FYUG Even Semester Exam., 2025

CHEMISTRY

(4th Semester)

Course No. : CHMDSC–252

(Organometallic and Analytical Chemistry)

Full Marks : 70
Pass Marks : 28

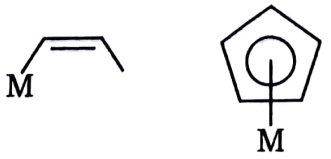
Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following questions : 2×2=4

(a) What is haptacity? Mention haptacity in the following compounds :

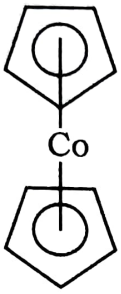


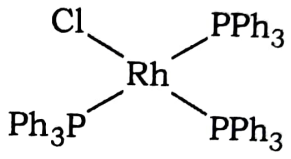
(b) What is 18-electron rule? Give examples.

(c) Draw the structures of eclipsed and staggered ferrocene.

Answer any *one* of the following questions : 10

2. *(a)* *(i)* Count the number of electrons in the following molecules as per EAN rule : 2





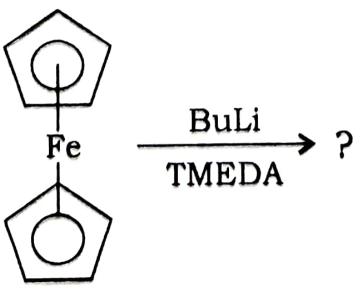
(ii) Give an example of 16-electron species. What do you mean by polynuclear carbonyl cluster? Give examples. 3

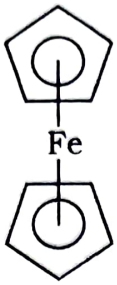
(b) *(i)* Compare the relative stabilities of ferrocene with benzene. 3

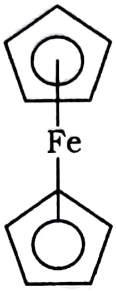
(ii) Discuss the classification of organometallic compounds. 2

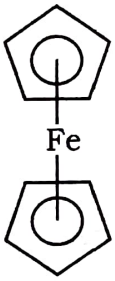
3. *(a)* Complete the following reactions : 1×5=5

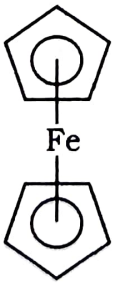
(i)



(ii)  $\xrightarrow{HgCl_2}$?

(iii)  $\xrightarrow{CH_3COCl}$?

(iv)  $\xrightarrow[\text{Benzene}]{CO_2/AlCl_3}$?

(v)  $\xrightarrow[H_2O]{CO_2}$?

(b) Mention one method of preparation of ferrocene. 2

(c) Discuss the stability of sandwich complex and half sandwich complex, taking suitable example of each. 3

UNIT—II

4. Answer any *two* of the following questions : 2×2=4

(a) Mention one method of preparation of Grignard reagent.

(b) Why is dry ether used in the preparation of Grignard reagent?

(c) Draw the structure of triethyl aluminium along with its use.

Answer any *one* of the following questions : 10

5. *(a)* Discuss the mechanism of polymerization of ethene. 5

(b) Taking suitable example explain the concept of multicentred bonding in organometallic compounds. 5

6. *(a)* Explain the structure of trialkyl aluminium and explain why Al—C bond lengths are not equal. 5

(b) Mention three uses of Grignard reagents in synthetic chemistry. 3

(c) Mention the factors affecting Schlenk equilibrium. 2

UNIT—III

7. Answer any *two* of the following questions : 2×2=4

(a) What is acid hydrolysis? Give example.

(b) What are inert and labile complexes?

(c) What is *trans*-effect?

Answer any *one* of the following questions : 10

8. *(a)* Explain the mechanism of ligand substitution reaction in square planar complexes. 5

(b) Discuss any one theory of *trans*-effect taking a suitable example. 5

9. *(a)* What is inert ligand? What types of intermediate are formed by pi-acceptor and pi-donor ligands? 5

(b) Discuss S_N1 (CB) mechanism taking suitable example. 5

UNIT—IV

10. Answer any *two* of the following questions : 2×2=4

(a) Why is Wilkinson catalyst called homogeneous catalyst?

(b) What is water-gas shift reaction? Mention the suitable catalyst. 1+1=2

(c) What do you mean by rate determining step in catalytic reaction?

Answer any *one* of the following questions : 10

11. (a) Discuss the mechanism of hydro-formylation reaction. 5

(b) Discuss catalytic cycle of alkene hydrogenation. 5

12. (a) Discuss the preparation of synthesis gas by metal carbonyl complex. 5

(b) What is syn gas? Mention its uses. 1+2=3

(c) Mention the hybridization state of central metal atom in Wilkinson catalyst and comment on its geometry. 2

UNIT—V

13. Answer any *two* of the following questions : 2×2=4

(a) What are meant by group reagents? Mention group reagent of group I.

(b) Discuss solubility product and its relation with precipitation.

(c) What do you mean by interfering radicals?

Answer any *one* of the following questions : 10

14. *(a)* Discuss the removal of PO_4^{3-} from the inorganic salt mixture. 5

(b) What is common ion effect? Explain why Zn^{2+} cannot be precipitated as ZnS in acidic medium. 5

15. *(a)* Discuss the process of detection and removal of borate from inorganic samples. 5

(b) Discuss the detection of PO_4^{3-}, oxalate and F^- from the sample along with reactions. 5

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