

Title	Transition Metal and Organometallic Chemistry	Number	CYL6XX0
Department	Chemistry	Structure L-T-P[C]	3-0-0 [3]
Offered for	M.Sc. (CY) Program	Type	Compulsory
Prerequisite			

Objectives

The Instructor will:

1. To provide students with an overview of transition metal chemistry which form a foundation for students pursuing further studies in chemistry
2. To provide students fundamental of organometallic compounds and their practical applications.

Learning Outcomes

The students are expected to have the ability to:

1. Understand the properties and reactivities of selected transition metal complexes with their structure and bonding
2. Utilize the principles of transition metal coordination complexes in understanding reactivity and properties of organometallic compounds

Contents

Coordination Compounds: Survey of various ligands, coordination, thermodynamic stability, Isomerism, Irving-William series, chelate and macrocyclic effect. (5 Lectures)

Bonding in Coordination Complexes: VBT, CFT and MOT, Crystal Field Stabilization Energies and its applications, High and low spin complex, Jahn-Teller theorem. (8 Lectures)

Reaction mechanisms in Coordination complexes - substitution reactions in complexes, trans effect and its influence, water exchange, anation and base hydrolysis, stereochemistry, inner and outer sphere electron transfer mechanism (4 Lectures)

Spectroscopic properties: Color of the complexes, Selection rules. Splitting of the free ion energy levels in Octahedral and Tetrahedral complexes. Term Symbol, Orgel, and Tanabe-Sugano diagrams. (6 Lectures)

Magnetic Properties: Origin of Magnetic moment, Effect of orbital contributions. (2 Lectures)

Bonding and properties of organometallic compounds: Ligands (carbonyl, olefins, phosphine, hydride, alkyls, carbenes, carbenes). Compounds with carbonyl, olefins, effective atomic number (EAN) rule. Classification of ligands-sigma, pi-donor, pi-acceptor. (7 Lectures)

Bonding in organometallics: sigma and pi-back bonding, synthesis of organometallic compounds. Characterization by FTIR. (3 Lectures)

Organometallic Reaction and catalysis: Oxidative addition, reductive elimination, CO insertion and migration reactions. Applications of Organometallic compounds in homogeneous catalysis – isomerization, hydrogenation reaction, hydroformylation, Monsanto acetic acid synthesis, C-C coupling reactions, polymerization and metathesis. (6 Lectures)

Text Books

1. Weller, (2014), *Inorganic Chemistry*, 6th Edition, Oxford University Press
2. Huheey, J. E. (2006), *Inorganic chemistry: principles of structure and reactivity*, 4th Edition, Pearson
3. Crabtree, R. H. *The Organometallic Chemistry of the Transition Metals*, Wiley, 1998

Reference Books

1. Kettle, S.F.A., (2010), *Physical Inorganic Chemistry, A Coordination Chemistry Approach*, Springer
2. Housecroft, C and Sharpe, A. G. (2012) *Inorganic Chemistry*, 4th Edition, Pearson

Self Learning Material

1. Ray, D *Coordination Chemistry*, NPTEL course material, Department of Chemistry, Indian Institute of Technology, Kharagpur, <http://nptel.ac.in/courses/104105033/>
2. Samuelson, A.G., *Introduction to Organometallic Chemistry*, NPTEL Course Material, Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore, <http://nptel.ac.in/courses/104108062/>