

**Birla Institute of Technology & Science, Pilani, Rajasthan 333031**  
**COMPREHENSIVE EXAMINATION**  
**II Semester, 2017-2018**

**Course Title: Adv Inorganic Chemistry**  
**PART I (CLOSE BOOK)**

**Course Number: G552**  
**Time: 90 minutes**

**Date: 07.05.2018**  
**Max. Marks: 20**

**Instructions to the students:**

1. There are **three questions** in all. Attempt all the questions.
2. Start answering each question on a fresh page. **Answer all parts of a question together.**
3. Write brief answers to the point with proper justifications.
4. Data: At. No. of H, O, F, Cl, Ca, Al, Ti, Cr, Mn, Fe, Co, Zn are 1, 8, 9, 17, 20, 13, 22, 24, 25, 26, 27 and 30 respectively.

**Q. 1. (A)** Compare the bond angle of (i)  $\text{H}_2\text{O}$  versus  $\text{F}_2\text{O}$  and (ii)  $\text{ClF}_2^-$  Versus  $\text{ClF}_2^+$ . Justify your answer in brief. (2)

**(B)** Which one is having more ionic character,  $\text{AlF}_3$  or  $\text{AlCl}_3$  and why? (1)

**(C)** What is trans effect? Explain in brief. (1)

**(D)** Comment on the radius of  $\text{Fe(II)}$  in weak field and strong field octahedral complex? (1)

**Q. 2. (A)** Sketch the  $\chi$  versus T curve for (i) antiferromagnetic and (ii) ferromagnetic material. Label the significant features on the curve. (1)

**(B)** Calculate the approximate Lattice Energy of  $\text{Co(OH)}_2$  from the following data:

The crystal field splitting for  $\text{Co(OH)}_2$  is  $300 \text{ kJmol}^{-1}$ ; Lattice energies of dihydroxides of Ca, Mn, and Zn are  $-2600$ ,  $-2800$  and  $-3000 \text{ kJmol}^{-1}$  respectively. (2)

**(C)** Draw the Orgel diagram for  $[\text{Cr(en)}_3]^{3+}$  with proper labeling to indicate the absorption peaks arising due to d-d transition. Write the expression describing each electronic transition using appropriate term symbols. (2)

**(D)** Given that the maximum absorption d-d peak for  $[\text{Ti(H}_2\text{O)}_6]^{3+}$  occurs at  $20300 \text{ cm}^{-1}$ , determine the CFSE of  $[\text{Ti(H}_2\text{O)}_6]^{3+}$  in  $\text{kJ/mol}$ . (Assume regular geometry for  $\text{Ti}^{3+}$  complex) (2)

**Q. 3. (A)** Deduce all the terms associated with  $p^3$  electronic system. (2)

**(B)** The cryoscopic measurement and molar conductivity of the following coordination complexes are given below

Complex	Cryoscopic measurement	Molar conductivity
$\text{PtCl}_4.5\text{NH}_3$	4 particles	6 charges
$\text{PtCl}_4.\text{NH}_3.\text{KCl}$	2 particles	2 charges

Based on this information, write the formulae of the coordination complexes. (1)

**(C)** Write short notes on (4)

(i) Titanium complex catalyzed polyethylene synthesis

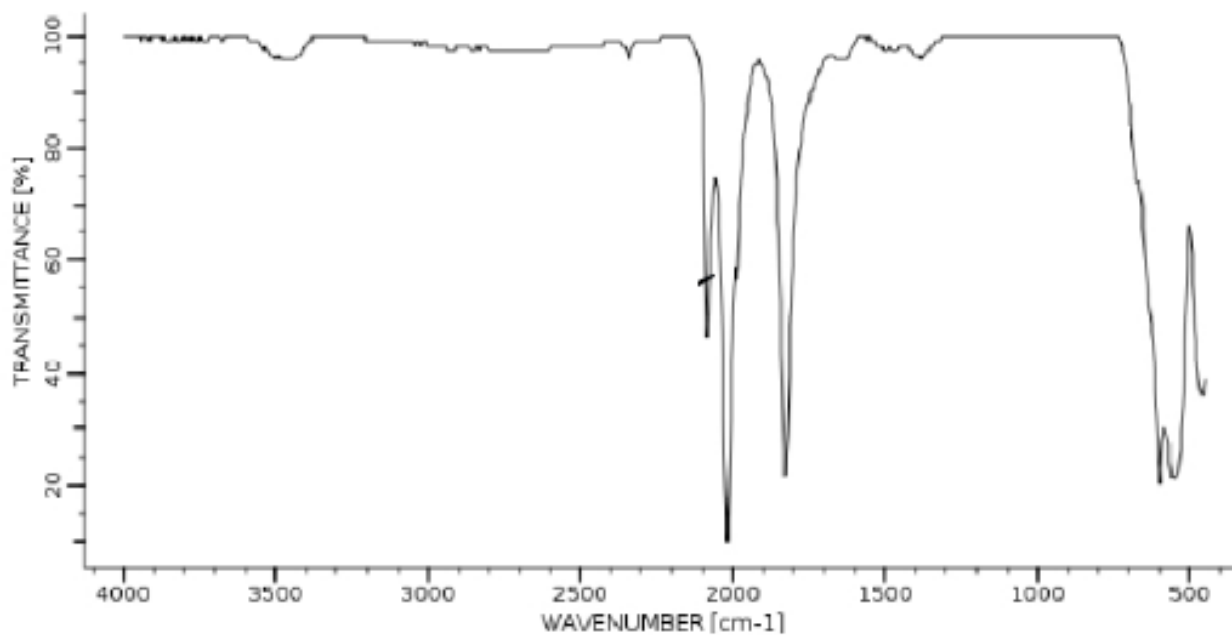
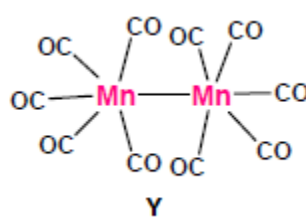
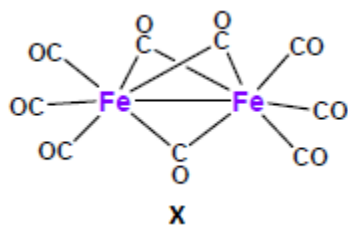
(ii) Olefin hydroformylation reaction

(iii) Binding modes of cyclopentadienyl anion with transition metal ions

(iv) Advantage of CFT over valence bond theory to understand the chemistry of transition metal complexes

**PTO**

(D) The IR spectrum given below is for X or Y? Justify your answer by assigning the peaks. (1)



\*\*\*\*\*The End of Part One\*\*\*\*\*