2017/ODD/08/22/CH–301 (C)/076

PG Odd Semester (CBCS) Exam., December—2017

CHEMISTRY

(3rd Semester)

Course No. : CH–301 (C)

(Inorganic Chemistry—III)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

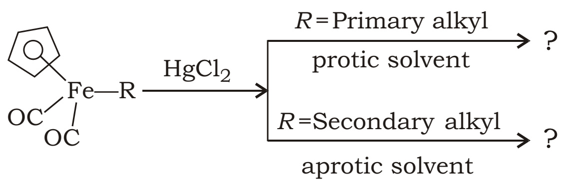
The figures in the margin indicate full marks for the questions

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

UNIT—I

1. *(a)* Illustrate with suitable example, three different methods of obtaining metal-carbon sigma-bonded compounds. 3+3=6

(b) Write the products in the following reactions. Give reason : 2+2=4



(c) Briefly account the H_2 addition reaction to $Ir^{I}(CO)(Cl)(PPh_3)_2$ and $Rh^{I}(CO)(Cl)(PPh_3)_2$. 3

(d) Give the preparative scheme for $Ni(PR_3)_2PhCl$ from $Ni(PR_3)_3$. 2

2. *(a)* Complete the following reactions (give structures) : 2×3=6

(i) WMe_6 PMe_2Ph H_2 ?

(ii) $Mn(CO)_4CH_3$ $C_6H_5N{=}NC_6H_5$ 100 °C ?

(iii) Cp_2ZrPh_2 h C_2H_4 ?

(b) What is isolobal relationship? How do isolobal fragments predict the structure of cluster compounds? 1+3=4

(c) Write notes on the following : 2½×2=5

(i) -H elimination

(ii) Fluxionality in substitution reaction

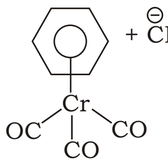
UNIT—II

3. *(a)* What is hydrosilylation reaction? Which catalyst is used for it? Write Chalk-Harrod mechanism for it. Discuss the stereochemical aspects of the reaction. 1+1+3+2=7

(b) What is oxidative addition reaction? Give example. What conditions are to be met for such a reaction to occur? 5

(c) Write the product and comment on the following reactions : 1½×2=3

(i) $Rh(PPh_3)_3Cl + O_2 \xrightleftharpoons{CH_2Cl_2} ?$

(ii) 

$+ \overset{\ominus}{C}H_2—CO_2Me \longrightarrow ?$

4. (a) What is hydroformylation reaction? Which catalyst is used for it? Write the mechanism. Discuss the effect of high hydrogen pressure in hydroformylation reaction. 1+1+3+2=7

(b) Explain the coordinative unsaturation by taking a suitable example. Give one method of its preparation and one application. 5

(c) Complete the following reactions : 3

(i) $RuHCl(PPh_3)_3 + 3P(OPh)_3 \xrightarrow{reflux} A + B + C$

(ii) $[Ir(CO)_3(PPh_3)_2]^+ \underset{H^+}{\overset{CH_3O^-}{\rightleftharpoons}} D$

UNIT—III

5. (a) Using figurative illustration, show for NH_3 molecule, similarity transform of $C_3^1 \;\; {}_v C_3^1 \quad C_3^2$. 4

(b) Show that for a C_{2v} point group—

(i) $Li^2 \quad h \quad 4$;

(ii) all representations are orthogonal. 6

(c) Briefly explain the group theoretical criteria for IR activity of a vibrational molecule. 3

(d) Furnish the point group notations for—

(i) H_2CN_2;

(ii) IF_7. 2

6. (a) For a BF_3 molecule, list the symmetry elements, classes and state the order of the point group and construct the character table. 8

(b) Work out the symmetry permitted orbitals of a tetrahedral AB_4 molecule, suitable for hybridization. 7

UNIT—IV

7. *(a)* Briefly discuss the principle of proportional counter. What are its advantages and disadvantages? 5

(b) Explain the photochemical process in NaI(Tl) scintillator. 6

(c) Write short notes on the following : 4

(i) GM counter

(ii) Nuclear cross-section

8. *(a)* What do you mean by *Q*-value of a nuclear reaction? Explain the significance of a positive and a negative *Q*-value. Find the threshold energy for the reaction $^{13}C(p, n)^{13}N$, where the *Q*-value is 3·236 MeV. 5

(b) Define nuclear fission reaction. Explain qualitatively the fission reaction using liquid-drop model. 5

(c) Discuss briefly the principle of Ge(Li) detector. What are its advantages and disadvantages over NaI(Tl) detector? 5

UNIT—V

9. *(a)* What is recognition in connection with supramolecular species? How is molecular recognition used to determine the molecular length? Explain by taking a suitable example. 5

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

(c) What do you mean by coupled transport? Explain electron-coupled transport process by taking a suitable example. 4

10. *(a)* Define self-assembly in supramolecular chemistry. Explain the metal-directed self-assembly process by taking a suitable example. 5

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

(c) Explain the optoelectrical switching process by taking a suitable example. Give one of its applications. 6

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