

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSC
BRANCH: CHEMISTRY

SEMESTER : VII
SESSION : MO/18

SUBJECT: SAC1105 METAL CHEMISTRY

TIME: 3 HOURS

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
 2. Candidates may attempt any 5 questions maximum of 60 marks.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) From Molecular Orbital Theory explain the top most position of CO in the spectrochemical series. [6]
Q.1(b) From LCAO method show the overlap of the following pairs of orbitals to form the bonding and anti-bonding molecular orbital: s-p, $p_x-d_{x^2-y^2}$, $d_{xy}-p_y$ [6]
- Q.2(a) Discuss the π acidity of the ligand by Molecular Orbital Theory. [6]
Q.2(b) From LCAO method develop the molecular orbitals (both bonding and nonbonding) by the combinations of the following pair of orbitals; $p_z-d_{z^2}$, p_y-p_y (bonding axis: x), p_y-p_y (bonding axis: y) [6]
- Q.3(a) Calculate the % s character in the hybrid orbital of the central metal atom of the following species: Na_2CoCl_4 , $Ru(Ph_3)_3Cl_2$, $[Co(NH_3)_5Cl]^{2+}$, oxy-hemoglobin. [4]
Q.3(b) Discuss δ bonding with example. [4]
Q.3(c) $NaCl$, $MgCl_2$ are colourless whereas AgI is yellow in colour. Explain. [4]
- Q.4(a) Discuss the synthesis and structure of phosphazenes. [4]
Q.4(b) Write notes on (i) Phyllosilicates and (ii) Aluminosilicates [8]
- Q.5(a) The large difference between the rate data of acid hydrolysis and base hydrolysis of $[Co(NH_3)_5Cl]^{2+}$ can only explained by $SN1CB$ mechanism. -Explain. [6]
Q.5(b) Explain Ray and Dutta twist mechanism of racemization. [6]
- Q.6(a) Nephelauxetic Ratio (β) is always less than one - explain. [2]
Q.6(b) Draw the Orgel diagram for the following electronic configuration and show the possible electronic transitions: Octahedral - d^2 , Tetrahedral- d^1 [4]
Q.6(c) A 2nd period element with 15 microstates possesses the ground state term symbol 3P_0 . Identify the element and arrange all the microstates in increasing order of energy. [6]
- Q.7(a) What do you mean by Redox Spectra? Give example. [2]
Q.7(b) $[Co(H_2O)_6](BF_4)_2$ shows three peaks at 8100 cm^{-1} , $16,000\text{ cm}^{-1}$ and $20,000\text{ cm}^{-1}$ with a high intensity shoulder at $21,600\text{ cm}^{-1}$. Assign the peaks and shoulder showing the transitions. [4]
Q.7(c) Electronic spectrum of $Ru(bipy)_3Cl_2$ displays a strong band at 452 nm. Assign the nature of the band and show the transition with a Molecular Orbital diagram. (bipy = 2,2' bipyridine) [6]

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