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Total Number of Pages: 02

M.Sc.
16MCYC101

1st Semester Regular/Back Examination 2017-18
INORGANIC CHEMISTRY
BRANCH(S): M.Sc. (AC)
Time: 3 Hours
Max Marks: 70
Q.CODE : B750

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1 Answer the following questions: (2 x 10)**
- (a) Which p orbital can form $d\pi - p\pi$ bond with d_{yz} orbital in a diatomic molecule? Diagrammatically illustrate the overlap of the bond.
 - (b) Provide two evidences in favour of dissociative mechanism of Acid Hydrolysis of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$.
 - (c) Differentiate between labile and inert complexes with examples.
 - (d) Write down the ground CF states of High Spin and Low Spin complexes of $d^5 O_h$ system.
 - (e) Write down the LGOs (SALCs) of ligand orbital which will match with the symmetries of $d_{x^2-y^2}$ and d_{xy} orbitals of metal in an O_h complex.
 - (f) Determine the structures of ClF_5 and XeF_4 from VSEPR theory.
 - (g) How does the Racah parameter 'B' vary with the oxidation state of the metal ions?
 - (h) For $[\text{Co}(\text{NH}_3)_6]^{3+}$ (O_h), one of the spin allowed transition ${}^1A_{1g} \rightarrow {}^1T_{1g}$ is symmetry forbidden. The M-N odd vibrational modes for O_h are T_{1u} and T_{2u} . Is this transition vibronically allowed? Justify.
 - (i) How do the following states of a free ion split in an octahedral field? S, F, P and G
 - (j) Arrange the ligands in increasing order of trans effect: NH_3 , Cl^- , CO and OH^-
- Q2 Calculate the s and p character of bonding and anti-bonding MOs of H_2O molecule. (10)**
- Q3 List the angular scaling factors for d-orbitals for O_h and T_d complexes. (10)**
- Q4 (a) Why might d-d absorption bands for tetrahedral complexes be expected to be more intense than those for octahedral complexes for the same metal ion? (2)**
- (b) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ is expected to give three bands. Assign each band by the help of Orgel diagram. (3)**
- (c) Construct and explain the Orgel diagrams for a d^2 - configuration under octahedral and tetrahedral environment. (5)**

- Q5** Derive the possible terms of d^2 - configuration. **(10)**
- Q6** Construct the σ and π LGOs to match the symmetry of p, $d_{x^2-y^2}$ and d_{xy} AOs of metal in an O_h complexes. Draw the sketches of these LGOs. **(6+4)**
- Q7** (a) Discuss the mechanism of outer sphere electron transfer reactions. **(5)**
(b) What do you meant by Marcus cross reaction? Discuss its application. **(5)**
- Q8** **Write notes on :**
- (a) Swain –Scott equation. **(5)**
(b) Bents rule and its application. **(5)**