

**CHE-501****Inorganic Chemistry**

M.Sc. Chemistry (MSCCH-12/13/16/17)

First Year, Examination, 2018

**Time : 3 Hours****Max. Marks : 80**

**Note :** This paper is of **eighty (80)** marks containing **three (03)** Sections A, B, C. Attempt the questions contained in these Sections according to the detailed instructions given therein.

**Section-A****(Long Answer Type Questions)**

**Note :** Section 'A' contains four (04) long answer type questions of nineteen (19) marks each. Learners are required to answer *two* (02) questions only.

1. State Grand Orthogonality Theorem (GOT) and derive the character table for  $C_{3v}$  point group.
2. Discuss the salient features of molecular orbital theory. Draw the molecular orbital diagrams of an octahedral complex involving :
  - (a) Only  $\sigma$ -bonding
  - (b) Both  $\sigma$  and  $\pi$ -bonding
3. What do you mean by overall stability and stepwise stability constants ? Prove that the overall stability constant is equal to the product of stepwise stability constants.

4. What are electron transfer reactions ? Give examples. Discuss the mechanism of electron transfer in  $\text{Fe}(\text{CN})_6^{4-} - \text{Fe}(\text{CN})_6^{3-}$  system.

### Section-B

#### (Short Answer Type Questions)

**Note :** Section 'B' contains eight (08) short answer type questions of eight (08) marks each. Learners are required to answer *four* (04) questions only.

1. Discuss applications of Group Theory.
2. Describe factors affecting crystal field splitting energy with reference to metal ion.
3. Draw Orgel energy diagrams in octahedral field for  $d^1$  and  $d^9$  electronic system.
4. How can stability constant of a complex be measured by potentiometry ? Explain in detail.
5. Define the term haem. What are the main functions of myoglobin ?
6. What is trans effect ? How does it influence substitution in square planar complexes ?
7. Give evidences in favour of conjugate base mechanism.
8. Explain how the nature of ligand affects the stability of metal complexes.

### Section-C

#### (Objective Type Questions)

**Note :** Section 'C' contains ten (10) objective type questions of one (1) mark each. All the questions of this Section are compulsory.

Choose the right answer :

1.  $\text{H}_2\text{O}$  belongs to point group symmetry :  
(a)  $D_{2h}$

- (b)  $C_{2v}$
  - (c)  $C_2$
  - (d)  $C_s$
2. The least stable complex is :
- (a)  $[C_4(NH_3)_4]^{2+}$
  - (b)  $[C_4(en)_2]^{2+}$
  - (c)  $[C_4(dien)_2]^{2+}$
  - (d)  $[C_4(trien)_2]^{2+}$
3. Minimum trans effect is shown by :
- (a)  $CN^-$
  - (b)  $H_2O$
  - (c)  $NH_3$
  - (d)  $C_2H_4$
4. If two complexes form a bridged intermediate, the mechanism of the reaction will be :
- (a) Outer sphere
  - (b) Inner sphere
  - (c)  $SN_1$
  - (d)  $SN_2$
5. Which one of the following complexes has a magnetic moment of 5.9 BM ?
- (a)  $Ni(CO)_4$
  - (b)  $[Fe(H_2O)_6]^{2+}$
  - (c)  $[Co(NH_3)_6]^{2+}$
  - (d)  $[Mn(Br)_4]^{2+}$

6. Ground state term for  $d^2$  metal ion is :
- (a)  $^3P$
  - (b)  $^3F$
  - (c)  $^1G$
  - (d)  $^1S$
7. The CFSE of complex ion,  $[\text{CoCl}_4]^{2-}$  is :
- (a)  $0.6 \Delta t$
  - (b)  $1.2 \Delta t$
  - (c)  $1.8 \Delta t$
  - (d)  $2.4 \Delta t$
8. The most common pathway for the decomposition of transition metal alkyls is :
- (a) Fluoride elimination
  - (b)  $\beta$  -elimination
  - (c) Reductive elimination
  - (d) None of these
9. Fe(II) containing metalloporphyrin complex is known as :
- (a) Haemoglobin
  - (b) Chlorophyll
  - (c) Hemocyanin
  - (d) Calmodulin
10. Which one of the following produces strong ligand field ?
- (a)  $\text{NO}_2^-$
  - (b) CO
  - (c)  $\text{NH}_3$
  - (d) en