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Total No. of Pages : 03

Total No. of Questions : 11

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

INORGANIC CHEMISTRY-I

Subject Code : CHL-401-18

M.Code : 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

- Q1. 1) How many ligands molecule would be required to form the octahedral complexes of a metal, if ligand is (i) ethylenediammine, and (ii) ethylenediaminetetraaceticacid.
- 2) What do you understand by chelate effect, explain?
- 3) A square planar complex of Cu^{2+} was formed with (i) ammonia and (ii) ethylene. Which one will be more stable and why?
- 4) Find out the ground state term symbol of d^2 system.
- 5) Calculate the crystal field stabilization energy for the complex $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$.
- 6) Identify the group of orbitals that will remain nonbonding during the sigma bonding in transition metal complexes.
- 7) Explain why, KMnO_4 is intense purple on color?
- 8) How will you differentiate between a diamagnetic and paramagnetic complexes?
- 9) Magnetic moment in transition metal complexes is calculated on the basis of unpaired electrons. While the magnetic moment generated due to proton spin is ignored, explain.
- 10) Identify the complex(es) having orbital contribution towards their magnetic moments and why?
- (i) $[\text{Cr}(\text{NH}_3)_4]^{3+}$ (ii) $[\text{Mn}(\text{NH}_3)_6]^{2+}$

SECTION-B

- Q2. (a) Show the correct hybridization and predict the geometry of the following complexes :
- (i) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (ii) $[\text{FeCl}_4]^{2-}$
- (b) With proper reasoning, find out the complexes that will undergo tetragonal distortion from the following :
- (i) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (ii) $[\text{Fe}(\text{CN})_6]^{4-}$
- (c) In the following complexes, indicating the splitting of d-orbitals explain their magnetic behaviors :
- (i) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
- (ii) $[\text{Co}(\text{NH}_3)_6]^{2+}$
- Q3. (a) How does the chelating ligands will affect the stability of transition metal complexes, explain?
- (b) Write the correct IUPAC name for the following complexes :
- (i) $[\text{Pt}(\text{en})_2(\text{ONO})(\text{SCN})]\text{SO}_4$ (ii) $[\text{Fe}(\text{CNCH}_3)_6]\text{Br}_2$
- (c) Explain why, the $d \rightarrow d$ absorption band in complex $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ was found to be splitted into two overlapping bands.
- Q4. (a) Out of the following molecules which will be expected to yield the white precipitate of AgCl on treating with AgNO_3 and why?
- (i) $\text{Co}(\text{NH}_3)_3.\text{Cl}_3$ (ii) $\text{Co}(\text{NH}_3)_6.\text{Cl}_3$
- (b) How does the crystal field splitting in $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ will effect the ionic radii of metal, explain?
- Q5. (a) With the help of Orgel diagram, explain the electronic spectra for $[\text{Ti}(\text{H}_2\text{O})_6]^{2+}$ complex.
- (b) In the absorption spectra of $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$, absorption intensity was found to be very weak, explain.
- Q6. On the basis of ligand field theory, in $[\text{Co}(\text{NH}_3)_6]^{2+}$ complex, describe the various ligand and metal group of orbitals and construct the molecular orbital energy level diagram for the complex.
- Q7. In case of $\text{Cr}(\text{CO})_6$, how metal to ligand back bonding will influence the $\text{Cr}-\text{C}$ and $\text{C}-\text{O}$ bond lengths? How it would be detected with the help of IR spectroscopic technique, explain.

- Q8. (a) Define Bohr magneton and magnetic susceptibility.
- (b) Explain out of A, E and T state, which will show the orbital contribution in magnetic moment and why?
- Q9. Discuss the origin of paramagnetism in transition metal complexes. How it is different from diamagnetism and ferromagnetism, explain?

SECTION-C

- Q10. (a) Explain how the stability of the coordination complexes will be influenced by the nature/charge of ligand, size/charge of metal?
- (b) Discuss main shortcomings of the valance bond theory.

Or

- (a) With the help of Orgel diagram, assign the various absorption peaks expected in the electronic spectra of $[\text{Ti}(\text{H}_2\text{O})_6]^{2+}$.
- (b) What are the main limitations of the Orgel diagram? How these limitations could be confronted by employing the Tanabe Sugano (T-S) diagram, explain with the help of appropriate example?
- Q11. What do you understand by symbiosis and antisymbiosis, explain? With the help of an example, discuss the formation of pi complexes of ethylene molecule.

Or

How will you experimentally measure the magnetic susceptibility of the inorganic complexes, explain with the help of diagram and principle of the instrument.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.