[91] SEAT No._____ No. of Printed pages: 3

SARDAR PATEL UNIVERSITY
M.Sc. (SEMESTER-II) EXAMINATION
MONDAY, 22nd OCTOBER, 2018
TIME: 10.00 A.M. to 1.00 P.M.
CHEMISTRY (PS02CCHE01)
(INORGANIC CHEMISTRY-II)

Note: Numbers to the right indicate full marks. **Total Marks: 70**

Q.1. Attempt the followings: [8]

1. Example for ferri-magnetic materials.
   a) super conductors b) alkali metals
   c) non-transition metals d) magnetite
2. Which of the following correctly places the ligands in their order in the spectrochemical series?
   a) $Br^- < Cl^- < NH_3 < H_2O$ b) $I^- < Br^- < H_2O < [OH]^-$
   c) $F^- < Cl^- < H_2O < NH_3$ d) $I^- < Cl^- < H_2O <$ en
3. Which metal complex ion is expected to be subject to a Jahn-Teller distortion?
   a) $[Cr(OH_2)_6]^{3+}$ b) $[Cr(NH_3)_6]^{2+}$
   c) $[Cr(CN)_6]^{3-}$ d) $[Cr(bpy)_3]^{3+}$
4. Match up the correct formula and magnetic property.
   a) $[Zn(OH_2)_6]^{2+}$; paramagnetic b) $[Co(NH_3)_6]^{3+}$; diamagnetic
   c) $[CoF_6]^{3-}$; diamagnetic d) $[V(OH_2)_6]^{2+}$; diamagnetic
5. For which of the following configurations for an octahedral, first row d-block metal ion do you expect there to be an orbital contribution to the magnetic moment?
   a) t_{2g}^2 b) t_{2g}^3
   c) $t_{2g}^6 eg^1$ d) $t_{2g}^6 e_g^2$
6. Which one of the following statements is FALSE?
   a) In an octahedral crystal field, the d electrons on a metal ion occupy the eg set of orbitals before they occupy the t_{2g} set of orbitals
   b) Diamagnetic metal ions cannot have an odd number of electrons
   c) Low spin complexes can be paramagnetic
   d) In high spin octahedral complexes, Δ_{oct} is less than the electron pairing energy, and is relatively very small
7. The first lanthanide complex used as shift reagent was_____.
   a) $Eu(dpm)_3$ b) $Pr(dpm)_3$
   c) $Eu(fod)_3$ d) $Pr(fod)_3$
8. The CFSE for a high-spin d^4 -octahedral complex is:
   a) $-0.6\Delta_{oct}$ b) $-1.8\Delta_{oct}$
   c) $-1.6\Delta_{oct} + P$ d) $-1.2\Delta_{oct}$

Q.2. Attempt any SEVEN of the followings: [14]

1. The term symbols for d^1 and d^9– configuration is ^2D. Explain.
2. Define the microstate and calculate the number of microstate for the ^4G and ^6H terms.
3. Calculate the number of pair of parallel spin for low spin d^4 to d^7-configurations.
4. Explain the intramolecular antiferromagnetisn giving suitable examples.
5. Explain the term point dipole with suitable examples.
6. Give the difference between Specrtochemical series and Nephelauxetic series.
7. Show that effective magnetic moment value of Am(III) (z=95) is zero B.M.
8. Explain the terms baricentre and 10 Dq.
9. What are the sources of paramagnetism?

Q.3.A. Discuss the factor affecting on the magnitude of crystal field splitting energy. Arrange the following complexes in increasing order of crystal field splitting energy giving suitable reason. [6]

1. $[Co(en)_3]^{3+}$ 2. $[Cr(NH_3)_6]^{3+}$ 3. $[FeF_6]^{3-}$
4. $[Fe(NO_3)_6]^{4-}$ 5. $[Ni(SCN)_6]^{4-}$ 6. $[Mn(Br)_6]^{4-}$

B. Discuss tetragonal distortion in octahedral complexes and explain the structure of $[MnF_6]^{3-}$ and $[Ni(edta)]^{2-}$. [6]

OR

B. Derive the magnetic moment equation for the multiple width large as compared to thermal energy.

Q.4.A. Draw and explain the correlation diagram for $[V(edta)]^{-1}$ chelate and show that $^3T_2g_{(g)}$ state is lower energy state. [6]

B. Explain T.S. diagram for $[Co(H_2O)_6]Cl_2$ complex and calculate the value of electronic parameters, Dq, %β, β and configuration interaction (x). [6]
[Given: $\nu_1 = 8{,}100\ cm^{-1}$, $\nu_2 = 16{,}000\ cm^{-1}$, $\nu_3 = 19{,}400\ cm^{-1}$ and B_0 for Co(II) = $971\ cm^{-1}$]

OR

B. Give the crystal field terms and calculate the number of microstates for ^1S, ^3P, ^3F, ^1D, ^1G, ^3H, ^1I and arrange them in decreasing order of energy.

Q.5.A. Explain first order Zeeman effect and second order Zeeman effect. Derive Van-Vleck equation for the magnetic susceptibility of the coordination compounds. [6]

B. Prove χ=C/T-Tc Currie's Weiss law. [6]

OR

B. Answers the following:

1. State and prove Lande interval rule.
2. Calculate $\chi_{dia(corr)}$ for 2-Amino pyridine.

Given: $\chi_C = -6.6\times10^{-6}$ cgs, $\chi_H = -2.93\times10^{-6}$ cgs, $\chi_{Nchain} = -5.57\times10^{-6}$ cgs, $\chi_{Nring} = -4.61\times10^{-6}$ cgs, $\lambda_c = -0.24\times10^{-6}$ cgs.

Q.6.A. Derive the term symbols, gyro magnetic ratio and magnetic moment value for the Tb(III) (z = 65), Pr(III) (z = 59), Eu(III)(z =63), Cf(III) (z=98) Pu(III)) (z = 94) and Cm(III) (z=96). [6]

B. Explain the spin orbit coupling on A,E and T terms. [6]

OR

B. Explain the aspects of spin paring and cross over region.

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