

PG Odd Semester (CBCS) Exam., December—2016

CHEMISTRY

(3rd Semester)

Course No. : CH-301 (C)

(Inorganic Chemistry—III)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

The figures in the margin indicate full marks
for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

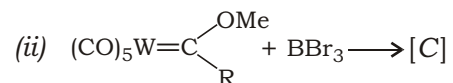
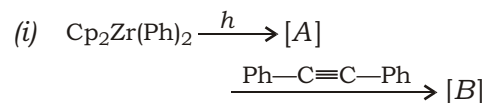
1. (a) What is meant by organometallic compounds? Write down the different strategies to obtain kinetically stable organometallic compounds. 1+5=6
- (b) Illustrate the MO diagram showing *d*-orbital overlap between metal atoms of $[\text{Os}_2\text{Cl}_8]^{2-}$. Predict the bond order and draw the most stable structure. 3+1+1=5

- (c) Write down the products of the following (give structures) : 1×4=4
- (i) WCl_6 LiMe ?
- (ii) $[\text{CpIrCl}_2]_2$ $\begin{matrix} \text{AlMe}_3 \\ \text{[O]} \end{matrix}$?
- (iii) $\text{Ni}(\text{PPh}_3)_3$ $\text{C}_2\text{H}_5\text{I}$?
- (iv) $\text{K}[\text{Mn}(\text{CO})_5]$ PhCH_2I ?

2. (a) Determine the total valence electrons (TVE) of the following compounds and comment on their isolobal relationship : 1×4=4
- (i) $[(\eta^5\text{-C}_5\text{H}_5)\text{Fe}(\text{CO})_2]$
- (ii) $[\text{CoH}(\eta^8\text{-C}_8\text{H}_8)]$
- (iii) $[\text{Mn}(\text{CO})_6]$
- (iv) $[\text{Pt}(\text{Ph})(\text{CO})\text{Cl}_2]$
- (b) Taking suitable example show how the change in ligands and metals influence the steric saturation in organometallic compounds. 3
- (c) Give a schematic route to obtain Schrock-alkylidene compound from Fischer-carbene compound. How does Fischer-type compounds differ from Schrock-type compounds? Discuss the bonding in Schrock-type organometallic compounds. 2+2+2=6

(3)

(d) Give products of the following reactions : 1×2=2

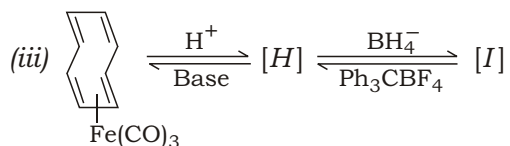
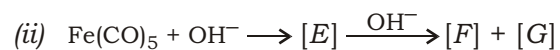
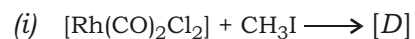


UNIT—II

3. (a) What is meant by 'coordinative unsaturation'? How is it related to catalytic properties of inorganic complexes? Furnish two examples. 1+2+2=5

(b) Suggest a plausible mechanism for the oxidative addition of H₂ to metal complexes. 4

(c) Write the products and comment on the following reactions : 2×3=6



(4)

4. (a) Furnish the products of the following reactions and predict the probable structure : 1½×2=3



(b) The rate of reaction of O₂ with *trans*-IrX(CO)(PPh₃)₂ in benzene decreases in the order X I Br Cl N₃ F. Explain the observation. 4

(c) Briefly discuss Ziegler-Natta catalysis for polymerization of alkene. 5

(d) Write a note on insertion reaction. 3

UNIT—III

5. (a) Deduce the symmetry point group notation for a planar *cis*- and *trans*-PtCl₂X₂. 5

(b) Work out the point group symmetry of the following : 6



(c) Develop the matrix for an inversion (i) operation performed on a vector having coordinates (x₁, y₁, z₁). 4

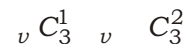
(5)

6. (a) Furnish the symmetry point groups of the following (explain with suitable illustrations) : 5



- (b) What is meant by character of a symmetry element? Define dimension of representation. What is the dimension of C_2 in a C_{2v} point group? 3

- (c) Show using figurative illustration for C_{3v} point group : 3



- (d) Show that

$${}^k \chi_i^2(R) = h$$

where symbols have their usual significance in relation GOT. 4

UNIT—IV

7. (a) Discuss the principle of ionization chamber for radiation measurements. Why is signal amplification needed in this technique? 3+2=5

- (b) Discuss the energetics of nuclear fission. 5

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(Turn Over)

(6)

- (c) Explain the concept and utility of nuclear reaction cross section. 5

8. (a) Explain the photochemical process in an inorganic scintillator. 5

- (b) Discuss briefly the principle of Ge(Li) detector. Write down its advantages and disadvantages over NaI(Tl) detector. 4+3=7

- (c) Write a short note on any one of the following : 3

(i) GM counter

(ii) Nuclear fusion

UNIT—V

9. (a) Define molecular recognition. Write down the factors for high recognition. How can a spherical macrocyclic cryptand be useful for spherical, tetrahedral and anion recognition? Explain by taking suitable examples. 1+3+4=8

- (b) ATP hydrolysis can be catalyzed by the protonated macrocyclic polyamines. Briefly discuss. 3

- (c) Discuss light driven ($2e^-$ $2H^+$) symport across a membrane via the quinone carrier molecule, vitamin K_3 . 4

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(Continued)

10. (a) Dithienylethene system bearing two phenol groups shows the dual-mode of optical-electrical switching process. Explain. 5
- (b) Show schematically the processes involved in supramolecular photochemistry. Explain A-ET-E process by taking a suitable example. 2+2=4
- (c) Hydrogen bonds have been used to drive the formation of rotaxanes and catenanes. Briefly discuss. 6

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