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EASTERN UNIVERSITY SRI LANKA

DEPARTMENT OF CHEMISTRY

THIRD YEAR IN SCIENCE

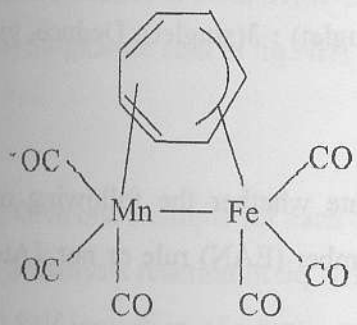
SECOND SEMESTER – 2002/2003

CH 305 ORGANOMETALLIC CHEMISTRY & NON-AQUEOUS SOLVENTS

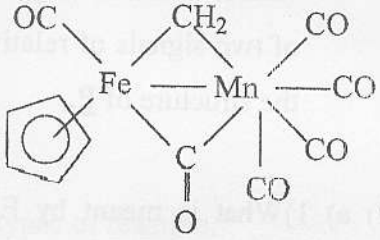
ANSWER ALL QUESTIONS **TIME – ONE HOUR**

1) a) Indicate the monohapto, dihapto, trihapto, tetrahapto, pentahapto and bridging ligands present in the following compounds

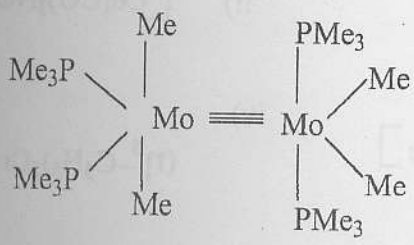
i)



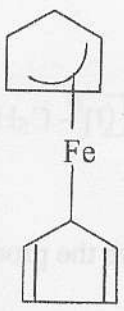
ii)



iii)



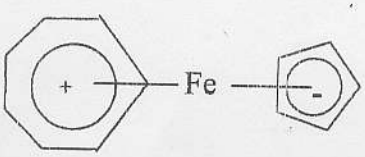
iv)

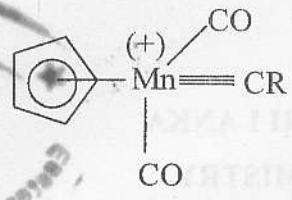


b) Give the systematic names of the following organometallic compounds.

i) $[Cr(CO)_4(PR_3)_2]$

ii)



iii) 

iv) $[(CO)_5CrCl]^-$

C) i) Arrange the following compounds in the order of increasing stretching frequency of the C-O bond.

CO, $[V(CO)_6]^-$, $[Cr(CO)_6]$, $[Mn(CO)_6]^+$

Account for your arrangement.

ii) A diamagnetic organometallic compound **P** having molecular formulae $Co_2(CO)_8$ shows strong absorption at 2000 cm^{-1} and 1805 cm^{-1} in the region where CO stretching frequencies are observed. The ^{13}C nmr spectrum of **P** consist of two signals of relative intensity 1(singlet) : 3(singlet). Deduce, giving reasons, the structure of **P**.

2) a) 1)What is meant by EAN rule? Indicate whether the following organometallic compounds obey Effective Atomic Number (EAN) rule or not. (Atomic number: V = 23, Co = 27, Fe = 26, Cr = 24)

i) $[V(CO)_6]$

ii) $[Co(CO)_3NO]$

iii) $[(\eta^5-C_5H_5)Fe(CO)PPh_3Me]$

iv) $(\eta^5-C_5H_5)_2Cr$

2) Give the product that you would expect from the hydroformylation reaction of

$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH=CH_2 \xrightarrow[HCo(CO)_4]{H_2/CO}$$

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Give the mechanism and structures of all the compounds involved in the above catalytic cycle.

b) Explain the following with appropriate reasons

i) Acetamide behaves as a weak base in aqueous solution but shows acidic property in liq. NH_3.

ii) Non-polar compounds are usually insoluble in strong polar solvents.

c) 1) Give balanced chemical equations for the following reactions.

i) $SiCl_4$ in liq.NH_3.

ii) CH_3COOH in Conc.H_2SO_4.

iii) Sulphamic acid in liq.NH_3.

2) Give one example for each of the following types of reaction.

i) Solvolysis reaction in liq.NH_3.

ii) Self-ionization of a protic solvent.

iii) Amphoteric reaction in liq.NH_3.