SARDAR PATEL UNIVERSITY
M.Sc. (SEMESTER-II) EXAMINATION
Tuesday, 5th April, 2016
10:30 A.M. to 01:30 P.M.
CHEMISTRY: PS02CCHE01
(INORGANIC CHEMISTRY-II)

$\left[\dfrac{36}{A \cdot 46}\right]$

Note:-figures to the right indicate full marks: | Total marks: 70

Q.1. Answer the following: [8]

1. Which theory treats the Ligand non-bonding electron pair as point charges?
   (a) LFT (b) CFT (c) VBT (d) MOT

2. The energy order in a tetragonal compression along the Z-axis is:
   (a) $dz^2 > dx^2-y^2 > dxz, dyz > dxy$
   (b) $dz^2 > dx^2-y^2 > dxy > dxz, dyz$
   (c) $dz^2 < dx^2-y^2 < dxz, dyz < dxy$
   (d) $dz^2 < dx^2-y^2 < dxy < dxz, dyz$

3. For ionic complex β - value is:
   (a) 0 (b) 0.5 (c) 1 (d) none

4. The energy of $^3A_{2g}$ state is:
   (a) 6 Dq (b) 12 Dq (c) -6Dq (d) -12Dq

5. Curies law holds for a ferromagnet at a temperature _____ than T_c.
   (a) < (b) ≤ (c) > (d) ≥

6. The effective magnetic moment value of $[Ni(H_2O)_6]^{2+}$ is......
   (a) 1.73 B.M. (b) 3.87 B.M. (c) Zero B.M. (d) 2.83 B.M.

7. When _____ , the low spin form becomes ground state.
   (a) $\Delta > P$ (b) $\Delta < P$ (c) $\Delta = P$ (d) $\Delta \leq P$

8. The Critical 10Dq value is equal to $- 8$ Dq + 2P for _____.
   (a) $[Fe(CN)_6]^{4-}$ (b) $[Ni(H_2O)_6]^{2+}$ (c) $[Mn(H_2O)_6]^{2+}$ (d) $[Co(H_2O)_6]^{2+}$

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

1. Splitting of d-orbital's in oxo-vanadium (IV) complexes.
2. Explain the σ–overlap and π- overlap.
3. Prove that $15B = v_2 + v_3 - 3 v_1$ for octahedral $[Cr(H_2O)_6]^{3+}$ complex.
4. Explain Orgel diagram for d^4 and d^6 – system.
5. Explain the magnetic susceptibility and volume susceptibility.
6. Explain 90^0 super exchange for Cr(III).
7. The term symbols for d^3 and d^7 – configuration is ^4F, Explain.
8. Explain: Europium (III) & Terbium (III) both contain 6 unpaired electrons even though one having B.M value zero & other having B.M value 9.72.
9. Define the term Hyper sensitive transition & discuss the absorption spectra of Lanthanide complexes.

Q. 3. [A] Derive the microstates for the d^2 complex. Find out the terms arising from it and indicate the order of increasing energy of these terms. [6]

[B] Give the difference between Spectrochemical series and Nephelauxetic series and arrange the following complexes in increasing value of 10 Dq and decreases value of 15B value giving proper justifications.
   (I) $[Co(H_2O)_6]^{2+}$ (II) $[Co(NH_3)_6]^{3+}$ (III) $[Co(Ox)_3]^{4-}$
   (IV) $[Co(en)_3]^{2+}$ (V) $[Co(NCS)_6]^{4-}$ (VI) $[Co(Br)_6]^{4-}$

Or

[B] Answer the following: [6]
(I) Explain the splitting of d-orbital's in trigonal bipyramidal geometry.
(II) Differentiate splitting of d-orbitals in octahedral field and tetrahedral field.

Q.4. **[A]** Explain the correlation diagram for d^2 system. [6]

[B] Explain T.S. diagram for $[Mn(H_2O)_6]^{2+}$ complex and calculate the value of electronic parameters, %β, β, % Ionic character and % Covalent character. [6]
[Given: $v_1 = 18600$ cm^{-1}, $v_2 = 22900$ cm^{-1}, $v_3 = 24500$ cm^{-1} and $v_4 = 25150$ cm^{-1}
B_0 for Mn(II) = 860 cm^{-1}]

Or

[B] Answer the following:
1. Why Orgel diagram for d^2 & d^7 and d^3 & d^8 are identical. [6]
2. Why Orgel diagram for d^9 octahedral configuration is inverse of d^1 configuration.

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

[B] Derive the diamagnetic susceptibility equation and find out the diamagnetic correction $\chi_{dia(corr.)}$ for bis(salicylidine)ethylene diamine. [6]
[Given: $\chi_c = -6.0 \times 10^{-6}$ cgs, $\chi_H = -2.93 \times 10^{-6}$ cgs, $\chi_O = -4.61 \times 10^{-6}$ cgs, $\chi_{Nchain} = -5.57 \times 10^{-6}$ cgs, $\lambda_{C=N} = 8.15 \times 10^{-6}$ cgs, $\lambda_c = -0.24 \times 10^{-6}$ cgs.]

Or

[B] Answers the following: [6]
1. Explain the types of Antiferromagnetism.
2. Explain the sources of diamagnetism.

Q.6. **[A]** Explain the conditions under which the cross-over region occurs in detail. [6]

[B] Explain the spin orbit coupling on A, E and T terms. Calculate the effect of spin orbit coupling on effective magnetic moment value of complex $[Ni(H_2O)_6]^{2+}$. [6]
[Given: $\lambda = -315$ cm^{-1} and 10Dq=9000 cm^{-1}]

Or

[B] Answers the following: [6]
1. State and prove the Lande interval rule.
2. Uses of Lanthanides compounds as shift reagent.

"Best of Luck"