TDC (CBCS) Even Semester Exam., 2022

CHEMISTRY

(Honours)

(6th Semester)

Course No. : CHMHCC-601T

(Inorganic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 20)

Answer any *ten* questions from the following : 2×10=20

1. What is a sandwich compound? Give an example. 1+1=2

2. Define hapticity of a ligand. If the complex $[W(C_p)_2(CO)_2]$ follows 18-electron rule, what are the hapticities of the C_p ligands? 1+1=2

3. Using 18-electron rule as a guide, indicate the values of n and $3d$ metal M in the following : 1×2=2

(a) $[Co(\pi\text{-}C_3H_5)(CO)_n]$

(b) $[(\eta^5\text{-}C_5H_5)M(C_2H_4)_2]$

4. Define multicentre bonded organometallic compounds. Give an example. 1+1=2

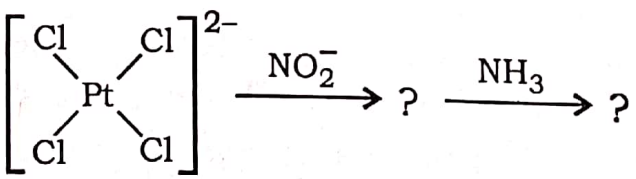
5. Write the name of an organometallic compound which is used as a heterogeneous catalyst. Mention its application. 1+1=2

6. Comment on the structural features of methyl lithium.

7. Define thermodynamic and kinetic stability of complexes.

8. What is base hydrolysis? Give an example. 1+1=2

9. Predict the products of the following reaction :



(Continued)

10. Define oxidative addition reaction. Give an example. 1+1=2

11. Write the process used in hydroformylation of olefins. Mention the active catalytic species involved in it. 1+1=2

12. What is syngas? Mention its use. 1+1=2

13. Under what condition a precipitate is formed when solutions of $BaCl_2$ and Na_2SO_4 are mixed?

14. Name the group reagents used for analysing *(i)* Al^{3+} and *(ii)* Ni^{2+} cations. 1+1=2

15. A brown precipitate appears in a bottle containing aqueous $FeCl_3$ solution on standing. Give reason.

SECTION—B

(*Marks* : 30)

Answer any *five* questions from the following : 6×5=30

16. *(a)* What is EAN rule? Calculate EAN of the following organometallic compounds and draw their structures : 1+2+2=5

(i) $Co_2(CO)_8$

(ii) $Ir_4(CO)_{12}$

(b) Write the limitations of EAN rule. 1

17. (a) In the formula of ferrocene $(\eta^5\text{-}C_5H_5)_2Fe$, what does the prefix η^5 denote? 1

(b) The cyclopentadienyl rings in ferrocene have aromatic character but cyclopentadiene itself has no such character. Explain. 2

(c) Ferrocene is more reactive than benzene towards Friedal-Crafts acylation reaction. Justify. 3

18. (a) What is Grignard reagent? Why are ether solvents most suitable for the preparation of Grignard reagents? 1+2=3

(b) Write the composition of Grignard reagent in diethylether at equilibrium. 1

(c) Mention the factors affecting the position of Schlenk equilibrium. 2

19. Draw the structure of dimeric dialkyl aluminium and explain why all Al—C bond lengths are not identical. 6

20. *(a)* What are anation reactions? Give example. 1+1=2

(b) Discuss the mechanism of nucleophilic substitution reactions in octahedral complexes. 4

21. *(a)* What is *trans*-effect? How would you explain the high *trans*-directing ability of pi-acceptor ligands in square-planar nucleophilic substitution reactions? 1+3=4

(b) Nickel complexes are observed to undergo substitution reaction much faster than platinum complexes. Offer an explanation. 2

22. What is Fischer-Tropsch process? Describe the most plausible mechanism for this reaction. 2+4=6

23. Discuss the catalytic cycle involved in the production of synthesis gas using metal carbonyl complexes.

24. Briefly explain the terms 'common ion effect' and 'solubility product'. Discuss their applications in qualitative analysis. 3+3=6

25. What are interfering radicals? Explain the method of detection and removal of BO_3^{3-} radical from an inorganic salt mixture. Give chemical equations. 1+5=6

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