## PG CBCS

# M.Sc. Semester-IV Examination, 2022 <br> CHEMISTRY <br> PAPER: CEM 402 (SPL PAPER) <br> (ADVANCED INORGANIC CHEMISTRY-I) 

## GROUP-A

1. Answer any four questions from the following questions: $\quad 2 \times 4=8$
a) The number of f-electron in $\mathrm{Eu}^{3+}$ and $\mathrm{Am}^{3+}$ is same, but they have different magnetic moment value. Explain.
b) Discuss the magnetic property of $\left[\mathrm{PdCl}_{2}\left(\mathrm{PMe}_{3}\right)_{2}\right]$.
c) What is meant by magnetically concentrated substances? Give an example.
d) What is zero field splitting? Cite an example.
e) Graphically show the effect of temperature on paramagnetic susceptibility of a substance.
f) What are interstitial hydrides? Draw the structure of the cluster $\left[H R u_{6}(\mathrm{CO})_{18}\right]^{-}$

## GROUP - B

2. Answer any four questions from the following questions:

a) Determine the magnetic susceptibility of dimeric copper(II) acetate dihydrate and relate this value to the number of unpaired electron per copper atom. Given: Molecular weight of $\left[\mathrm{Cu}_{2}(\mathrm{OAc})_{4} .2 \mathrm{H}_{2} \mathrm{O}\right]$ is $399.3 \mathrm{gm} / \mathrm{mol}$; $\chi_{\text {meas }}$ of the sample is $1.30 \times 10^{-3} \mathrm{emu} \mathrm{mol}^{-1}$ at temperature of 296.5 K .
b) How will you synthesize $\left[\mathrm{Mo}_{6} \mathrm{Cl}_{14}\right]^{2-}$ ion starting from $\mathrm{MoCl}_{5}$ ? Discuss the structure of $\left[\mathrm{Mo}_{6} \mathrm{Cl}_{14}\right]^{2-}$ anion. $\quad 2+2$
c) Calculate the $\chi_{\mathrm{D}}$ for bipy and $\mathrm{PPh}_{3}$ compounds by using Pascal's constant.
i. $\chi_{D}\left(C_{\text {ring }}\right)=-6.24 ; \quad \lambda$ (benzene $)=-1.4$;
ii. $\chi_{\mathrm{D}}(\mathrm{P})=-6.3 ; \quad \lambda$ (pyridine) and $\lambda(\mathrm{Ar}-\mathrm{Ar})=-0.5$;
iii. $\chi_{D}\left(N_{\text {ring }}\right)=-4.61 ; \quad \chi_{D}(H)=-2.93 ; \quad 2+2$
d) Give an example of metal compound containing M-M quintuple bond and discuss it structure. Write down the synthesis procedure of the compound. $1+2+1$
e) Between the given two complexes I and II which will shows lower carbonyl stretching frequency? - Explain.
(2)


I


II

f) What is meant by multiplet width? What will be the magnetic moment when multiplet width is small in comparision to thermal energy?

## GROUP - C

3. Answer any two questions from the following questions: $\quad 8 \times 2=16$
a) Derive Langevin's theory of diamagnetism. Show that magnetic susceptibility is negative and independent of temperature.
b) Prove that $\mu_{l}=V_{l}(l+1) \cdot \beta$ where $\beta=$ Bohr Magneton. Calculate the expected magnetic moment for $\mathrm{Nd}^{3+}$. For $\mathrm{Sm}^{3+}(\mathrm{g}=2 / 7)$ the calculated and experimental magnetic moment is different-Explain.
$3+2+3$
c) Calculate the number of metal-metal bond in $\mathrm{M}_{4}(\mathrm{CO})_{12}[\mathrm{M}=\mathrm{Co}, \mathrm{Rh}, \mathrm{Ir}]$ and explain the structures of the above clusters. Explain the metal-metal bonding in $\left[\mathrm{Os}_{2} \mathrm{Cl}_{8}\right]^{2-}$ cluster. $\mathrm{Re}_{2} \mathrm{Cl}_{8}{ }^{2-}$ is eclipsed while $\mathrm{Os}_{2} \mathrm{Cl}_{8}{ }^{2-}$ is staggered-Explain. $(3+3+2)$
d) (i) Use Wades rule to predict the geometry of the cluster core of the following cluster compounds. (i) $\left[\mathrm{Ni}_{6}(\mathrm{CO})_{12}\right]^{2-}$ (ii) $\left[\mathrm{Os}_{5} \mathrm{C}(\mathrm{CO})_{15}\right]$
(ii) Discuss edge-sharing bioctadra and face-sharing bioctadra geometry in $\mathrm{M}-\mathrm{M}$ bonded system.
