EASTERN UNIVERSITY, SRI LANKA

SPECIAL DEGREE EXAMINATION IN CHEMISTRY

2008/2009 (NOVEMBER 2011)

CH401 Advanced Inorganic Chemistry I

Answer all questions **Time: 02 hours**

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1. **Answer all parts (a), (b), (c), (d) and (e)**

a) Identify the point groups of the following molecules.

i. Hexachlorobenzene

ii. *trans*-1,2 dichloroethylene

iii. Ammonia

(30 Marks)

b) Explain the following terms with suitable example

i. Symmetry operation

ii. Symmetry elements

(10 Marks)

c). Find all the axes of symmetry in the following molecules.

i. NH_2Cl

ii. CO_3^{2-}

iii. BF_3

(30 Marks)

d). Show diagrammatically the location of all the rotation axis/axes of symmetry in the following molecules.

i. p-dichlorobenzene

ii. m-dichlorobenzene

(20 Marks)

e) Write down all symmetry operation corresponding to the H_2O molecule. By set up its multiplication table show that it constitutes a group using matrix algebra.

(10 Marks)

2. **Answer all parts (a), (b) and (c).**

a) i) Derive the spectroscopic term symbols for P^2 configuration.

(10 M

ii) Deduce the term symbol for the ground state of P^2 configuration.

(10 M

b) i) Derive the spectroscopic term symbols for Ni^{2+} ion.

(10 M

ii) Deduce the term symbol for the lowest energy state of Ni^{2+} ion.

(10 M

iii) Calculate the number of microstates for Ni^{2+}

(10 M

c) i) Draw the simplified Orgel diagram for V^{3+} octahedral and tetrahedral comple

(10 M

ii) The solution of $[V(C_2O_4)_3]^{3-}$ ion is reported to exhibit bands at 16 500 (ε_{max}= 16 L mol^{-1} cm^{-1}) and 23 500 cm^{-1} (ε_{max}= 12 L mol^{-1} cm^{-1}). Sketc electronic spectrum you would expect for $[V(C_2O_4)_3]^{3-}$. Give reasons and a these bands to the appropriate transitions and account for any missing allowed bands.

(30 M

iii) Calculate the values of the ligand field parameter Δ and the Racah parameter for $[V(C_2O_4)_3]^{3-}$ using the data given in c(ii) above.

(10 M

3. a) i) Define the terms ligand, chelate complex and penetration complexes.

(15 M

ii) Briefly explain the trigonal and tetragonal distortion in octahedral complexes.

(25 M

b) Explain the following factors in determining the structure of linkage isomers

i) effect of π-bonding

ii) steric factor effect of stereochemistry

iii) symbiotic theory

(30 Marks)

c) i) What are the limitations of valence bond theory.

(10 Marks)

ii) The magnetic moment of $[MnBr_4]^{2-}$ is 5.9 B.M. what is the geometry of this complexes. Explain how the magnetic moment of a complex could be used to predict the geometry.

(20 Marks)

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