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Total No. of Questions : 11

M.Sc (Chemistry) (2018 Batch) (Sem.-1)

INORGANIC CHEMISTRY-I

Subject Code : CHL401-18

Paper ID : [75113]

Time : 3 Hrs. Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains EIGHT questions carrying FIVE marks each and students have to attempt any SIX questions.**
3. **SECTION-C will comprise of two compulsory questions with internal choice in both these questions. Each question carries TEN marks.**

SECTION-A

1. Answer briefly :

a) How would you define a transition element? Give their general electronic configuration.

b) What is the difference between coordination complex and double salt? Explain with the help of example.

c) Write one example each of bidentate and hexadentate ligands.

d) If one mole of $CoCl_3.5NH_3$ and $CoCl_3.6NH_3$ is separately treated with $AgNO_3$, different amounts of AgCl is formed. How will you explain this observation?

e) Find out the ground state term symbol for Co(III) system.

f) Show the generation of spectroscopic terms for d^1 configuration under octahedral field.

g) With the help of molecular orbital diagram show that Δ_o value will decrease in $[CoF_6]^{4-}$ due to π bonding interactions between ligand and metal.

h) How will you differentiate between terminally bonded and bridging carbonyl group on the basis of IR technique.

i) Differentiate between diamagnetism and anti-ferromagnetism.

j) Which of the following complexes have orbital contribution towards their magnetic moments and why?

i) $[V(bipy)_3]^{3+}$ ii) $[Co(en)_3]^{3+}$

SECTION-B

2. a) Show the correct hybridization and draw the structure of the following complexes:

   i) $[Fe(CN)_6]^{3-}$ ii) $[MnCl_4]^{2-}$ (2)

   b) With proper reasoning, find out the complexes that will undergo tetragonal distortion from the following :

   i) $[Cu(NH_3)_6]^{2+}$ ii) $[Co(CN)_6]^{4-}$ (2)

   c) In the following complexes, indicating the splitting of d-orbitals and occupancy of the electrons in same :

   i) $[Cr(H_2O)_6]^{2+}$ ii) $[Co(CN)_6]^{4-}$ (2)

3. a) What do you understand by chelating effect in transition metal complexes, explain? (2)

   b) Write the correct IUPAC name for the following complexes :

   i) $[Co(ethylenediamine)_2(H_2O)Br]Cl_2$ ii) $K_2[PtCl_4]$ (2)

   c) What do you understand by thermodynamic stability of the complexes, explain with an example? (2)

4. With the help of an example show the calculation of 10 Dq from spectral data. (6)

5. a) With the help of d^2 electronic configuration, explain the LS coupling. (2)

   b) Write the selection rules for the electronic transitions in case of transition metal complexes. (2)

   c) Predict the magnetic behavior of the following complexes on the basis of crystal field theory :

   i) $[Mn(H_2O)_6]^{2+}$ ii) $[Fe(CN)_6]^{4-}$ (2)

6. On the basis of molecular orbital theory, show how CO ligand will effect the energy difference between t_{2g} and e_g level in transition metal complexes. (6)

7. With the help of IR technique, give evidence for the formation of back bonding in case of metal carbonyls. (6)

8. a) Explain Curie and Curie-Weiss law. (3)

b) What do you understand by Zeemen effect, explain? (3)

9. Write the conditions that will prevent the spin-orbital coupling in transition metal complexes. (6)

SECTION-C

10. a) Discuss the factors that would affect the stability of the coordination complexes. (5)

b) What is nephelauxetix effect? What information about the coordination complex could be achieved from the same? (5)

Or

a) With the help of Orgel diagram, explain the number of absorption peaks expected in the electronic spectra of $[V(H_2O)_6]^{2+}$. (5)

b) What is the advantage of using Tenabe Sugano (T-S) diagram over Orgel diagram? What information about the coordination complexes could be achieved out of T-S diagram, explain? (5)

11. Discuss the formation of ligand and metal group of orbitals. With the help of example of $[Fe(CN)_6]^{4-}$ show the molecular orbital diagram and discuss its magnetic property. (10)

Or

Discuss the principal and instrumentation of magnetic susceptibility measurement using the Gouy's method. (10)