

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

No. Printed pages:4

SARDAR PATEL UNIVERSITY
M.Sc. (SEMESTER-II) EXAMINATION

2016

Saturday, 22nd October

10.00 a.m. to 01.00 p.m.

CHEMISTRY: PS02CCE01
(INORGANIC CHEMISTRY-II)

Note:-figures to the right indicate full marks.

Total marks: 70

Q.1. Answer the following:

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

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

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

- 4F
- 4G
- 3I
- 3H

- (iv) > (iii) > (i) > (ii)
- (iii) > (i) > (iv) > (ii)
- (ii) > (iv) > (i) > (iii)
- (ii) > (i) > (iii) > (iv)

4. The ground state for the $[Fe(CN)_6]^{4-}$ is:

- $^2T_{2g}$
- $^1A_{1g}$
- $^3T_{1g}$
- 2E_g

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(P.T.O.)

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5. Below Curie temperature substance behave like :
- Paramagnetic
 - Antiferromagnetic
 - Ferromagnetic
 - Ferrimagnetic
6. The correct order of effective magnetic moment value of the following coordination compounds is :
- (i) $[\text{Co}(\text{NH}_3)_6]^{2+}$ (ii) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (iii) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (iv) $[\text{V}(\text{NH}_3)_6]^{3+}$
- $i < ii < iii < iv$
 - $iv < iii < ii < i$
 - $ii < iv < i < iii$
 - $iii < iv < i < ii$
7. Which of the following lanthanides produce largest down-field shift?
- Gd(III)
 - Tm(III)
 - Ho(III)
 - Tb(III)
8. The number of pair of parallel spin for high-spin d^8 -configuration is:
- 9
 - 11
 - 10
 - 13

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

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

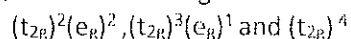
Q.3.A. Derive the microstates for the $[\text{V}(\text{H}_2\text{O})_6]^{3+}$ complex. Find out the terms arising out of this configuration and indicate the order of increasing energy of the terms. 6

B. Discuss the tetragonal distortion in octahedral complexes and explain the structure of $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cu}(\text{NH}_3)_6]^{2+}$ complexes. 6

OR

B. Answer the following:

- Differentiate splitting of d-orbitals in octahedral field and tetrahedral field.
- Calculate the number of microstate for the following configurations and arrange them in decreasing order of energy.



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Q.4.A. Explain the Laporte and spin selection rules. Calculate Nephelauxetic ratio, Racah parameter, covalent character, crystal field splitting energy and configuration interaction term for the $[\text{Co}(\text{NH}_3)_6]^{2+}$ complex. Given: $\nu_1 = 8,250 \text{ cm}^{-1}$, $\nu_2 = 15,950 \text{ cm}^{-1}$, $\nu_3 = 19,300 \text{ cm}^{-1}$ and B_0 for $\text{Co(II)} = 971 \text{ cm}^{-1}$. 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) $[\text{Mn}(\text{Br})_6]^{3-}$
- (ii) $[\text{Sc}(\text{H}_2\text{O})_6]^{2+}$
- (iii) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
- (iv) $[\text{Fe}(\text{CN})_6]^{3-}$
- (v) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
- (vi) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$

Q.5.A. Derive the equation for diamagnetic susceptibility. Calculate the effective magnetic moment for $\text{K}_4[\text{Fe}(\text{CN})_6]$ 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: $\chi_{\lambda} \rightarrow C = -6.0 \times 10^{-6}$ cgs units, $H = -2.93 \times 10^{-6}$ cgs units, $O = -4.61 \times 10^{-6}$ cgs units, $O_2 = -7.95 \times 10^{-6}$ cgs units, $N_{(\text{Open chain})} = -5.57 \times 10^{-6}$ cgs units and $N_{(\text{ring})} = -4.61 \times 10^{-6}$ cgs units.

$\lambda \rightarrow C = -0.24 \times 10^{-6}$ cgs units and $C=N = +8.15 \times 10^{-6}$ cgs units.

2. Explain ferrimagnetism and canting giving suitable examples.

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Q.6.A. Answer the following:

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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: $Dq = 890 \text{ cm}^{-1}$ and $\lambda = 315 \text{ cm}^{-1}$.
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:

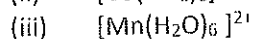
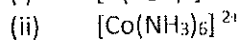
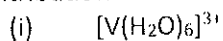
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1. Give an account of the electronic spectra of the actinide complexes.
2. State and prove the Lande interval rule.

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.



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

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