SC

SEAT No._____

[29]

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**SARDAR PATEL UNIVERSITY**
**M.Sc. (SEMESTER-II) EXAMINATION**
**Tuesday, 10th April, 2018**
**10:00 a.m. to 01:00 p.m.**
**Chemistry: PS02CCHE01**
**(INORGANIC CHEMISTRY-II)**

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

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

1. Which of the following system is known as hole-equivalent?
   (a) $Mn^{+3}$ and $Co^{+3}$ (b) $Cu^{+2}$ and $Fe^{+3}$ (c) $Ti^{+2}$ and $Fi^{+3}$ (d) $Ni^{+2}$ and $Cr^{+3}$
2. Which of the following complex exhibits doubly forbidden transition?
   (a) $[Mn(H_2O)_6]^{3+}$ (b) $[Fe(H_2O)_6]^{3+}$ (c) $[Cr(Br)_6]^{3-}$ (d) $[Cu(H_2O)_6]^{2+}$
3. Which of the following system exhibits regular octahedral structure?
   (a) High Spin – $d^9$ (b) Low Spin – $d^3$ (c) High Spin – $d^8$ (d) High Spin – $d^5$
4. The ground state value of J for $^3F$ term derive from V(III) is :
   (a) Four (b) Two (c) Three (d) One
5. Which of the following lanthanides produces largest up-field shift?
   (a) Gd(III) (b) Eu(III) (c) Tm(III) (d) Dy(III)
6. The ground state for $[Fe(CN)_6]^{4-}$ is
   (a) $^2T_{2g}$ (b) $^2E_g$ (c) $^3T_{1g}$ (d) $^1A_{1g}$
7. Which of the following system shows orbital contribution?
   (a) Td high-spin $d^4$ system (b) Oh high-spin $d^5$ system
   (c) Oh low-spin $d^8$ system (d) Td low-spin $d^4$ system
8. Which of the following system has similar Orgel diagram?
   (a) $Ti^{+2}$ and $Co^{+2}$ (b) $Cr^{+2}$ and $Co^{+2}$ (c) $Cu^{+2}$ and $Co^{+3}$ (d) $Ti^{+2}$ and $Ni^{+2}$

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

1. Explain the term "complex" on the basic of CFT.
2. Explain the term whole equivalent with suitable examples.
3. Specify the $M_L$, $M_S$ and term symbol for following microstate, $(2^+, 1^-)$, $(3^-,2^-)$.
4. Give the difference between Specrtochemical series and Nephelauxetic series.
5. Calculate the number of microstate for $^2G$ term.
6. Define the term closed subshell.
7. Explain diamagnetic correction and Pascal's constant.
8. Explain the $\sigma$- orbital and $\pi$- orbital.
9. Show that effective magnetic moment value Am(III) (z=95) is zero B.M.

**Q.3.A** Discuss the splitting of d-orbital in square planer and pentagonal bipyramidal stereochemistry. **[6]**

[P.T.O.]

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

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. $[Mn(Br)_6]^{4-}$

**OR**

**B. (i)** Discuss the factor affecting on crystal field splitting by ligand. **[3]**
**(ii)** Dedifferentiate CFT and LFT. **[3]**

**Q.4. A** Derive the microstates for the $d^2$ –configuration. Find out the terms arising from it and indicate the ascending of energy of these terms. **[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.** Draw and explain the correlation diagram for [V(EDTA)] chelate and show that $^3T_2g_{(g)}$ state is lower energy state. **[6]**

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

**B. (i)** Derive the Curie Weiss equation $\chi = c/(T-\theta)$. **[3]**
**(ii)** Derive the diamagnetic susceptibility equation and find out the diamagnetic correction $\chi_{dia(corr)}$ for bis(salicylidine)ethylene diamine. **[3]**
**[Given:** $\chi_c = -6.6\times10^{-67}$ cgs, $\chi_H = -2.93\times10^{-6}$ cgs, $\chi_O = -4.61\times10^{-6}$ cgs, $\chi_{Nchain} = -5.57\times10^{-6}$ cgs, $\lambda_{C=N} = 78.15\times10^{-6}$ cgs, $\lambda_c = -0.24\times10^{-6}$ cgs.]

**OR**

**B. (i)** What are the sources of Paramagnetism? Derive the equation $\mu_L = g\,[L(L+1)]^{1/2}\beta$ **[3]**
**(ii)** Determine the effect of spin orbit coupling on effective magnetic moment value of $[Co(SCN)_4]^{2-}$. Given 10 Dq = $7{,}000\ cm^{-1}$ and $\lambda = 300\ cm^{-1}$. **[3]**

**Q.6.A.** Derive the tam symbols, gyro magnetic ratio and magnetic moment value for the Tb(III) (z = 65), Bk(III) (z = 97 ), pu(III)) (z = 94) and Cm(III) (z=96) **[6]**

**B. (i)** Explain the role of shift reagents in $^1$H-NMR spectra of n- pentanol and di-butyl ether. **[3]**
**(ii)** Discuss the electronic spectra of actinides complexes. **[3]**

**OR**

**B. (i)** Determine the effect of spin orbit coupling on effective magnetic moment value of $[Co(SCN)_4]^{2-}$ **[Given:** 10 Dq = $7{,}000\ cm^{-1}$ and $\lambda = -300\ cm^{-1}$] **[3]**
**(ii)** Explain the spin orbit coupling on T-term of $d^9$-strong tetrahedral field **[3]**