

Quadrant I - Notes

Programme: Bachelor of Science (Third Year)

Subject: Chemistry

Paper Code: CHC - 109

Paper Title: Inorganic chemistry (Section A)

Unit: Organometallic Chemistry

Module Name: Definition and Nomenclature of Organometallic Compounds

Module No: 1

Name of the Presenter: Dr. Pritam S. Patil

DEFINITION

Organometallic compounds are the compounds which contain one or more metal - carbon linkage.

e.g. $\text{Pb}(\text{CH}_2\text{CH}_3)_4$ - Tetraethyl lead , $\text{Zn}(\text{CH}_2\text{CH}_3)_2$ - Diethyl zinc

Compounds like triethoxy aluminium $(\text{C}_2\text{H}_5\text{O})_3\text{Al}$, Sodium acetate $(\text{CH}_3\text{COONa})$ etc. are not included in organometallic compounds because the metal is not directly linked to carbon.

IUPAC NOMENCLATURE

1. Nomenclature of simple compounds

The simple alkyl or aryl organometallic compounds of metals are named by writing the name of the metal after the name of organic group.

CH_3Li - Methyl lithium

$(\text{C}_2\text{H}_5)_2\text{Zn}$ - Diethyl zinc

$\text{C}_2\text{H}_5\text{MgBr}$ - Ethyl magnesium bromide

$\text{C}_6\text{H}_5\text{MgCl}$ - Phenyl magnesium chloride

2. Nomenclature of carbonyls

i) The compounds contain CO as ligand and metal in zero oxidation state

$\text{Ni}(\text{CO})_4$	- Tetracarbonylnickel (0)
$\text{Mn}_2(\text{CO})_{10}$	- Decacarbonyldimanganese(0)
$\text{Fe}_2(\text{CO})_9$	- Nonacarbonyldiiron(0)
$\text{Co}_2(\text{CO})_8$	- Octacarbonyldicobalt(0)
$[\text{V}(\text{CO})_6]^-$	- Hexacarbonylvanadate (0) ion

ii) If the ligands act as bridges between two metal atoms, the Greek letter mu (μ) is written before their names. The prefix μ is repeated before the name of each kind of bridging ligand.

For ex.

$[(\text{CO})_3\text{Co}(\text{CO})_2\text{Co}(\text{CO})_3]$ - Di- μ - carbonyl bis (tricarbonyl cobalt)

$[(\text{CO})_3\text{Fe}(\text{CO})_3\text{Fe}(\text{CO})_3]$ - Tri- μ - carbonyl bis (tricarbonyl iron)

iii) When the metal carbonyls contain metal- metal bonds, these may be classified as symmetrical or unsymmetrical.

The symmetrical metal carbonyls are named by the use of multiple prefixes (bis, tris, etc.).

$[(\text{CO})_4\text{Co} - \text{Co}(\text{CO})_4]$ - Bis (tetracarbonylcobalt)

In case of unsymmetrical metal carbonyls, one central metal atom and ligands are treated as a ligand on the other central metal atom.

$[(\text{CO})_4\text{Co} - \text{Re}(\text{CO})_5]$ - Pentacarbonyl (tetracarbonyl cobalto) rhenium

3. Nomenclature of σ and π bonded ligands

σ and π notations are used to distinguish between one carbon bonded and multiple carbon bonded ligands.

e.g. Cyclopentadiene (C_5H_5) is $\sigma - C_5H_5$ one carbon bonded ligand

$\pi - C_5H_5$ five carbon bonded ligand

For unsaturated molecules or group, the prefix η (eta or hapto) is used.

η^1 - monohapto, η^2 - dihapto, η^3 - trihapto and so on

$Fe(C_5H_5)_2$	Bis (η^5 - cyclopentadienyl) iron
$Cr(C_6H_6)_2$	Bis (η^6 - benzene) chromium
$Co(CO)_3(\pi - C_3H_5)$	(η^3 - allyl) tricarbonyl cobalt
$(C_6H_6) Cr (CO)_3$	(η^6 - benzene) tricarbonyl chromium
$Fe_2(CO)_4(C_5H_5)_2$ tetracarbonyldiiron	Bis(η^5 - cyclopentadienyl)
$Fe(CO)_2(\sigma - C_5H_5) (\pi - C_5H_5)$	Dicarbonyl (η^1 - cyclopentadienyl) (η^5 - cyclopentadienyl) iron
$Fe(CO)_3(C_4H_6)$	(η^4 - butadiene) tricarbonyl iron