(24 & A-10) **Seat No.:**_____

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SARDAR PATEL UNIVERSITY
M.Sc. (SEMESTER-II) EXAMINATION
2016
Saturday, 22nd October
10.00 a.m. to 01.00 p.m.
CHEMISTRY: PS02CCHE01
(INORGANIC CHEMISTRY-II)

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

Q.1. Answer the following: **8**

1. Which of the following orbital is most destabilized in trigonal prismatic geometry?
   a. dxz, dyz
   b. dx^2-y^2
   c. dxy
   d. dz^2

2. Which of the following system exhibits highly distorted octahedral structure?
   a. low spin-d^9
   b. high spin-d^5
   c. low spin-d^4
   d. high spin-d^6

3. Arrange the following term in decreasing order of the energy:

   (i). ^4F
   (ii). ^4G
   (iii). ^3I
   (iv). ^2H

   a. (iv) > (iii) > (i) > (ii)
   b. (iii) > (i) > (iv) > (ii)
   c. (ii) > (iv) > (i) > (iii)
   d. (ii) > (i) > (iii) > (iv)

4. The ground state for the $[Fe(CN)_6]^{4-}$ is:
   a. $^2T_{2g}$
   b. $^1A_{1g}$
   c. $^3T_{1g}$
   d. ^2E_g

2...
(P.T.O.)

5. Below Curie temperature substance behave like :
   a. Paramagnetic
   b. Antiferromagnetic
   c. Ferromagnetic
   d. Ferrimagnetic
6. The correct order of effective magnetic moment value of the following coordination compounds is :
   (i) $[Co(NH_3)_6]^{2+}$ (ii) $[Co(NH_3)_6]^{3}$ (iii) $[Cr(H_2O)_6]^{2+}$ (iv) $[V(NH_3)_6]^{3+}$

   a. i < ii < iii < iv b. iv < iii < ii < i
   c. ii < iv < i < iii d. iii< iv < i < ii

7. Which of the following lanthanides produce largest down-field shift?

   a. Gd(III)
   b. Tm(III)
   c. Ho(III)
   d. Tb(III)

8. The number of pair of parallel spin for high-spin d^8 -configuration is:

   a. 9
   b. 11
   c. 10
   d. 13

Q.2. Attempt any **SEVEN** of the following: 14

1. Explain the term point dipole with suitable example.
2. Why dose energy of t_{2g} orbital decrease by 4 Dq?
3. Calculate the number of microstates for ^2H and ^4H terms.
4. Give the crystal field terms for the ^1G, ^2D, ^3F, ^4P and ^5S terms.
5. What are the sources of paramagnetism?
6. Explain the σ -overlap and π- overlap:
7. Calculate the electron exchange energy for high-spin d^1 to d^7- configurations.
8. Calculate the number of pair of parallel spin for low-spin d^1 to d^7 -configurations.
9. Explain the aspects of spin pairing and cross over region.

Q.3.A. Derive the microstates for the $[V(H_2O)_6]^{3+}$ complex. Find out the terms arising out of this configuration and indicate the order of increasing energy of the terms. 6

B. Discuss the tetragonal distortion in octahedral complexes and explain the structure of $[Cr(H_2O)_6]^{2+}$ and $[Cu(NH_3)_6]^{2+}$ complexes. 6

OR

B. Answer the following:

1. Differentiate splitting of d- orbitals in octahedral field and tetrahedral field.
2. Calculate the number of microstate for the following configurations and arrange them in decreasing order of energy.
   $(t_{2g})^2(e_g)^2$,$(t_{2g})^3(e_g)^1$ and $(t_{2g})^4$ 3.....

Q.4.A. Explain the Loporte and spin selection rules. Calculate Nephelauxetic ratio, Racah parameter, covalent character, crystal field splitting energy and configuration interaction term for the $[Co(NH_3)_6]^{2+}$ complex. Given: ν_1 = 8,250 cm^{-1}, ν_2 = 15,950 cm^{-1}, ν_3 = 19,300 cm^{-1} and B_0 for Co(II) = 971 cm^{-1}. **6**

B. Answer the following: **6**

1. Draw and explain the Orgel diagram for octahedral and tetrahedral Cr(III)-system.
2. Draw and explain the Tanabe Sugano diagram for low-spin Fe(III) and low-spin Co(III) complexes.

OR

B. Explain the types of transitions in the following systems.

(i) $[Mn(Br)_6]^{3-}$
(ii) $[Sc(H_2O)_6]^{2+}$
(iii) $[Co(H_2O)_6]^{3+}$
(iv) $[Fe(CN)_6]^{3-}$
(v) $[Mn(H_2O)_6]^{2+}$
(vi) $[Cr(H_2O)_6]^{3+}$

Q.5.A. Derive the equation for diamagnetic susceptibility. Calculate the effective magnetic moment for $K_4[Fe(CN)_6]$ complex. **6**

B. Define the magnetic susceptibility and derive the Van Vleck equation for magnetic susceptibility. **6**

OR

B. Answer the following:

1. Find out the diamagnetic susceptibility correction for bis(salicylidene)ethylenediamine and 4-methyl aniline.
   Given: $\chi_A \rightarrow$ C= - 6.0 x 10^{-6} cgs units, H = - 2.93x10^{-6} cgs units, O = - 4.61x10^{-6} cgs units, O_2 = - 7.95x10^{-6} cgs units, $N_{(Open\ chain)}$= - 5.57 x 10^{-6} cgs units and $N_{(ring)}$ = - 4.61 x 10^{-6} cgs units.
   $\lambda \rightarrow$ C = - 0.24x10^{-6} cgs units and C=N = + 8.15x10^{-6} cgs units.
2. Explain ferrimagnetism and canting giving suitable examples.

(P.T.O.)

Q.6.A. Answer the following: 6

1. Calculate the value of spin-orbit coupling constant for d^1 to d^{10} systems. What will be the effect of spin orbit coupling on effective magnetic moment value of octahedral Ni(II) complex? Given: Dq = 890 cm^{-1} and λ = 315 cm^{-1}.

2. Derive the term symbols and magnetic moment value for the Nd(III) (z =60), Sm(III) (z = 62) and Cf(III) (z = 98).

B. Answer the following: 6

1. Give an account of the electronic spectra of the actinide complexes.
2. State and prove the Lande interval rule.

OR

B. Answer the following:

1. Use the orbital rotation and transformation model and predict the orbital contribution for the following complexes giving proper justification.
   (i) $[V(H_2O)_6]^{3+}$
   (ii) $[Co(NH_3)_6]^{2+}$
   (iii) $[Mn(H_2O)_6]^{2+}$

2. Show that complexes of europium(III) and americium(III) are diamagnetic even though both having six unpaired electrons.

— X —

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