

M.SC. CHEMISTRY
Second Semester
Inorganic Chemistry

(MSC-07)

Duration: 3Hrs.

Full Marks: 70

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

1. Answer the following questions:

- a) Predict the geometry of the following molecules in the light of VSEPR theory
i) IF_3 ii) SF_4 iii) XeF_4 **2×3=6**
- b) Explain the Allred –Rochow method for the determination of electronegativity. **3**
- c) What are the five corollaries of the Great Orthogonal Theorem? **3**
- d) Write down the systematic procedure for the symmetry classification of molecules. **3**
- e) Write down the character table for a the molecule PCl_5 **5**

Or

Draw and explain the Walsh diagram for the H_2O molecule

- f) Write short notes on: **2½ × 2 = 5**
i) Orbital overlap
ii) Reducible and Irreducible representation

2. Answer the following questions (**any three**)

5×3=15

- a) Explain the chemistry of isopoly and heteropoly acids/salts of molybdenum and tungsten.
- b) Why 1st transition series elements possess different properties from those elements of heavier transition elements? Explain.
- c) What is column efficiency? Explain the plate theory of chromatography.
- d) What is high performance liquid chromatography? What types of materials are used for the columns of both normal and reverse phase chromatography? Explain reverse phase HPLC.
- e) What is LCMS? Explain. Why it is superior to GCMS?

3. Write short notes on (**any two**):

5×2=10

- a) Creutz-Taube ion,
- b) Ion exchange chromatography,
- c) Adsorption chromatography

M.SC. CHEMISTRY
Second Semester
Inorganic Chemistry

(MSC-07)

(The figures in the margin indicate full marks for the questions)

Duration: 20 minutes

Marks – 20

(PART A- Objective)

Choose the correct answer:

1×20=20

- The molecule closo- $[B_6H_6]^{2-}$ has the point group
i) D_{2h} ii) C_{2v} iii) O_h iv) C_3
- The molecule ICl_3 belongs to the system
i) AB_4E_2 ii) AB_2E_3 iii) AB_2 iv) AB_2E_2
- The total numbers of horizontal planes of symmetry in an octahedron are
i) 2 ii) 3 iii) 4 iv) 5
- The total number of proper C_3 axes in a tetrahedron are
i) 4 ii) 5 iii) 6 iv) 8
- The bond order of NO^+ is
i) 1.5 ii) 2 iii) 2.5 iv) 3
- The bond order of O_2^{2-} is
i) 1 ii) 1.5 iii) 2 iv) 2.5
- The shape of SOF_4^+ is
i) Trigonal pyramidal ii) tetrahedral
iii) square pyramidal iv) octahedral

PTO.....

8. The NO molecule has _____ electron(s) in the anti-bonding orbital
- i) 1 ii) 2 iii) 3 iv) 4
9. In the Walsh diagram the variation of the bond angle for an XH_2 molecule is
- i) 45-60 degrees ii) 60-90 degrees iii) 90 - 180 degree iv) 180 – 240 degrees
10. The delta bonds contain
- i) Pi – bond ii) sigma bond iii) coordinate bond iv) quadruple bonds
11. The correct order of elution of the following solutes in reversed phase HPLC is:
- (A) Benzene (B) 4-Chlorobenzene (C) phenol (D) Hydroquinone
- (i) A, B, C, D (ii) D, C, B, A (iii) C, D, A, B (iv) B, A, C, D
12. Mobile phase for gas chromatography is
- (i) Helium (ii) Hexane (iii) Benzene (iv) Oxygen
13. In HPLC, smaller stationary phase particles results in
- (i) Higher operating pressures for the same flow rate.
- (ii) Smaller plate heights.
- (iii) Better separations.
- (iv) Higher column costs.
- (v) All the above are correct.
14. Which of the following detectors in GC allows for both identification and quantification of an unknown peak in a sample?
- (i) Mass spectroscopy (ii) Flame ionization
- (iii) Thermal conductivity (iv) Liquid chromatography
15. Osmium (Os) exhibits several oxidation states because
- (i) Its atomic number is high (ii) It forms strong bond with oxygen
- (iii) 4f orbitals participate in bonding (iv) Only 6s orbital participates in bonding

16. Among the following compounds that is both paramagnetic and coloured
- (i) $K_2Cr_2O_7$ (ii) $(NH_4)_2[TiCl_6]$ (iii) $VOSO_4$ (iv) $K_3[Cu(CN)_4]$
17. The value of 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is
- (i) d^4 (in strong ligand field)
(ii) d^4 (in weak ligand field)
(iii) d^3 (in weak as well as strong ligand fields)
(iv) d^5 (in strong ligand field)
18. In context to the transition elements, which of the following statements is incorrect?
- (i) In higher oxidation states, the transition metals show basic character and form cationic complexes.
(ii) In the highest oxidation states of the first five transition elements (Sc to Mn), all the 4s and 3d electrons are used for bonding.
(iii) Once the d^5 configuration is exceeded, the tendency to involve all the 3d electrons in bonding decreases.
(iv) In addition to the normal oxidation states, the zero oxidation state is also shown by these elements in complexes.
19. Among the following oxides of manganese the order of increasing acidic strength is
- (i) $MnO > Mn_3O_4 > Mn_2O_3 > MnO_2 > Mn_2O_7$
(ii) $MnO < Mn_3O_4 < Mn_2O_3 < MnO_2 < Mn_2O_7$
(iii) $MnO > Mn_3O_4 > Mn_2O_7 > MnO_2 > Mn_2O_3$
(iv) $MnO < Mn_3O_4 < Mn_2O_3 < Mn_2O_7 < MnO_2$
20. The colour of the transition metal ions is due to
- (i) d-d transition, (ii) charge transfer, (iii) change in geometry (iv) none
