



Shri Sangameshwar Education Society, Solapur

Kannada Linguistic Minority Institute

Sangameshwar College, Solapur

Autonomous

The Written Test – the First Phase of the Selection Process
for the Post(s) of Assistant Professor

Syllabus

Subject: Chemistry

Unit 1: Chemical Kinetics:

Rate of reaction, Order and Molecularity of reaction, Methods to determine the order of reactions, First, second & third order reaction & its derivation of rate constant, Characteristics of first, second, third order reaction and its examples, Pseudo-unimolecular reactions, Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

Unit 2: Chemical Thermodynamics:

Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

Unit 3: Electrochemistry:

Conductance, Types of conductors, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance, Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution.

Basic circuit of D.C. Wheatstone Bridge, Measurement of conductance by Wheatstone bridge, use of alternating current, conductivity water, Different types of conductivity cells, cell constant and its determination. Conductometric acid-base titrations, Advantages of Conductometric titrations. Nernst equation, redox systems, electrochemical cells; Debye Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations

Unit 4: Crystal Field Theory (CFT) and Molecular Orbital Theory (MOT):

(CFT): Shapes of d orbital, Application of CFT in the Formation of octahedral, Tetrahedral and square planar complexes, Factors affecting the crystal-field splitting, Jahn–Teller distortion, Crystal field stabilization energy and its calculation for octahedral and tetrahedral complexes, Applications and limitations of CFT. (MOT): Introduction, Symmetry classes of atomic orbitals, Formation of octahedral complex Assumption, M.O. energy level diagram for hypothetical octahedral complex Examples: octahedral complexes with sigma bonding, Comparison between CFT and MOT.

Unit 5: Co-ordination Chemistry:

Bonding in complexes, ligands, co-ordination number, co-ordination sphere, effective atomic number, double salt and complex salt, Werner's theory: Postulates of theory, Applications of theory to cobalt amine complexes, Optical isomerism, Geometrical isomerism in co-ordination compounds with CN = 4 and CN = 6. Valence bond theory of transition metal complexes: High spin and low spin complexes, Limitations of VBT, Electronic Spectra of Transition metal complexes: Energy Levels, Spin-Orbit Coupling, Term symbol, Microstates, selection rules (Laporte and Spin), Orgel diagrams for complexes (3d series: d^1 , d^2 , d^3 , d^4 , d^6 , d^7 , d^8 , d^9 only), charge transfer spectra, calculation of Dq .

Unit 6: Reaction Mechanism and Synthesis:

Reaction intermediates, Reaction mechanisms, Name reactions, Reagents for organic transformation (oxidation and reduction), Carbonyl chemistry, Pericyclic reactions, Organometallic/coupling reactions, Heterocyclic chemistry, Retrosynthesis and modern organic synthesis

Unit 7: Stereochemistry and Structure:

Chirality and optical isomerism, geometrical isomerism, conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. R/S and E/Z nomenclature, Stereoselective and stereospecific reactions. Aromaticity: Aromatic, Non-Aromatic, Antiaromatic compounds, Benzenoid and non-benzenoid compounds, Annulenes, Aromaticity in heterocyclic compounds etc. Aromatic substitution reactions, generation and reactions.

Unit 8: Spectroscopy & Structure Elucidation:

Organic: UV-Visible spectroscopy, IR spectroscopy, NMR spectroscopy (1H , ^{13}C , 2D NMR), Mass spectrometry, Combined spectral analysis and structure determination Inorganic: Characterization of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, electron spectroscopy and microscopic techniques.

Unit9: Teaching Methodology and NAAC