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**PG (CBCS)**
**M.Sc. Semester-IV Examination, 2026**
**CHEMISTRY**
**PAPER: CEM 402**
**(ADVANCED INORGANIC CHEMISTRY-III)**

**Full Marks: 40** **Time: 2 Hours**

The figures in the right-hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

## GROUP – A

**1. Answer any FOUR of the following questions:** **2×4 = 8**

a) What do you mean by HNCC & LNCC in carbonyl cluster?
b) In Cu(II) acetate monohydrate, with the increase of the number of electronegative substituents on acetate, the magnetic moment increases.- Explain.
c) What is metal-metal quintuple bond? Give an example
d) State the Lande Interval rule?
e) What are Chini's clusters? Give an example.
f) $[Cr_2Cl_9]^{3-}$ is paramagnetic while $[W_2Cl_9]^{3-}$ is diamagnetic - Explain.

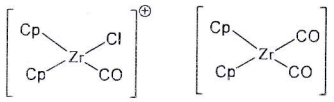
## GROUP - B

**2. Answer any FOUR of the following questions:** **4×4 = 16**

a) Draw a plot of $\chi_M$ vs temperature T(K) for different magnetic substances and explain Curie and Neel temperature. ($\chi_M$=Magnetic Susceptibility). (2+2)
b) Calculate the $\chi_D$ for bipyridine and triphenylphosphine($PPh_3$) by using Pascal's constant. (4)

Given, $\chi_D(P) = -26.3 \times 10^{-6}$ emu mol$^{-1}$; $\lambda(C_{ring}) = -6.24 \times 10^{-6}$ emu mol$^{-1}$;
$\chi_D(H) = -2.93 \times 10^{-6}$ emu mol$^{-1}$; $\chi_D(N_{ring}) = -4.61 \times 10^{-6}$ emu mol$^{-1}$.
$\lambda$ (benzene) $= -1.4 \times 10^{-6}$ emu mol$^{-1}$; $\lambda$ (pyridine) $= 0.5 \times 10^{-6}$ emu mol$^{-1}$
$\lambda$ (Ar-Ar) $= -0.5 \times 10^{-6}$ emu mol$^{-1}$

c) Between the given two complexes I and II which will show a lower carbonyl stretching frequency? - Explain. (4)




I II

d) Explain the metal- metal bonding in $[Os_2Cl_8]^{2-}$ anion. $Re_2Cl_8^{2-}$ is eclipsed while $Os_2Cl_8^{2-}$ is staggered-Explain. (2+2)

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e) What is single molecular magnet? Give an example. Write down the properties of single molecular magnet. (2+2)

f) Describe the correlation between total electron count (TEC) and skeletal electron pair (SEP), and use same to predict the structure $[Fe_4N(CO)_{12}]^-$ and $[H_3Ru_4(CO)_{12}]^-$. (4)

## GROUP - C

**3. Answer any TWO of the following questions:** **8×2 = 16**

a) Derive an expression for Curie's law of paramagnetism. Show that paramagnetic susceptibilities depend inversely on the absolute temperature. (6+2)

b) Prove that $\mu_l = \sqrt{l(l+1)}.\beta$ where β=Bohr Magneton. Calculate the magnetic moment for a complex of $Ho^{3+}$, such as $Ho(phen)_2(NO_3)_3$. (5+3)

c) Determine the structure of $Ir_4(CO)_{12}$ and $Co_4(CO)_{12}$ clusters. Explain the different geometry of $Ir_4(CO)_{12}$ and $Co_4(CO)_{12}$ clusters with proper reason. (4+4)

d) Discuss the 'semi bridging binding mode' of CO in $Fe_2(CO)_7$(4,4'-bipy). Cite one complex where CO acts as $6e^-$ donor. Show the binding mode of CO in this complex. (4+4)

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