

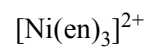
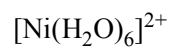
**Chem E-1a**  
**Friday Review Problems**  
**Chapter 20: Coordination Compounds**

1. Consider the coordination compound  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{ClBr}]\text{Cl}$ 
  - a) Write the correct name of this compound.
  - b) Determine the oxidation state of cobalt in this compound.
  - c) Determine the number of  $d$  electrons on cobalt.
  - d) This complex is low-spin. Draw an energy level diagram for the  $d$  orbitals of Co in this compound.
  - e) Determine the number of unpaired electrons in this compound.

1. (cont.)

f) Draw all unique geometric and optical isomers of the complex  $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{ClBr}]^+$

2. You have three solutions each containing one of the following complex ions:



One solution is blue, one is green, and one is violet (though not necessarily in that order).

- a) Match the color of each solution with the nickel complex it contains.

- b) All of these nickel complexes have the same *d*-orbital electron configurations. Show a diagram of the *d*-orbital energies with the correct number and configuration of electrons.

- c) Will these complexes be paramagnetic or diamagnetic?

3. Consider the octahedral complex  $[\text{CoClBr}(\text{en})_2]^+$   
where en = ethylenediammine ( $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$ )

a) Provide the correct systematic name for the compound  $[\text{CoClBr}(\text{en})_2]\text{Cl}$ .

b) Draw all the unique geometric and optical isomers of this complex. Indicate whether each isomer is chiral or achiral.

3. (cont.)

c) This cobalt complex,  $[\text{CoClBr}(\text{en})_2]^+$ , is known to be diamagnetic. The cobalt complex  $[\text{CoF}_6]^{3-}$ , however, is paramagnetic. Explain why these two species exhibit different magnetic behavior.

d) The  $[\text{CoF}_6]^{3-}$  complex appears blue. Would you expect the  $[\text{CoClBr}(\text{en})_2]^+$  complex to absorb light of a higher energy or lower energy? Name one color that  $[\text{CoClBr}(\text{en})_2]^+$  could *not* be.