

THIRD SEMESTER

CA H 511: FUNDAMENTALS OF ADVANCED INORGANIC CHEMISTRY AND INTRODUCTION TO ANALYTICAL CHEMISTRY

Course Outcomes

- Students will get an exposure to the Chemistry of d- and f- block elements including their spectral and magnetic properties.
- Understand the catalysis by organometallic compounds in synthesis and Inorganic reaction mechanisms.
- Learn the stability constants of metal complexes and their applications.
- Know the evaluation of analytical data in terms of statistics and interpretation of the sources of random errors and effects of random errors on analytical results.
- Learn and analyse the different gravimetric and titrimetric analysis methods.

Unit-I: Chemistry of d- and f-block elements

[12 Hours]

Term-symbols, Russel-Saunders states, Crystal field theory and splitting in O_h , T_d , D_{4h} and C_{4v} systems, Orgel and Tanabe-Sugano diagrams, determination of Dq and Racah parameters, oxidation states and electronic absorption spectra of complex ions. Spectrochemical series and effects of covalency. Nephelauxetic series, magnetic properties of transition metal complexes and lanthanides.

Unit-II: Catalysis and Inorganic Reaction Mechanisms

[12 Hours]

Transition metal ion catalysts for organic transformations and their application in hydrogenation (using symmetric and chiral organometallic catalysts), isomerization, olefin oxidation, carbonylation and polymerization reactions.

Mechanisms of substitution reactions of tetrahedral, square planar, trigonal bipyramidal, square pyramidal and octahedral complexes. Potential energy diagrams, transition states and intermediates, isotope effects, Berry's pseudo rotation mechanism, factors affecting the reactivity of square planar complexes, Swain-Scott equation, Trans effect and its application to synthesis of complexes.

Unit-III: Stability constants of metal complexes and their applications

[12 Hours]

Stoichiometric and thermodynamic equilibrium constants, stepwise formation of complexes, formation functions, ϕ , n and α_C and relationship between different functions. Calculation of stability constants. Graphical Methods: using sets of data $\{\phi, [A]\}$; $\{\alpha_C, [A]\}$ and $\{n, [A]\}$. Curve fitting method, Elimination method, Numerical method, Potentiometric method, Method of corresponding solutions, Ion exchange method, Solvent extraction, Polarographic method. Spectrophotometric methods which include Job's method of continuous variation, Logarithmic method, Bent and French mole ratio method. Turner and Anderson methods and Yatsimirskiis method.

Unit-IV: Errors and Evaluation & Analytical methods**[12 Hours]**

Definition of the terms-mean and median, precision–standard deviation, relative standard deviation, accuracy-absolute error. Types of errors in experimental data determination (systematic), indeterminate (random) and gross. Sources of errors and their effect upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data - indeterminate errors. The use of statistics.

Analytical applications of complex formation; gravimetric analysis, complexometric titrations, Conditional constants, titration curves, titration error, detection of end point using metal indicators and instrumental methods. Indicator errors, Indicator correction etc. Simultaneous titrations, stepwise titrations, back titrations). Use of masking and demasking agents in complexometric titrations.

References

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