

Selected Topics in Co-ordination Chemistry - Web course

COURSE OUTLINE

This course includes certain selected topics that are superficially covered in most of the standard syllabi.

Metal carbonyls and nitrosyls are special classes of compounds that can stabilize zero or even negative formal oxidation states of metal ions. These compounds have a unique type of Metal-Ligand bonding. Owing to these, they find interesting applications. The first two topics of the course will highlight preparations, properties, structures and bonding in the said compounds.

Coordination compounds exhibit a variety of isomerisms. Different types of structural isomerism, geometrical isomerism and optical isomerism in coordination compounds will be discussed in detail in the next twelve lectures of the course.

Thermodynamics and kinetics provide a gateway to synthesis and reactivity of coordination compounds. Thus, aspects leading to determination of stability constants and composition of complexes will then be discussed. A wide variety of nucleophilic substitution reactions are exhibited by both octahedral and square planar complexes. Salient features of such reactions will be covered in the last section comprising of fifteen lectures.

Selected Topics in Coordination Chemistry:

- Metal Carbonyls [7 Hrs.]
- Metal Nitrosyls [6 Hrs.]
- Isomerism [12 Hrs.]
- Thermodynamic & Kinetic Aspects [3 Hrs.]
- Stability, Stability Constants & Composition of Complexes [2 Hrs.]
- Reactions in Octahedral Complexes [5 Hrs.]
- Reactions in Square Planar Complexes [5 Hrs.]

COURSE DETAIL

Module NO.	Topics Covered	No. Of Lectures
Module 1	Metal Carbonyls	11
	Introduction, Synthesis of metal carbonyls, Physical Properties, Chemical Properties, Bonding in metal carbonyls, Infrared Spectroscopy, Classification of metal carbonyls, Mono Nuclear Carbonyls, Polynuclear carbonyls, Structures of a few Polynuclear carbonyls, Effective Atomic Number (EAN) Rule, Catalytic Activity of Metallic Carbonyls, Exercises.	
Module 2	Metal Nitrosyls	04
	Introduction, Bonding in metallic Nitrosyls, Infrared Spectroscopy, Classification of Nitrosyls, Synthesis of metallic Nitrosyls, Individual nitrosyls, Effective atomic number (EAN) rule.	
Module 3	Isomerism	10



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Chemistry and Biochemistry

Pre-requisites:

- Knowledge of basic concepts of coordination chemistry (Higher Secondary Syllabus).

Additional Reading:

- Inorganic Chemistry By Gary L. Miessler & Donald A. Tarr and Donald A. Tarr, Pearson, Prentice Hall, New Jersey, 2010.

Hyperlinks:

- <http://www.webelements.com>

Coordinators:

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	Introduction, Classification of Isomerism, Structural Isomerism, Experimental Separation and identification of Isomers, Optical isomerism, Resolution of racemic mixture, Exercises.	
Module 4	<i>Thermodynamics and Kinetics</i>	06
	Introduction, Stability and lability of complexes, Steps Involved in Formation of a Complex ML _n , Stepwise and Overall Stability Constants, Explanation of lability and inertness of octahedral complexes, Factors Affecting the Stability and Lability of Complexes, Methods for detection of complex Formation, Experimental determination of stability constant and composition of a complex, Exercises.	
Module 5	<i>Reactions in Octahedral Complexes</i>	06
	Potential Energy Curves, Mechanisms of Nucleophilic Substitution Reactions in Octahedral Complexes, Mechanisms Involved in Reactions like Acid Hydrolysis and Base Hydrolysis of Six-Coordinated Co (III), Ammine Complexes, Anation reaction, Substitution reactions without M-L bond cleavage, Electron transfer reactions, Isomerization reactions, Exercises.	
Module 6	<i>Reactions in square planar complexes</i>	03
	Introduction, The trans effect and its applications, Theories for explaining trans effect, Mechanism of substitution reactions, Factors affecting the rate of substitution reactions in square planar complexes, Exercises.	

References:

1. Chemistry of the Elements by N N Greenwood & A Earnshaw, Butterworth-Heinemann, Elsevier, Oxford, 2005 (Indian Reprint).
2. Concise Inorganic Chemistry by J D Lee, Fifth Edition, Chapman and Hall, London, 1996.
3. Advanced Inorganic Chemistry by F. Albert Cotton, Geoffery Wilkinson, Carlos A. Murillo and Manfred Bochmann, Sixth Edition, Wiley-VCH, 1999.
4. Inorganic Chemistry by James E. Huheey, Ellen A. Keiter, Richard R. Keiter, Fourth Edition, Addison-Wesley, Reading, Massachusetts, 1993.