

HW 4
CHEM 362

Available: Feb. 18, 2008

Due: Feb. 25, 2008

1. Draw all of the isomers, geometrical and optical for the following:
 - a. $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
 - b. $[\text{Co}(\text{en})_2\text{NH}_3\text{Cl}]^{2+}$
 - c. $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^{2+}$
2. Draw the molecular structures of the following complexes:
 - a. *cis*-dichlorotetracyanochromate(III)
 - b. *mer*-triamminetrichlorocobalt(III)
 - c. *trans*-dichlorobis(trimethylphosphine)palladium(II)
 - d. *fac*-triaquatrinutrocobalt(III)
3. Give the proper name for each of the following compounds:
 - a. $[\text{Pt}(\text{py})_4][\text{PtCl}_4]$
 - b. $\text{Pt}(\text{acac})(\text{NH}_3)\text{Cl}$
 - c. $\text{Rh}(\text{NH}_3)_5\text{Cl}$
 - d. $[\text{Pt}(\text{en})_2][\text{ClO}_4]_2$
 - e. $\text{Na}_3[\text{Fe}(\text{CN})_6] \cdot 2\text{H}_2\text{O}$
 - f. $\text{Na}_4[\text{Fe}(\text{CN})_6]$
 - g. $[\text{Co}(\text{H}_2\text{O})_6]\text{SO}_4$
 - h. $[\text{Ni}(\text{Phen})_3][\text{ClO}_4]_2$
 - i. $\text{Ni}(\text{CO})_4$
 - j. $\text{Co}(\text{NH}_3)(\text{Cl})(\text{Br})(\text{CH}_3\text{COO})$
 - k. $\text{Na}_2[\text{PdCl}_6]$
4. For each coordination number from two to nine, mention the principal geometrical arrangement (or arrangements).
5. What is meant by tetragonal, rhombic and trigonal distortions of an octahedron?
6. Give one example of each of the following types of isomers:
 - a. Ionization isomer
 - b. Linkage isomer
 - c. Coordination isomer
7. What is meant by the chelate effect? Give an example.
8. Show with drawings how axial-equatorial exchange in a square pyramidal (sp) complex AB_5 could occur through a trigonal bipyramidal (tbp) intermediate.
9. Draw all the possible isomers for an octahedral complex having four different monodentate ligands. Indicate optical isomers.
10. Why do you think that species such as AlCl_3 , $[\text{CuCl}_3]^-$ and $\text{Pt}(\text{NH}_3)_2\text{Cl}^+$ are not actually three-coordinate mononuclear complexes but rather dinuclear compounds?

11. Write the chemical reactions for:
 - a. Water exchange in the hexaaquanickel(II) ion
 - b. Base hydrolysis of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$
 - c. $\text{cis-Pt}(\text{PEt}_3)_2(\text{CN})(\text{Cl}) + \text{H}_2\text{O}$
12. Show with drawings, the enantiomorphs of
 - a. $\text{M}(\text{en})_2\text{Cl}_2$
 - b. $\text{M}(\text{en})_3$
13. Contrast the general trends for substitution reactions of (1) octahedral and (2) square planar complexes regarding:
 - a. Leaving group effects
 - b. Charge effects
 - c. Steric effects
14. Summarize the types of data that indicate a predominantly dissociative mechanism for substitution reactions of octahedral complexes.
15. Summarize the types of data that indicate a predominantly associative mechanism for substitution reactions of octahedral complexes.
16. For $[\text{PtX}_4]^{2-}$ compounds, both ligand exchange and thermodynamic stability increase in the order

$$\text{X} = \text{Cl} < \text{Br} < \text{I} < \text{CN}$$
 Explain why these observations are not inconsistent with each other.
17. What do each of the following abbreviations stand for?
 - a. *tbp*
 - b. *fac*
 - c. *mer*
 - d. *bpy*
18. Draw structures of the following ligands:
 - a. ethylenediamine (*en*)
 - b. acetylacetonate (*acac*)
 - c. diethylenetriamine (EDTA)
 - d. 1,10-phenanthroline
 - e. 2,2'-bipyridine
 - f. acetate ion
 - g. dimethylsulfoxide (DMSO)
19. Draw the six-coordinate ML_6 complex as an octahedron and as a trigonal prism
 - a. What is the relationship between the two structures?
 - b. Why is the octahedral geometry more favored than the trigonal prism?
 - c. Show how the number of geometrical isomers differ for the octahedron and the trigonal prism geometry for $\text{M}(\text{bpy})_2\text{Cl}_2$.