

**Write the following information in the first page of Answer Script before starting answer**

ODD SEMESTER EXAMINATION: 2020-21

Exam ID Number \_\_\_\_\_

Course \_\_\_\_\_ Semester \_\_\_\_\_

Paper Code \_\_\_\_\_ Paper Title \_\_\_\_\_

Type of Exam: \_\_\_\_\_ (Regular/Back/Improvement)

**Important Instruction for students:**

1. Student should write objective and descriptive answer on plain white paper.
2. Give page number in each page starting from 1<sup>st</sup> page.
3. After completion of examination, Scan all pages, convert into a single PDF, rename the file with Class Roll No. **(2019MBA15)** and upload to the Google classroom as attachment.
4. Exam timing from 10am – 1pm (for morning shift).
5. Question Paper will be uploaded before 10 mins from the schedule time.
6. Additional 20 mins time will be given for scanning and uploading the single PDF file.
7. Student will be marked as ABSENT if failed to upload the PDF answer script due to any reason.

**M.Sc. CHEMISTRY  
THIRD SEMESTER  
INORGANIC CHEMISTRY-III  
MSC-301**

Duration : 3 hrs.

Full Marks : 70

**( PART-A : Objective )**

Time : 20 min.

Marks : 20

**Choose the correct answer from the following:**

**1X20=20**

- Reactions of benzene are mainly electrophilic substitution, but as a coordinated ligand it undergoes:
  - Free radical reaction
  - Nucleophilic substitution
  - Redox reactions
  - None of the above
- The reactivity of ferrocene ring is similar to that of:
  - Benzene
  - Naphthalene
  - Reactive thiophene & phenol
  - None of the above
- The stronger M-C bond:
  - Increases tendency of CO to leave the metal ion
  - Neither increases nor decreases the tendency to leave the metal ion
  - Decreases the tendency of CO to leave the metal ion
  - None of the above
- The associatively activated substitution even in 18 electron complexes with NO ligand is feasible because:
  - Linear NO ligand switches to angular NO
  - Angular NO ligand switches to linear NO
  - It becomes 20 electron complex
  - None of the above
- 1,2 Insertion reaction:
  - Takes place with change in oxidation number of the metal
  - Is reverse of beta-hydride elimination reaction
  - Is migratory insertion
  - None of the above
- The rate of CO substitution of 6-coordinate metal carbonyls often:
  - Increases as more strongly basic ligands replace CO
  - Remain unchanged as more strongly basic ligands replace CO
  - Decrease as more strongly basic ligands replace CO
  - None of the above
- The compound which does not obey 18-electron rule is:
  - $\text{Fe}(\text{CO})_5$
  - $\text{Ni}(\text{CO})_4$
  - $\text{Cr}(\text{CO})_6$
  - $\text{W}(\text{CH}_3)_6$
- The Carbonyl stretching of the compounds are  $\text{Ni}(\text{CO})_4$  ( $2060\text{ cm}^{-1}$ ),  $\text{Co}(\text{CO})_4^-$  ( $1890\text{ cm}^{-1}$ ) and  $\text{Fe}(\text{CO})_4^{2-}$  ( $1790\text{ cm}^{-1}$ ). The decrease of stretching frequency is because of:
  - Increase of back bonding
  - Decrease of back bonding
  - Increase of negative charge
  - Increase effective nuclear charge

9. The ethylene molecule in  $[\text{Fe}(\text{CO})_4(\text{C}_2\text{H}_4)]$  and  $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$  are respectively ..... and ..... to the molecular plane.
- Perpendicular and in Plane
  - Perpendicular and Perpendicular
  - In Plane and Perpendicular
  - In plane and in plane
10. In the Syndiotactic polypropylene polymers the methyl groups are:
- On the same side of the polymer chain
  - On alternate side of the polymer chain.
  - At random side of the polymer chain
  - None of the above
11. The Compound  $\text{Cp}_2\text{MoH}_2$  and  $\text{Cp}_2\text{ZrH}_2$  are respectively:
- $\pi$ - acid and  $\pi$ -base
  - $\pi$ -base and  $\pi$ -base
  - $\pi$ -acid and  $\pi$ -acid
  - $\pi$ - base and  $\pi$ -acid
12. The  $^1\text{H}$ NMR spectra of the compound  $(\eta^5\text{-C}_5\text{H}_5)(\eta^1\text{-C}_5\text{H}_5) \text{Fe}(\text{CO})_2$  at room temperature shows only:
- One proton resonance
  - Two proton resonance
  - Five Proton resonance
  - Multiple proton resonance
13. When rearrangement between two or more chemically equivalent configuration take place, then it is called:
- Isomerization
  - Tautomerization
  - Fluxional
  - Stereo-isomerization
14. The oxidation state of the Mn-atom in the epoxidation of Alkene by the Mn-Salen catalyst in Jacobsen oxidation is:
- Mn(I)
  - Mn(II)
  - Mn(III)
  - Mn(V)
15. The complex with spin only magnetic moment of 4.9BM:
- $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
  - $[\text{Fe}(\text{CN})_6]^{3-}$
  - $[\text{Fe}(\text{CN})_6]^{4-}$
  - $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
16. Electron transfer from  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  to  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  is likely to occur via:
- d-d transition
  - Inner sphere electron transfer
  - $\text{S}_{\text{N}}1$  mechanism
  - Outer sphere mechanism
17. Reduction of  $[\text{CoCl}(\text{NH}_3)_5]^{2+}$  by  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  is via:
- Inner sphere mechanism
  - Quarter sphere mechanism
  - Both (a) and (b)
  - None of these
18. Lability of ions  $\text{Cr}^{2+}$ ,  $\text{Mn}^{2+}$  and  $\text{V}^{2+}$  should follow the order:
- $\text{Cr}^{2+} > \text{Mn}^{2+} > \text{V}^{2+}$
  - $\text{Mn}^{2+} > \text{V}^{2+} > \text{Cr}^{2+}$
  - $\text{Cr}^{2+} > \text{V}^{2+} > \text{Mn}^{2+}$
  - $\text{V}^{2+} > \text{Cr}^{2+} > \text{Mn}^{2+}$
19. The most suitable route to prepare the trans isomer of  $[\text{PtCl}_2(\text{NH}_3)\text{PPh}_3]$ :
- $[\text{PtCl}_4]^{2-}$  with  $\text{PPh}_3$  followed by reaction with  $\text{NH}_3$
  - $[\text{PtCl}_4]^{2-}$  with  $\text{NH}_3$  followed by reaction with  $\text{PPh}_3$
  - $[\text{Pt}(\text{NH}_3)_4]^{2+}$  with  $\text{HCl}$  followed by reaction with  $\text{PPh}_3$
  - $[\text{Pt}(\text{NH}_3)_4]^{2+}$  with  $\text{PPh}_3$  followed by reaction with  $\text{HCl}$
20. The most acidic aqua ion is:
- $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
  - $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$
  - $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
  - $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$

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**( PART-B : Descriptive )**

Time : 2 hrs. 40 min.

Marks : 50

**[ Answer question no.1 & any four (4) from the rest ]**

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| 1. a. Write an explanatory note on Migratory Insertion reaction of Collman reagent [ tetracarbonyl ferrate (II ) ] in presence of triphenyl phosphine.                       | 3      |
| b. Give a brief account of carbonylate anion as nucleophile.   | 2      |
| c. Give an explanatory note on alkene metathesis.  | 3      |
| d. What is Grubb's Catalyst? Mention its function.   | 2      |
| 2. a. What is Tolman Cone Angle? How does it influence dissociative mechanism?   | 1+2=3  |
| b. What is oxidative addition? How does it differ from reductive elimination?  | 2+2=4  |
| c. Give a brief account of beta-hydride elimination.   | 3      |
| 3. Discuss the preparation and structure of Zeise's salt. Explain how the substitution in the alkene affects the C-C bond distance and the bond angle of coordinated alkene? | 10     |
| 4. Explain the preparation and structure and bonding of Ferrocene.   | 10     |
| 5. Discuss in details Monsanto process of production of Acetic acid from methanol.   | 10     |
| 6. a. Explain the two theories of trans effect.  | 5×2=10 |
| b. Discuss about two electron transfer reactions.  |        |
| 7. a. Explain the acid hydrolysis mechanism of octahedral complexes.   | 5×2=10 |
| b. Discuss the mechanism of base hydrolysis reaction.  |        |
| 8. a. Explain about overall and stepwise stability constant. What are the factors affecting stability constant?  | 5×2=10 |
| b. What is Irving Williams series? Discuss with examples of inert and labile complexes.  |        |

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