CVM UNIVERSITY

M.Sc.(Organic Chemistry) – SEMESTER 1 EXAMINATION 2021
Monday, 22nd February 2021
Time: 10:00 AM to 12:00 PM
101330101: Electron spectroscopy & Magnetochemistry

Maximum Marks: 60

NOTE: (1) Attempt all questions
       (2) Figures to the right indicate marks

Que. 1[A]   **Choose correct answer of the following questions.**   **08**

1. Which of the following orbital is most stabilized in square planner Pt(II) complex?
   (A) d_{xz}
   (B) $d_{x^2-y^2}$
   (C) d_{xy}
   (D) d_{z^2}

2. On the basis of molecular orbital theory, the number of electrons in non-bonding molecular orbital in $[CoF_6]^{-3}$ complex is _____.
   (A) Six
   (B) Three
   (C) Two
   (D) Four

3. Which of the following systems has similar orgel diagram?
   (A) Cr^{+2} and Co^{+2}
   (B) Cu^{+2} and Co^{+3}
   (C) Ti^{+2} and Co^{+2}
   (D) Ti^{+2} and Ni^{+2}

4. For free ion with d^6 configuration, the ground state is _____.
   (A) ^5D
   (B) ^3F
   (C) ^3D
   (D) ^5F

5. The effective magnetic moment value of $[Ni(H_2O)]^{+2}$ is_____.
   (A) 1.73 B.M.
   (B) 3.87 B.M.
   (C) 0 B.M.
   (D) 2.83 B.M.

6. Which of the following compound is paramagnetic?
   (A) $[Ni(CN)_6]^{-2}$
   (B) $[Ni(DMG)_2]$
   (C) $K_4[Fe(CN)_6]$
   (D) $[Fe(H_2O)_6]^{+2}$

7. For the Octahedral law spin complex, which one has the orbital contribution is expected?
   (A) $(t_2g)^3(e_g)^0$
   (B) $(t_2g)^6(e_g)^0$
   (C) $(t_2g)^6(e_g)^2$
   (D) $(t_2g)^1(e_g)^0$

8. According to Lande's interval rule, energy difference(ΔE) between the successive J level is _____.
   (A) $\lambda(J+2)$
   (B) $\lambda(J+2)/2$
   (C) $\lambda(J+1)$
   (D) $\lambda(J+1)/2$

Que. 1[B]   **Answer the following. (Fill in the blanks and True or False)**   **08**

1. Pairing energy means energy need to pair up the electron. **True or False?**
2. The number of microstate for the ^4G are _____. (24, 36, 44)
3. Total number of microstates of $(t_2g)^1(e_g)^1$ are_____. (24, 36, 44)
4. In orgel diagram of d^2-cofiguration considerable terms are_____. (^3P & ^3F, ^1S & ^1G, ^3P & ^1F)
5. Π-interaction more effective in oxobridge complex than hydroxo bridge complex. **True or False?**
6. Paramagnetism is property of substance containing _____ electron. (paired, unpaired)
7. When t_2g orbital is not half-filled or fulfilled then orbital contribution is_____. (expected, not expected)
8. Actinides are stronger in color due to spin-orbit coupling. **True or False?**

Que. 2   **Answer ANY SIX of the following.**   12
1. Give the term symbol of V^{+2} and Co^{+2}.
2. Explain amount of octahedral splitting is greater than tetrahedral splitting.
3. Give the total microstate for $(t_2g)^2(e_g)^2$ & $(e_g)^3$.
4. Draw the orgel diagram for octahedral d^6 configuration.
5. Derive the equation for spin magnetic moment which is source of paramagnetism.
6. Explain the volume susceptibility & molar susceptibility.
7. Calculate diamagnetic susceptibility for pyridine.(Given: χ_A for C= -6.0×10^{-6} cgs, H=-2.93×10^{-6} cgs, N_{ring}=-4.61×10^{-6} cgs, The value of constitutive correction λ for C =-0.24×10^{-6} cgs)
8. What is important characteristic of Holmium(III)? Why?

Que. 3   Give the derivation of term symbol for D^2 configuration.   08
OR
Que. 3   Explain the splitting of d-orbital in trigonal prismatic complex, square pyramidal complex, Trigonal bipyramidal geometry.   08

Que. 4   Explain & draw the Tanabe-Sugano diagram for d^2 system **AND** calculate the value   08
electronic parameters 10Dq, %β, β, % Ionic character and % of covalent character for $[V(H_2O)_6]^{+2}$ complex.
[Given: v_1=18600 cm^{-1}, v_2=22000 cm^{-1}, v_3=24500 cm^{-1}, v_4=25150 cm^{-1} ,B_0 for Mn(II)= 860 cm^{-1}]
OR
Que. 4   Give the crystal field terms for ^1S, ^3P, ^1D, ^3F, ^1G, ^3H, ^1I and arrange them in decreasing   08
order of energy. Calculate the number of microstate and energy of strong field of d^2-system. Explain the non-crossing and one to one correspondence rules giving appropriate examples.

Que. 5   Derive the Langevin equation for multiple width larger than thermal energy.   08
OR
Que. 5   What is first order & Second order Zeeman effect? Derive the Van-vleck equation for   08
the magnetic susceptibility of the coordination compounds.

Que. 6   Explain the spin-orbit coupling on A and E terms. Determine the effect of spin-orbit   08
coupling on effective magnetic moment value of $[Ni(H_2O)_6]^{+2}$ complex.
(Given: λ= -351 cm^{-1}, 10Dq = 9000 cm^{-1})
OR
Que. 6   Derive the L, S, J, g, μ_{eff}, and term symbol for the Nd(III) (Z= 60), Eu(III) (Z= 63),   08
Ho(III) (Z= 67), Er(III) (Z= 68), Tm(III) (Z= 69), Yb(III) (Z= 70) **AND** discuss the spectra of Lanthanide complex.
****

2