric analysis, Separation and purification techniques- Redox titrations, complexometric titrations and Conductometric titrations. PHYSICAL CHEMISTRY

UNIT-IV

H. GASEOUS STATE Gas laws

Boyle's law, Charles law, Avogadro's law- kinetic theory- ideal gas equation- deviation from ideal behaviour- Maxwell distribution of molecular velocities(no derivation)- mean, root mean square and most probable velocities- Calculation of molecular velocities-collision diameter- mean free path- collision numberbehaviour of real gases-deviation from ideal behaviour--Inversion temperature-Liquefaction of gases

I. SOLID STATE

i) Classification of solids, Isotropic and anisotropic crystals- Crystal systems- Laws of crystallography Miller indices, Bravais lattices- Unit cell- Crystal symmetry- X-ray diffraction- Structures of NaCl, CsCl and ZnS- Bragg's equation- Radius ratio- Packing in crystals- defects in crystals ii) Semiconductors: n and p -type, intrinsic and extrinsic semiconductors

UNIT- V

J. THERMODYNAMICS

i) Definitions: System and surrounding, isolated, closed and open systems- state of the system-intensive and extensive properties-Thermo dynamic processes: reversible and irreversible, isothermal and adiabatic processes, state and path functions ii) First law of



thermodynamics, Internal energy, enthalpy, heat capacity, Relationship between C_p and C_v
Hess's law of constant heat summation-Kirchoff's equation- Second law of thermodynamics-Carnot theorem, entropy and probability-free energy and chemical equilibrium-Third law-Gibb's & Helmholtz functions

K. CHEMICAL KINETICS

i) Rate of reactions, rate law, Rate constant-order and molecularity of reactions- Derivation of first order rate constant, Zero order reaction, Effect of temperature on reaction rates- Half-life period, Activation energy- Arrhenius equation ii) Theory of reaction rates, failure of collision theory-Significance of entropy and free energy of activation

UNIT-VI

L. COLLOIDS AND SURFACE CHEMISTRY

i) Classification of colloids-Preparation and purification of colloids-Properties of colloids-Stability of colloids-Gold number, gels- emulsion-types, emulsifiers-Application of colloids ii) Physisorption, chemisorption, difference between them-Factors influencing adsorption-Adsorption isotherm, Langmuir isotherm(no derivation)

M. ELECTROCHEMISTRY

i) Galvanic cells- Types of reversible and irreversible electrodes-conventional representation of electrochemical cells. Nernst equation- reference electrodes, Computation of cell emf, Calculation of thermodynamic parameters of cell reactions-Over potential, Hydrogen over voltage. ii) Arrhenius theory, Debye-Huckel equation- Kohlrausch law, Ostwald's dilution law – Determination of pH and pKa of acids by potentiometric methods-Corrosion- Types of corrosion-Prevention of corrosion

UNIT-VII

N. SPECTROSCOPY

i) Electromagnetic spectrum-Different regions of spectra- Microwave spectra of diatomic molecules, rotational constants, selection rules-Infrared spectroscopy-Applications-Raman spectroscopy-Principles and applications ii) Principles, instrumentation and applications of UV Vis, NMR, ESR and Mass spectrometry.

ORGANIC CHEMISTRY

UNIT-VIII



O. TYPES OF REACTIONS

i) Aliphatic nucleophilic substitution reactions – Aromatic electrophilic substitution reactions – Free radical reactions – Addition to C=C and C=O compounds – Elimination Reactions. ii) Reduction and oxidation reactions – Oxidation with osmium tetroxide, ozone – reduction with NaBH₄, LiAlH₄

P. ELECTRON DISPLACEMENT METHODS

Inductive effects – Mesomeric effects, Hyper conjugation – Steric effects in substitution, addition and elimination reactions

Q) NOMENCLATURE OF ORGANIC COMPOUNDS

Classification of organic compounds – IUPAC nomenclature: alkanes, alkenes, alkynes, alcohols, aldehydes and ketones.

UNIT- IX

R. NATURE OF BONDING

1) Hybridization and geometry of simple organic compounds – Breaking of bonds – homolytic and heterolytic cleavage of C – C bonds – Reaction intermediates – free radicals : generation and stability – Carbocation and carbanion: formation and stability

S. STEREOCHEMISTRY

Stereoisomerism, definition and types – optical activity – asymmetric carbons, D and L notations, Enantiomerism, Diastereomerism – Racemization methods – Resolution methods – Walden inversion – Fischer, sawhorse and Newman projections – R and S notation of optical isomers: Cahn-Ingold and Prelog rules – Geometrical isomerism Z and E notations

UNIT X

T. MECHANISM IN AROMATIC SUBSTITUTION

i) Aromatic electrophilic substitution: Arsenium ion mechanism: nitration, halogenation, sulphonation, Friedel Crafts reaction – Orientation and reactivity in monosubstituted benzene rings – Activating and deactivating groups ii) Aromatic nucleophilic substitution: S_NAr mechanism, Benzyne mechanism

U. CARBOHYDRATES



Classification of carbohydrates-Monosaccharides-D family sugars-L family sugars-EpimersMutarotation- Interconversion of glucose to fructose and vice versa, Reactions of monosaccharidesDisaccharides – Lactose, Maltose, Gentiobiose, Sucrose, Manufacture of sucrose, properties and uses.

V. MATERIAL CHEMISTRY

i) Polymers-Types of polymerization-Homopolymers- copolymers- Thermosetting and thermoplastic polymers-Vulcanization of rubber ii) Dyes: Classification and Properties of dyes, Chromophores, auxochromes, Preparation of methyl orange, cangored, malachite green, fluorescein, indigo.