

(8 pages)

Reg. No. :

Code No. : 6396

Sub. Code : HCHM 22

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2016.

Second Semester

Chemistry

INORGANIC CHEMISTRY – II

(For those who joined in July 2012 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. According to CFT, Ni^{2+} can have two unpaired electrons in
- (a) Tetrahedral geometry only
 - (b) Square-planar geometry only
 - (c) Octahedral geometry only
 - (d) Both octahedral and tetrahedral geometry

2. The order of crystal field splitting energy is
- (a) $\Delta_{sp} > \Delta_o > \Delta_t$
 - (b) $\Delta_o > \Delta_t > \Delta_{sp}$
 - (c) $\Delta_t > \Delta_o > \Delta_{sp}$
 - (d) $\Delta_{sp} > \Delta_t > \Delta_o$
3. The number of metal-metal bonds in $\text{Ir}_4(\text{CO})_{12}$ is
- (a) 12
 - (b) 6
 - (c) 4
 - (d) 10
4. Oxidation occurs very easily in case of
- (a) $(\eta^5-\text{C}_5\text{H}_5)_2\text{Co}$
 - (b) $(\eta^5-\text{C}_5\text{H}_5)_2\text{Fe}$
 - (c) $(\eta^5-\text{C}_5\text{H}_5)_2\text{Co}^+$
 - (d) $(\eta^5-\text{C}_5\text{H}_5)_2\text{Ru}$
5. The reaction between $[\text{PdCl}_4]^{2-}$ and C_2H_4 produce a new compound. Compared to free C_2H_4 , the C-C bond order of the product is
- (a) between 1 and 2
 - (b) less than 2
 - (c) unaltered
 - (d) greater than 2
6. In Ziegler-Natta catalysis the commonly used catalyst system is
- (a) $\text{TiCl}_4, \text{Al}(\text{C}_2\text{H}_5)_3$
 - (b) $(\eta^5-\text{Cp})_2\text{TiCl}_2, \text{Al}(\text{OEt})_3$
 - (c) $\text{VO}(\text{acac})_2, \text{Al}_2(\text{CH}_3)_6$
 - (d) $\text{TiCl}_4, \text{BF}_3$

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7. The number of unpaired electrons present in the species $[\text{Fe}(\text{H}_2\text{O})(\text{NO})]^{2+}$ which is formed during 'brown ring test' is

(a) 2 (b) 4
(c) 3 (d) 5

8. Which of the following nuclei give NMR signal?

(a) ^{35}Cl (b) ^{31}P
(c) ^{11}B (d) All of the above

9. The supporting electrolyte for the separation of Ni and Co by controlled potential coulometry is

(a) $1\text{M NH}_4\text{Cl} + 1\text{M aq. NH}_3$
(b) 0.5M acid sodium tartrate, p^H 4.5
(c) 1M pyridine + HCl , p^H 7.0
(d) None of the above

10. In stripping techniques, the common supporting electrolyte is

(a) KCl (b) HCl , and KNO_3
(c) NH_3 and NH_4Cl (d) All the above

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What are the major steps involved in the outer sphere electron transfer process. (5)

Or

- (b) Describe the factors affecting the CFSE. (5)

12. (a) What are metal clusters? Explain the basis for their classification. (5)

Or

- (b) Discuss the significance of the isolobal fragments. (5)

13. (a) Describe the importance for the nucleophilic and electrophilic reactions of the coordinated ligands. (5)

Or

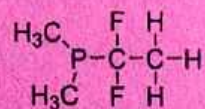
- (b) Draw the Tolman catalytic Loops. (5)



14. (a) Discuss the ESR spectrum of vanadyl acetyl acetate with suitable diagram. (5)

Or

- (b) (i) Write the ^{31}P and ^{19}F spectra of the following compound (3)



- (ii) How will you differentiate orthophosphoric acid and phosphorous acid using ^{31}P NMR? (2)
15. (a) What are the different types of currents contributing to the total current in polarographic technique? (5)

Or

- (b) Write the current voltage relationship in cyclic voltammetry and give the meaning of the parameters. (5)

PART C — (5 × 8 = 40 marks)

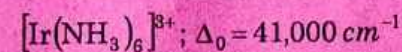
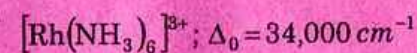
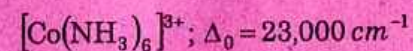
Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

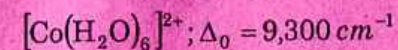
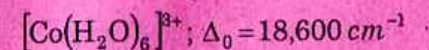
16. (a) Discuss the nature of d-orbital splitting in the following complexes $[\text{Cr}(\text{CN})_6]^{3-}$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$. Indicate their geometries and magnetic properties.

Or

- (b) (i) Reason out the following complexes (3)



- (ii) Explain the following complexes based on their absorbance (2)



- (iii) Why most of the tetrahedral complexes are high spin complexes. (3)



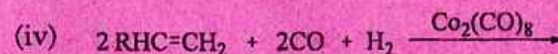
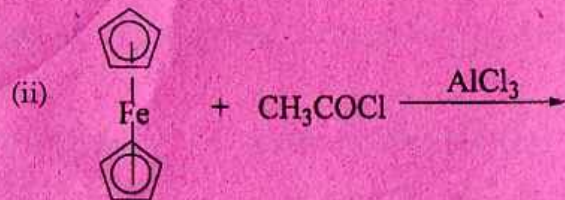
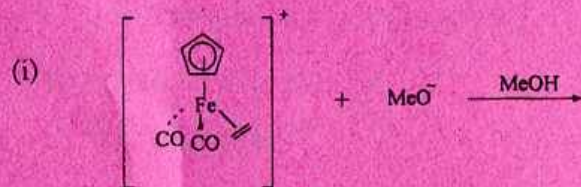
17. (a) Discuss the general features of carbenes, carbenes and carbides in alkyl and arene complexes. (8)

Or

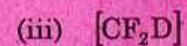
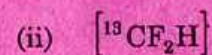
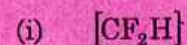
- (b) Discuss the hybridization carbene, carbene and carbide complexes. (8)
18. (a) (i) List out the difference between homogeneous and heterogeneous catalyst. (3)
- (ii) Discuss the Monsanto Acetic acid process with catalytic loop. (5)

Or

- (b) Predict the correct product of the following reactions. (4 × 2 = 8)



19. (a) Predict the number of lines in the ESR spectrum of each of the following radicals.



Or

- (b) What are paramagnetic shift reagents? Discuss the origin of paramagnetic shift and usefulness of such reagents in NMR. (8)

20. (a) (i) Account the various types of commonly observed curves in amperometric titrations. (4)
- (ii) Explain the basic concepts of direct and back titrations in complexometry? (4)

Or

- (b) Discuss the controlled current coulometry and controlled potential coulometry. (8)

