Worksheet I
Coordination Chemistry Review

Background Assumed:

1. Can assign oxidation states on inspection and give d-electron count of transition metal. Check: oxidation state and d-electron count of:

$Cr(H_2O)_6^{3+}$ $[CrCl_2(H_2O)_4]^+$ $Mn(CO)_5^-$ $OsO_4^=$

$Ni(CN)_4^{2-}$ $NiCl_4^{2-}$ $Ni(CO)_4$ $HFe(CO)_4^-$

Cp_2TiCl_2 Cp_2Fe

2. Can predict geometries and from geometries of complexes, predict crystal field, dorbital splitting diagrams, electron assignment, and magnetism:

$Ni(CN)_4^{2-}$ $NiCl_4^{2-}$ $Ni(CO)_4$ $Pt(NH_3)_6^{4+}$

$Co(NH_3)_6^{2+}$ $Co(NH_3)_6^{3+}$ trans $[CoCl_2(NH_3)_4]^+$

trans $Ir(Cl)(CO)(PR_3)_2$

3. Know the basis of spectrochemical series. Order the following in terms of ligand field strength:

OH^- H_2O F^- NH_3 CN^- PR_3 H^- C_2H_4

4. Lewis Acids /Bases and HSAB.
Which of the ligands above are “hard” and which are “soft” donors?

5. Predict the composition and geometries of the following:

(a) the ammine complex of Ru(II) (NH_3)

(b) the carbonyl complex of Cr(0)

(c) the bromide complex of Co(II)

(d) the phenanthroline complex of Co(III)

(e) the ammine complex of Cu(II)

(f) the ethylenediamine complex of Cr(II)

6. Consider the following list of species and *indicate by number* (in the spaces provided) those species that possess the indicated property. Note that a given species may posses more than one (or none) of the indicated properties.

(1) $Cr(OH_2)_6^{2+}$ (5) $Pt(NH_3)_2Cl_2$ (9) $Fe(C_2O_4)_3^{4-}$

(2) $Fe(CN)_6^{4-}$ (6) MnO_4^{2-} (10) $Zn(EDTA)^{2-}$

(3) $Pt(CN)_4^{2-}$ (7) HgI_4^{2-}

(4) $Ir(en)_3^{3+}$ (8) $Co(NCS)_4^{2-}$

(a) paramagnetic

(b) inert to ligand substitution _____

(c) colored

(d) tetragonally distorted from regular octahedral geometry _____

(e) tetrahedral complex

(f) chelate complex

(g) capable of existing in isomeric form

7. Indicate which of the following complexes would be expected to be inert to ligand substitution:

(a) FeF_6^{3-} (g) $Co(NH_3)_6^{3+}$ (m) $Rh(NH_3)_6^{3+}$

(b) $Ni(OH_2)_6^{2+}$ (h) $Co(NO_2)_6^{3-}$ (n) $PtCl_6^{2-}$

(c) $Cr(OH_2)_6^{2+}$ (i) $Zn(OH_2)_6^{2+}$ (o) $V(phen)_3^{3+}$

(d) $Fe(CN)_6^{4-}$ (j) $Sc(OH_2)_6^{3+}$ (p) $Zn(EDTA)^{2-}$

(e) $Cr(NH_3)_6^{3+}$ (k) $Ru(NH_3)_6^{3+}$ (q) $Fe(OH_2)_6^{3+}$

(f) $Co(NH_3)_6^{2+}$ (l) $V(OH_2)_6^{3+}$ (r) $Co(OH_2)_6^{3+}$