

DIRECT RECRUITMENT FOR THE POST OF POST GRADUATE ASSISTANTS / PHYSICAL EDUCATION DIRECTORS GRADE-I - 2018-2019 **SUBJECT: CHEMISTRY**

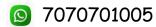
UNIT-I

- Periodic properties Atomic radius ionic radius, ionization potential, electron affinity and electronegativity - Their significance in chemical bonding. VB theory, MO theory applications - Comparision of VB and MO theories - VSEPR theory -Bond order - Bond energy - Bond length Bond polarity - Partial ionic character of bonds - The concept of multicentre bond - Electron deficient compounds - Hydrogen bond - Its influences.
- Non aqueous solvents A general study of typical reactions in non aquieous media comparison with reactions in aqueous media.
- Solid state chemistry Ionic bonding Lattice energy Born equation Born Haber cycle - Radius ratio rule - Born Meyer equation - Kapustinski's Modification energetics of the dissolution of ionic compounds in polar solvents - different types of electostatic interactions.
- Structural aspects of solids Fourier synthesis and analysis structure factors scattering factors - Spinels and Inverse spinels - defects in stoinchiometric and Non stoichiometric crystals.
- ❖ Electrical properties of solids Band theory semi conductors Junction devices Super conductivity - Ionic conductivity - Optical properties of solids - Lasers and phosphors Photovoltaic effect - solar energy.
- ❖ Magnetic properties of solids Different types dia, para, ferro, antiferro and ferri Magnetism - Magnetic hysteresis.

UNIT II

- Co-ordination chemistry Methods of preparation of complexes isomerism in complexes - applications of complex formation in analytical chemistry - complexes and their stability chelate effect Stability constants - Their determination - complexes of Metals in different oxidation states and their stability.
- Optical activity and concept of chirality Different kinds of opticalloy active compounds - configuration - Foscher, sawhorse and Newman projections - Absolute configuration R and S Notations - Methods with more than one chiral center -Asymmetric synthesis - optical purity.
- ❖ Geometrical isomerism resulting from double bonds The E.Z. system of nemenclature - Geometrical isomerism of monocyclic compounds and fused ring systems Sterospecific and stereo selective reactions with examples.
- Confermational analysis conformation and reactivity in acylic and cyclo hexane systems - conformation of decalins, cyclohexane and cyclohexanone.







UNIT III

- Organic reaction mechanisms General methods of investigating reaction mechanisms - kinetic and non-kinetic methods - different types of reaction intermediates.
- ❖ Aliphatic nucleophilic substitution SN1, SN2 and SNi reactions substitution at vinylic and benzylic carbon - stereo chemistry of nucleophilic reaction - solvents and substituent effects - Nucleophilicity Neighboring group participation.
- * Addition to double and triple bonds Mechanism Hydration Hydroboration Hydroxiylation - epoxidation.
- ❖ Elimination reactions E1, E2, E1cB Mechanism Orientation effects in elimination reactions - stereo chemistry of elimination reactors - dehydration of alcohols dehydro halogenation - cope elemination.
- ❖ Heterocyclics synthesis and reactivity of furan, thiophene, pyrrole pyridine, quinoline, isoquinoline, Indole, flavenes, and anthocyanins - skraup synthesis -Fischer indole synthesis.
- The chemistry; of natural products structure elucidations and Biogenesis of the following:
- * Alkaloids : Reticulene, Reserpine, Morphine
- * Terpenoids: Zingiberene, Squalene, Lanosteroal
- ❖ Steroids : Cholesterol, Oestrone, Progresterone
- ❖ Carbohydrates: Maltose, Starch, Cellulose (biogenis not expected)
- Structure and functions of biopolymer such as proteins and Nucleic acids Primary, Secondary and tertiary structures of proteins - Mechanism of Enzyme action - DNA and RNA.

UNIT IV

- ❖ The old quantum theory Inadequacy of classical mechanics Failure of classical mechanics - success of quantum hypothesis explaining black body radiation - Photo electric effect - the hydrogen spectrum - Bohr's explanation of hydrogen spectrum -Failure of Bohr's model.
- ❖ De broglie's postulates of Matter waves experimental observation of matter waves -Heisenberg's uncertainly principle - wave particle dualism - Davisson, Garmer experiments - Postulates of quantum mechanics - Time dependent schrodinger equation - Needs of an acceptable wave function - Physical significance of Psi
- Operators in quantum mechanics. Operator algebra Linear and Hermitian operators m Eigen functions and Eigen values - Hamiltonian operators - Angular momentum.
- Application of schrodinger equation particle in one and three dimensional boxes quantum mechanical results for a simple harmonic oscillaltor and rigid rotator approxination methods - perturbation methods - variation method - VB and MO
- Symmetry elements and symmetry operations Point groups representation of groups reducible and irreducible representations characters tables - Orthogonality theorem and its consequences.







❖ Symmetry selection rule for IR and Ramanspectra - Systematic procedure for determining symmetries of normal modes of vibration - symmetry applied to MO theory and orbital hybridization.

UNIT V

- * Thermodynamic equations of state closed and open systems partial molal quantities - chemical potential with temperature and pressure - third law of thermodynamics.
- Fugacity methods of determination activity and activity co-efficient standard states for gases, liquids - solids and solutions - mean activity co-efficients of electrolytes.
- ❖ Maxwell's distribution of molecular velocities derivation of expression for average, most probable and rcot mean square velocities - Microstates Macrostates - partial functions - Sackur tetrode equation - statistical approach to the third law of Thermodynamics Maxwell Boltzmann - Bose Einstein and Fermi
- ❖ Dirace statistics Heat capacities of solids Einstein and Debye Models Low temperature - Negative absolute temperature.
- ❖ Chemical equilibrium thermodynamic derivation of equilibrium constant standard free energy - calculations.
- Phase equilibrium thermodynamic derivation of phase rule application of phase rule - three component systems.
- * Chromotography column, paper, thinlayer, gas-liquid, High pressure liquid chromatography HPLC principle and applications.
- ❖ Thermal analysis different thermal analysis (DTA) Principle and applications thermogravimetric analysis (TGA) Principle and application.
- * Chemical crystallography Diffraction methods X ray Neutron, electron diffraction methods. Principle and applications.
- Polarimetry Circular ichroism Optical Rotatory dispersion (ORD) Principle and applications.

UNIT VI

Nuclear - chemistry - Nuclear nadii spin and moments - Nuclear structure Nuclear forces - Nuclear stability - Nuclear modes - Modes of Radioactivity decay. Nuclear isomerisation Nuclear Reaction Energy - Coulomb barrier cross section - excitation function Radiactive Equiliberia - Types of Neclear reactions - Nuclear fision Nuclear Reactors - Atomic Power Project in India - Radiation hazards - Radiation desimetry -Nuclear fusion - Stellar Energy.







UNIT VII

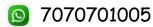
- ❖ Term symbols and term states Dn ions energy levels Diagrams weakfield and strong field and strong field concepts - spin orbit coupling - The Nephelanxetic effect charge transfer spectra - Applications of UV, IR, NMR, BSR and mossbaver spectroscopy techniques in the study of co-ordination chemistry.
- * Magnetic interactions Magnetic susceptibilities determination application in coordination chemistry. Application of VB, MO, CF and LF theories in co-ordination chemistry - Group theoretical approach - splitting of d-orbitals - spectro-chemical series - concept of weak and strong fields - Thermodynamic and chemical effect of dorbitals splitting - Jahn Teller distortion.
- Nuclear Magnetic Resonance Spectroscopy Theory Study of PMR chemical shift -Type of shielding - Spin-spin coupling spin decoupling - spplications to simple natural products.
- ❖ Electron spin resonance spectro scopy paramagnetism Nuclear hyperfine structure - Hyperfine coupling.

UNIT VIII

- ❖ Huckel's rule and concept of aromaticity aromaticity of Benzenoid Nonbenzenoid aromatics. The annulenes - Aromaticity in charged rings and fused ring systems. Aromatic electrophilic substitution - Mechanism and reactivity, Typical reactions to include diazonium coupling - Halognation, sulphonation. Friedal craft alkylation and acylation. Aromatic Nucleophilic substitution - Benzyne mechanism - Examples. Oxidation - Reduction reactions - Mechanisms - selectivity in oxidations and reductions.
- ❖ Molecular rearrangements Rearrangements with Carbon to Nitrogen, Carton to Oxygen and Carbon migrations. Curtivs, Lossen, Schmitts Baeyer - Villiger, Pinacol Pinacolene, Benzoil - Benzilicacid, Benzidine, Favorski and fries rearrangements sigmatropic rearragements - claisen and cope. Pericyclic reactions, selection rules orbital symmetry Electrocyclic reactions - cycle additions sigmatropic reactions.
- Modern synthetic reactions Diels alder reaction witting reactions stork Enamine reactions - Mannich reactions, Birch reductions.

UNIT IX

Theories of reaction rates - simple collision theory - absolute reaction rate theory (ARRT) - Reaction co-ordinate - Potential energy surfaces. Hammett - Taft equation Hammett acidity function - Acid base catalysis Bronsted relation Enzyme catalysis -Michaelis Menton Law - influence of PH and temperature. Surface phenomenon – Heterogeneous catalysis - Absorption isotherms. Electrolytic conductance applications - solubility product Interionic attraction theory - Debye - Huckel -Onsager equation - equivalent conductivity of electro lytes.





* Electro potentials - Electrochemical cells - electrode - electrolyte interface electrical double layer electro capillary phenomena - electro kinetic Phenomena - Membrane potential - Polarisation - over potential - Polarography - concentration polarization electro chemical polarization - sutler - Volmer equation.

UNIT X

Theory and applications of the following spectroscopic methods; electonics spectra-UV-Visible spectra - IR spectra - Raman spectra - Laser - Raman spectra - NMR WCR- ESR Spectra - Mossbaver spectro scopy - photoelectron spectro scopy -Polymerisation reactions - Mechanism - sterochemical aspects. Types of polymers organic and inorganic polymers - preparation - properties - structure - polystyrene -Polyvinylchloride - Polyesters Nylon - Phenol resin - amino resins - epoxy resins. Phosphonitrilic compounds - silicons Borazines applications of polymers.