

SEM6_C13_SUGGESSTION

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CHEMISTRY

INORGANIC CHEMISTRY-IV CORE-13

(CCCEMH13)

Time Allotted: 2 Hours

Full Marks: 25

Group-A

Answer any ten (10) questions from the following

10×1 = 10

- 1.(a) What is the oxidation state of Ni in $[\text{Ni}(\text{CO})_4]$?
- (b) Calculate the value of x in $\text{Co}_2(\text{CO})_x$ using 18-electron rule.
- (c) What is heptacity?
- (d) Write down the formula of Collman's reagents?
- (e) Give one example of reductive carbonylation reaction?
- (f) Give one example of acylation reaction reaction Ferrocene?
- (g) Draw the most stable structure of the oxidative addition product of Vaska's complex with O_2 molecule.
- (h) Give one example of insertion reaction.
- (i) What is the possible chemical composition Ziegler-Natta catalyst?
- (j) Draw the structure of one homogeneous hydrogenation catalyst?
- (k) Give an example of spectator ligand.
- (l) Give an example of non classical carbonyl.
- (m) Give one example of σ -donor and π -acceptor organometallic complex.
- (n) Find the number (n) of CO ligands in the complex $\text{Fe}_3(\text{CO})_n$ using 18-electron rule.
- (o) Cite one example of fluxional carbonyl.
- (p) Comment on the acidic behavior of $\text{HCo}(\text{CO})_4$.
- (q) Which compound is used as co-catalyst in Wacker process?
- (r) What is polymerization reaction?
- (s) Why Vaska's compound cannot act as hydrogenation catalyst-why?
- (t) What is the role of CuCl_2 in Wacker process?
- (u) Cite one example of positive catalyst.
- (v) What happens when BeCl_2 was treated with CH_3Li in presence of ether?
- (w) What is hydrometallation reaction
- (x) Draw the geometry of $\text{Mn}_2(\text{CO})_{10}$.

Group-B

Answer any one questions from the following

5×1 = 5

- 2.(a) The carbonyl stretching frequency of $[\text{Mn}(\text{CO})_6]^+$, $[\text{Cr}(\text{CO})_6]$ and $[\text{V}(\text{CO})_6]^-$ occurs at 2090, 2000 and 1860 cm^{-1} respectively. Give reasons for such variation.

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- (b) Square planer d^8 complexes usually undergo oxidative addition reaction-explain. 2
- 3.(a) Why ethylene cannot be hydrogenated by Wilkinson's catalyst? 2
- (b) Classify the following reactions as oxidative addition, reductive elimination, insertion, β -elimination, etc.
- (i) $TiCl_4 + 2Et_3N \rightarrow TiCl_4(NEt_3)_2$
- (ii) $Co_2(CO)_8 + H_2 \rightarrow 2HCo(CO)_4$ 2
- (c) How terminal CO group can be distinguished from a bridging CO group-explain briefly on the basis of IR data.
- 4.(a) "Infra-red spectroscopy is informative tool to describe the final structure of metal carbonyls- illustrate this statement with suitable example 3
- (b) What are the disadvantages of Co-catalyst in hydroformylation reaction? 2
- 5.(a) Why is reductive elimination described as 1,1-elimination? 2
- (b) Which of the following in each pair will be more reactive towards oxidative addition of dihydrogen?
- (i) $Rh(PPh_3)_3Cl$ or $Rh(PPh_3)_2(CO)Cl$
- (ii) $Ir(Cl(CO)(PPh_3)_2)$ or $Rh(Cl(CO)(PPh_3)_2)$
- (iii) $[Co(dppe)_2]^+$ or $[Ir(dppe)_2]^+$

Group-C

Answer any one questions from the following

10×1 = 10

6. (a) Discuss the mechanistic steps for the hydrogenation of olefins by Wilkinson's catalyst. 5
- (b) Substitution reaction of $Cr(CO)_6$ is very slow whereas the iso electronic complex $[V(CO)_5NO]$ is very reactive-why? 3
- (c) Using 18 electron rule as guideline calculate the number of M-M bonds present in $Ir_4(CO)_{12}$. 2
7. (a) What is Wacker process? Explain the role of $PdCl_4^{2-}$ in this reaction. 2+3=5
- (b) What are metallocene compounds? Distinguish between metallocene and sandwich compounds. How would you prepare Ferrocene from $FeCl_3$? 1+2+2=5
- 8.(a) Discuss the structure and bonding and bonding in $[PtCl_3(C_2H_4)]^-$ anion with special reference to PtC_2H_4 bond. Point out two evidences in favour of the bonding mechanism. 3+2=5
- (b) The V-C bond distances in $[V(CO)_6]^-$ and $[V(CO)_6]$ are 1.93 Å and 2.00 Å respectively-explain the difference in bond distance. 3
- (c) Which of the following complexes are likely to be unstable and why: $[Ti(CO)_4]^{4+}$, $Fe_3(CO)_{12}$, $Cd(CO)_3$. 2
9. (a) Predict the product in the following reactions: 4
- (i) $Ir(PPh_3)_3Cl$
- (ii) $W(CO)_6 + C_6H_5Li$
- (iii) $V(CO)_6NO$
- (iv) $[Fe(CO)_4]^{2-} + CH_3I$

- (b) Cyclopentadienyl ring in ferrocene has aromatic character but cyclopentadiene itself has no such property-Explain. 2
- (c) Nitration of ferrocene is not possible but acetylation of ferrocene is possible- comment. 2
- (d) What is trans effect? 2

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