

Tutorial 2

1. Explain the concept related to the classification of A, B and C groups as proposed by Chatt and Arland.
 - (a) Give the examples of hard acid and base.
 - (b) Compare the stability of the following complexes based on the affinity of ligands toward the central metal atoms.
 - (i) $[\text{Co}(\text{NH}_3)_5\text{NCS}]^{+2}$ and $[\text{Co}(\text{CN})_5\text{SCN}]^{-3}$
 - (ii) $[\text{Rh}(\text{NH}_3)_5\text{NCS}]^{+2}$ and $[\text{Rh}(\text{SCN})_6]^{-3}$
2. Draw all the possible isomers for the following compounds.
 - (i) $[\text{Rh}(\text{en})_2\text{Br}_2]^+$
 - (ii) $[\text{Ir}(\text{C}_2\text{O}_4)_2\text{Cl}_2]^{3-}$
3. Estimate the molar conductivity for
 - (i) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$
 - (ii) $\text{K}_4[\text{PtCl}_6]$
 - (iii) $\text{NH}_4[\text{CuCl}_2]$
4. Show the structure and state the effective atomic number (EAN) or 18-electron rule for the following species.
 - i. $\text{Mn}(\text{CO})_2(\text{NO})_3$
 - ii. $[\text{Cr}(\text{NO})(\text{CN})_2]^-$
 - iii. $\text{Fe}(\text{C}_5\text{H}_5)_2$
 - iv. $[\text{Re}(\text{CO})_5(\text{CH}_3)]$
5. Propose possible structure for $[\text{Fe}_2\text{Cl}_2(\text{NH}_3)_4(\text{CN})_4]^{2-}$ based on the effective atomic number rules.
6. How to distinguish between the pairs of the following isomers using spectroscopic methods (IR or NMR)?
 - i. *cis*- and *trans*- $[\text{PdCl}_2(\text{PPh}_3)_2]$
 - ii. *fac*- and *mer*- $[\text{RhCl}_2(\text{PMe}_3)_2]$
7. Complex $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic but $[\text{NiCl}_4]^{2-}$ is paramagnetic. What conclusion related to the geometry of this ionic complex can be deduced from the valence bond theory?
8. The magnetic moment (μ) values for $\text{Cs}_2[\text{MnCl}_4]$, $\text{K}_4[\text{Mn}(\text{CN})_6]$ and $\text{K}_2[\text{Ni}(\text{CN})_4]$ are 5.9, 1.8, and 0 B.M, respectively. Explain the difference of these values based on the valence bond theory.