PG Even Semester Examination, May 2025

CHEMISTRY

(4th Semester)

Course No.: CHM-653 (A)

(Inorganic Chemistry)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the right margin indicate full marks for the question.
Answer any five questions selecting one from each unit.

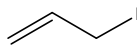
UNIT-I

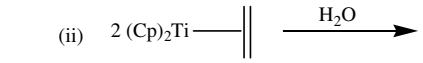
1. (a) Give two methods for the synthesis of metal-butadiene organometallic complexes. Explain the structure and bonding of metal-butadiene complex. 2+3=5

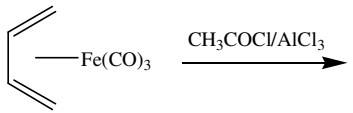
   (b) Furnish synthesis of metallocene from dicyclopentadiene ligand. 2

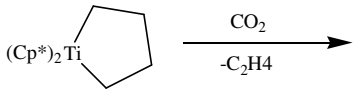
   (c) Illustrate applications of metal alkyne complexes in (i) [2+2+2] cycloaddition reaction and (ii) ring-opening polymerization reaction. 1.5+1.5=3

   (d) Give the product of the following reactions. 1×4=4

(i) $Ni(COD)_2$ + 

(ii) $2\ (Cp)_2Ti$ 

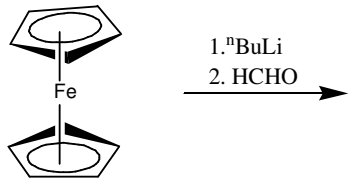
(iii) 

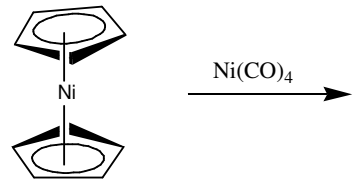
(iv) 

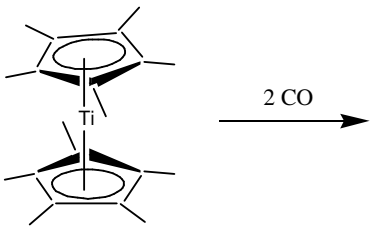
2. (a) Furnish synthesis of alkene complexes using (i) metal salt synthesis and (ii) metal atom synthesis. Explain bonding in metal-alkene complexes. 2+3=5

(b) Draw the structure of dinuclear $Co_2(CO)_6(C_2Ph_2)$ and explain based on isolobal relationship. 2

(c) Furnish the product of the following reactions: 3

(i) 

(ii) 

(iii) 

(b) What is carboxypeptidase-A(CPA)? Comment on the substrate selectivity of CPA. Explain the role of Arg-145 and Glu-270 in CPA activity. 6

UNIT-V

9. (a) Define the terms (i) supramolecular synthons and (ii) secondary building units used in crystal engineering.Give examples. 3

(b) What is polymorphism? Briefly discuss about different polymorphs of 2-(4-anisyl)-1,4-benzoquinone. 1+3=4

(c) Briefly discuss the overall crystal packing of dimorphic resorcinol at low and high temperature. 4

(d) Draw the total free energy (ΔG) versus cluster size (r) plot and explain. 3

10. (a) Briefly discuss the two major events of crystallization process. 5

(b) What are coordination polymers? Mention few applications of coordination polymers. 1+4=5

(c) Discuss non-covalent interactions and crystal packing of the coordination polymer $[Ag_2(4,4'\text{-bpy})_2](BF_4)_2.H_2O$ 4

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(d) Write a brief account onthe following-

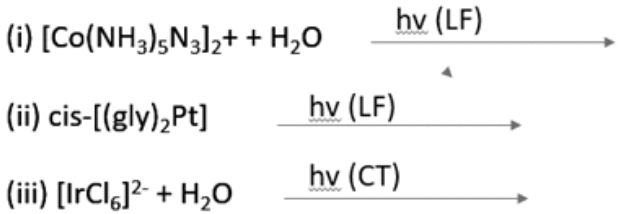
(i) Fluxionality

(ii) Ring slippage of cyclopentadiene ligand. 2+2=4

UNIT-II

3. (a) Furnish an account of excited state responsible for photochemical redox reaction of inorganic metal complexes. Provide two examples. 3+2=5

(b) Suggest and comment on the products formed. 3x2=6



(c) Write a note on 'thexi' state in relation to photochemical excitation of molecules. 3

4. (a) Discuss the salient features of photoaquation reaction of $[Cr(CN)_6]^{3-}$. 4

(b) Write short notes on – 3+3=6

(i) Non-radiative transition

(ii) Chemiluminescence

(c) Briefly discuss the role of a photoactive metal complex in actinometry taking a suitable example. 4

UNIT-III

5. (a) What is meant by 'hot-atom' chemistry? Describe Szilard-Chalmers process taking suitable example. Write conditions for Szilard-Chalmers separation of radioactive nuclei. Explain recoil energy. 1+2+2+2=7

(b) Illustrate the applications of tracer technique in industrial process. 7

6. (a) What is the radiotracer method? Mention advantages of radiotracer technique. 1+2=3

(b) Describe ion-exchange method for the radiochemical separation of actinides. 4

(c) Elucidate the determination of exchange rate in a chemical exchange reaction using isotope tracer technique. 7

UNIT-IV

7. (a) What is carbonic anhydrase? What is its biological function? Discuss the role of Zn(II) in carbonic anhydrase. Explain the function of sulphonamide in the treatmentof glaucoma. 1+1+3+3=8

(b) What are cytochromes? What is their function? How are Cytochromes classified? Illustrate with examples. 6

8. (a) Comment on the structural features of superoxide dismutase(Cu,Zn-SOD).Discuss the mechanism of Cu,Zn-SOD activity. 4+4=8