# M. Sc. CHEMISTRY
## SECOND SEMESTER
## INORGANIC CHEMISTRY - II
## MSC-203

**(Use Separate Answer Scripts for Objective & Descriptive)**

**Duration : 3 hrs.** **Full Marks : 70**

## ( PART-A : Objective )

**Time : 20 min.** **Marks : 20**

***Choose the correct answer from the following:*** ***1×20=20***

1. For Improper rotation Sn, n is always 3 or larger; because $S_1$ =? and $S_2$= ?
   a. $S_1 = \sigma$ and $S_2$= i
   b. $S_1$ = i and $S_2$= $\sigma$
   c. $S_1 = \sigma_v$ and $S_2$= i
   d. $S_1$ = i and $S_2$= $\sigma_v$

2. For Td point group, $C_4 \times \sigma_h$ =
   a. $S_3$
   b. $S_4$
   c. $S_6$
   d. $S_2$

3. The point group of trigonal bipyramid molecule $PCl_4F$ is-
   a. $C_{4V}$
   b. $D_{3h}$
   c. $C_{3V}$
   d. $D_{3d}$

4. For $C_{2h}$ point group, if the character $C_2$ = -1 and i = +1, then the representation is-
   a. $B_g$
   b. $B_u$
   c. $A_g$
   d. $A_u$

5. If a molecule have E, $C_3$, $C_2$, $S_3$, $\sigma_v$ and $\sigma_h$ symmetry elements, its point group is-
   a. $C_{3V}$
   b. $S_3$
   c. $D_{3h}$
   d. $D_{3d}$

6. If the character under identity E are- $A_1$=1, $A_2$=1 and E=2; then the order of the group is-
   a. 4
   b. 5
   c. 6
   d. 3

7. For $XeF_4$, $A_{1g}$ and $A_{2u}$ mode of vibrations are Raman and IR active respectively, therefore they are respectively
   a. IR inactive, Raman active
   b. IR inactive, Raman inactive
   c. IR active, Raman inactive
   d. IR inactive, Raman active

8. For stepwise stability constant, in general
   a. $K_1 > K_2$
   b. $K_1 < K_2$
   c. $K_1 = K_2$
   d. $K_1 \leq K_2$

9. $NCS^-$ (X) bonds to $[Co(NH_3)_5X]^{2+}$ and $[Co(CN)_5X]^{3-}$ through the atoms respectively
   a. S- and N-
   b. N- and S-
   c. Both S-
   d. Both N-

10. The Chelate effect is mainly due to
    a. Enthalpy and Entropy factors
    b. Only Entropy factors
    c. Only Enthalpy factors
    d. Not because of Enthalpy and Entropy.

11. Which of the following solvents have maximum eluting power?
    a. Pyridine
    b. Acetone
    c. Chloroform
    d. Methanol

12. In TLC glass plate can be coated by
    a. Spreading
    b. Pouring
    c. Spraying
    d. All of the above

13. The commonly used chromatographic methods for quantitative drug analysis are
    a. GLC
    b. TLC
    c. HPLC
    d. All of the above

14. Synthetic ion exchange resins have widely been used for
    a. Water softening
    b. Water deionisation
    c. Ion Separation
    d. All of the above

15. Which of the following solvents is most polar in chromatographic sense
    a. Water
    b. $CCl_4$
    c. $CHCl_3$
    d. Toluene

16. Which of the following adsorbent used for adsorption chromatography has maximum adsorptive power
    a. Silica Gel
    b. Magnesium oxide
    c. Aluminium oxide
    d. Calcium carbonate

17. The magnetic moment of an octahedral Co(II) complex is 4 BM. The electron configuration of Co(II) is
    a. $t_{2g}^4e_g^3$
    b. $t_{2g}^5e_g^2$
    c. $t_{2g}^6e_g^1$
    d. $t_{2g}^3e_g^4$

18. Which one of the metal carbonyl is prepared by the direct interaction of finely divided metal with CO
    a. $Fe(CO)_5$
    b. $Cr(CO)_6$
    c. $V(CO)_6$
    d. $Mn_2(CO)_{10}$

19. The metal atom present in the Creutz-Taube complex is
    a. Ru
    b. Rh
    c. Fe
    d. Zn

20. The isopoly acids and their related anions which contain only Mo or W along with
    a. Cobalt and nickel
    b. Oxygen and hydrogen
    c. Iron and cobalt
    d. All of the above

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Contd...

## ( PART-B : Descriptive )

**Time : 2 hrs. 40 min.** **Marks : 50**

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

1. Explain the structure and bonding in Metal-Carbonyls- mononuclear and binuclear metal carbonyls. How do you identify terminal and bridging carbonyl? Explain the 18 -electron rule . 10

2. Explain what is Hard and Soft Acid Base Principle? How are they classified, give examples. What is the Application of the theory? 10

3. a. Find the Symmetry elements of $CO_3^{2-}$ ion and the point group systematically.
   b. There are how many CO stretching vibrational mode in cis-$ML_2(CO)_2$ molecule ?
   c. What is the Order of $C_{3v}$point Group? 5+3+2 =10

4. Explain the principles, Instrumentation and Application of HPLC. 3+4+3 =10

5. Explain the chemistry of Polyoxometallates and heteropolyoxometallates of Mo and W (Isopoly and HeteropolyMolybdates and Tungstates). 10

6. Explain the bonding and structure of $NH_3$ molecule using SALC. ($C_{3v}$ character table should be provided to students) 10

7. a. Explain what is Chelate Effect and Marocyclic Effect?
   b. What is Irving Williams Series? 6+4 =10

8. Write short notes on : 3+3+4 =10
   a. Molybdenum blue
   b. Tungsten Bronze
   c. Variation of Oxidation states of Transition metals

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