

SEMESTER - V

PAPER – 11

Marks: 150

INORGANIC: d-BLOCK ELEMENTS, COORDINATION CHEMISTRY, LANTHANIDES & ACTINIDES

THEORY

Unit I: Transition elements

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer diagrams). Comparison of 3d elements with 4d & 5d elements.

Various oxidation states, their oxidizing and reducing nature and stability w.r.t. Ti, V, Cr, Mn, Fe and Co. Structure and chemical reactivity of following compounds: chromate, dichromate and chromium trioxide, KMnO_4 , peroxo compounds of chromium, V_2O_5 , $\text{K}_4[\text{Fe}(\text{CN})_6]$, $\text{K}_3[\text{Fe}(\text{CN})_6]$, $\text{Na}_3[\text{Co}(\text{NO}_3)_6]$, $\text{Na}_3[\text{Fe}(\text{CN})_5\text{NO}]$

Unit II: Coordination chemistry

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, concept of pairing energies and lattice energy, color and magnetic properties, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. Tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Elementary idea of Ligand field and MO Theory.

Unit III: Lanthanides and actinides

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction. Separation of lanthanoids (ion-exchange method only).

Recommended Texts:

1. Purecell, K.F. & Kotz, J.C. *Inorganic Chemistry*, W.B. Saunders Co. 1977.
2. Greenwood, N.N. & Earnshaw A. *Chemistry of the Elements*, Butterworth-Heinemann, 1997.
3. Lee, J.D. *Concise Inorganic Chemistry*, ELBS, 1991.
4. Gary L. Miessler, Donald A. Tarr, *Inorganic Chemistry*, 4/E, Pearson, 2010.
5. Huheey, J.E. *Inorganic Chemistry*, Prentice Hall 1993

PRACTICAL

INORGANIC: GRAVIMETRIC ANALYSIS AND INORGANIC PREPARATION

Gravimetric Analysis:

- i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
- ii. Estimation of copper as CuSCN
- iii. Estimation of iron as Fe₂O₃ by precipitating iron as Fe(OH)₃.

Inorganic Preparations:

- i. Tetraamminecopper (II) sulphate, [Cu(NH₃)₄]SO₄.H₂O
- ii. *Cis* and *trans* K[Cr(C₂O₄)₂. (H₂O)₂] Potassium dioxalatodiaquachromate (III)
- iii. Tetraamminecarbonatocobalt (III) ion
- iv. Potassium tris(oxalate)ferrate(III)

Spectrophotometric estimation:

- i. To draw calibration curve (absorbance at λ_{max} vs. Concentration) for various concentrations of a given coloured compound and to estimate the concentration of the same in a given solution.
- ii. Spectrophotometric estimation of Ferrous ion by using 1,10-phenanthroline
- iii. Determination of composition of Fe (III)-salicylic acid complex by Job's method.

Recommended Text:

1. Vogel, A.I., Fundamentals of Quantitative Analysis, 5th Ed., Addison Wesley longman., 1989.