Part A: Cell Potential and Concentration

True or False

_____ A concentration cell is an electrochemical cell that is comprised of two half-cells with the same electrodes, but differing in concentrations.

_____ In a concentration cell, electrons move from the higher concentration cell to the lower concentration cell.

_____ A pH meter is a specific type of concentration cell that uses the basic setup of a concentration cell to determine the pH, or the acidity/basicity, of a specific solution.

1. For the concentration cell bellow determine which compartment contains the anode and which contains the cathode. Then determine the flow of electrons.

$$\textit{Compartment 1} \qquad \textit{Compartment 2}$$
$$Fe|Fe^{2+}(aq, 0.01M)||Fe^{2+}(aq, 0.1M)|Fe$$

2. Calculate cell potential, E_{cell}, for the concentration cell listed above. Use the Nernst equation listed below.

$$E_{cell} = E^{o}_{cell} - \frac{0.0592}{n} logQ$$

Do you know the value for E^{o}_{cell}?

3. Calculate the concentration of the unknown, given the equation below and a cell potential, E_{cell} = 0.26V.

$$Ag|Ag+(xM)||Ag+(1.0M)|Ag$$

Part B: Properties of Transition Metals

True and False

_____As we move across the periodic table from left to right, the radii for transition metals decreases then increases slightly.
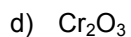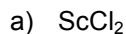Why?_____

_____

_____As we move down a group (from row 1 to 2), the radii for transition metals increases.

Why?_____

_____

_____As we move across the periodic table from left to right, ionization energy increases.
The Ionization energy of Zn is much much greater than Cr. Why?_____

_____

4. What is the oxidation state of the metal in the oxides listed below?

   a) $ScCl_2$

   b) TiO

   c) V_2O_5

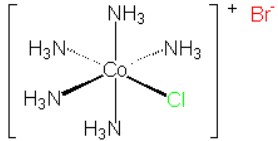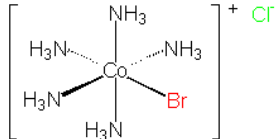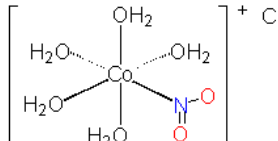   d) Cr_2O_3

   e) MnF_2

   f) $KMnO_4$

For compounds a-f, write the electron configuration for the transition metals.

5. As you can see from your answer in 4, there are many possible oxidation states for transition metals. What is a common oxidation state for transition metal ions? Why?

Part C: Complex ions or Coordination Complexes

Coordination Complexes are Complex ions. They consist of a transition metal and one or more small molecules (known as Ligands) that are attached. The bonding interaction between the transition metal and the ligand is a Lewis Acid-Base interaction. Fill out the following missing blanks in the table.

Example	Chemical Formula	Lewis Acid	Lewis Base	Coordination number
$[Co(NH_3)_5Cl]^+$ Br^- (structure)				
$[Co(NH_3)_5Br]^+$ Cl^- (structure)				
$[Co(H_2O)_5(NO_2)]^+$ Cl^- (structure)				
	$[Ag(NH_3)_2]^+$			
	$[PtCl_6]^{2-}$			
	$[Fe(H_2O)_4Cl_2]$			

In Exp 14, you will synthesize one of the following cobalt compounds. From the formulas, practice drawing the structures.

1) $[Co(NH_3)_5Cl]Cl_2$

2) $[Co(NH_3)_5(H_2O)]Cl_3$

3) $[Co(NH_3)_5(ONO)]Cl_2$

4) $[Co(NH_3)_5(NO_2)]Cl_2$

5) $[Co(NH_3)_6]Cl_3$