2018/ODD/08/22/CH–301 (C)/164

PG Odd Semester (CBCS) Exam., December—2018

CHEMISTRY

(3rd Semester)

Course No. : CH–301 (C)

(Inorganic Chemistry)

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)* Furnish two synthetic strategies to obtain Fischer-Carbene complexes. Discuss the bonding in Fischer-Carbene complex taking any one example. 2+3=5

(b) Write the products of the following reactions and give explanations : 1½×4=6

(i) $(CO)_5Cr=C(OMe)(OMe) \xrightarrow{NH(CH_3)_2} ?$

(ii) 

(iii) $Pt(CH_3)_2\ Cl_2 + \longrightarrow [A] \xrightarrow{Py} [B]$

(iv) $Pt_2(dmpe)_2\ Me_4 + 2MeI \longrightarrow ?$

(c) Illustrate the MO diagram showing *d*-orbital overlap between metal atoms of $[Os_2Cl_8]^{2}$. Predict the bond order and draw the most stable structure. 4

2. *(a)* 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

(b) Write notes on the following : 4

(i) Tebbe's reagent

(ii) Olefin metathesis

(c) In $[Mo_2Cl_8]^{4}$, explain the M-M bonding from relative energy-level diagram of *d*-orbital interaction. Predict the structure. Explain what will happen when oxidises with two electrons. 3+1+1=5

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 H_2 to metal complexes. 4

(c) Predict the product and chemistry involved in the following reactions : 2×3=6

(i) $Pt(O_2)(PPh_3)_2 + 2CS_2 \longrightarrow ?$

(ii) $[C_6H_6\,Mn(CO)_3]^+ + H^- \longrightarrow$

(iii) $^5\!-\!C_5H_5(CO)_2Fe-C(CN)(H)(CH_3) \underset{\text{Base}}{\overset{H^+(D^+)}{\rightleftharpoons}} ?$

4. *(a)* Briefly discuss Ziegler-Natta catalysis for polymerization of alkene. 5

(b) Write the mechanism of hydrosilylation reaction of alkene. Discuss the stereochemical aspects of the reactions. 5

(c) Illustrate with a suitable example, the Lewis acidity of a coordinative unsaturated compound. 2

(d) Write a note on insertion reaction. 3

UNIT—III

5. *(a)* Define character of symmetry elements. What is meant by dimension of a representation? What is the dimension of $_{yz}$ in a C_{zv} point group? 6

(b) Work out the character representation of hybrid orbitals of H_2O and then deduce the irreducible representation (IR). From this, comment on the type of hybrid orbitals involved. 7

(c) Give the point group notation for *trans*-nonplanar H_2O_2 molecule. 2

6. *(a)* Define irreducible representation. Show that sum of the square of the characters under any irreducible representation is equal to the order of the group

$$_{k}\quad {}^{2}_{i}\; R \quad h\,.$$ 5

(b) Develop the C_{3v} point group character table using GOT. State which IR is totally symmetric. 6

(c) Deduce the symmetry point group notation for a planar *cis*- and *trans*-$PtCl_2X_2$. 4

UNIT—IV

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

(b) Briefly discuss the scintillation methods for radiation detection and counting. 6

(c) Discuss the principle of solid-state detector. 4

8. *(a)* Draw and explain the variation of pulse size with applied voltage for   and   particles. 5

(b) Write a short note on any *one* of the following : 4

(i) Spallation reaction

(ii) Nuclear fusion

(c) Define nuclear fission reaction. Explain qualitatively the fission reaction using liquid-drop model. 6

UNIT—V

9. *(a)* In molecular recognition process, a molecule selectively recognizes its partner through various molecular interactions. Give an overview. 5

(b) What is A-ET-E process in supramolecular photonic devices? Discuss the functioning of Tb (III)-cryptate complex. 6

(c) Protoneted [24]N_6O_2 macrocyclic compound markedly accelerates the hydrolysis of ATP. Explain. 4

10. *(a)* What are the specific factors for designing an efficient carrier in carrier mediated transport process? Sketch out the light coupled electron transport process in a redox gradient. 4+4=8

(b) Explain the opto-electrical switching process by taking suitable example. 4

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

(i) Self-assembly

(ii) Co-receptor

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(i) $Pt(O_2)\,(PPh_3)_2 + 2CS_2 \longrightarrow ?$

(ii) $[C_6H_6\,Mn(CO)_3]^+ + H^- \longrightarrow$

(iii) $^{5}\text{—}C_5H_5(CO)_2\,Fe\text{—}\overset{\text{CN}}{\underset{\text{CH}_3}{\text{C}}}\text{—H} \underset{\text{Base}}{\overset{H^+(D^+)}{\rightleftharpoons}} ?$