ELECTROCHEMISTRY PROBLEMS

1. For this reaction: $MnO_4^-(aq) + 8H^+(aq) + 5Fe^{2+}(aq) \rightarrow Mn^{2+}(aq) + 5Fe^{3+}(aq) + 4H_2O(l)$

   a) What is the oxidation number for Mn in $MnO_4^-(aq)$? ____

   b) What is oxidized? _____

   c) What is reduced? _____

   d) What is the oxidizing agent? _____

   e) What is the reducing agent? _____

2. Based on their $E°_{red}$ values, determine the best oxidizing agent, best reducing agent, worst oxidizing agent, and worst reducing agent.

Half-reaction	$E°_{red}$
$Co^{2+}_{(aq)} + 2e^- \rightarrow Co_{(s)}$	-0.28 V
$Mn^{2+}_{(aq)} + 2e^- \rightarrow Mn_{(s)}$	-1.18 V
$Cd^{2+}_{(aq)} + 2e^- \rightarrow Cd_{(s)}$	-0.40 V

   best oxidizing agent _____   best reducing agent _____

   worst oxidizing agent _____   worst reducing agent _____

3. Which of the following will react spontaneously (refer to table in # 2)?

   A. Cd with Mn^{2+} B. Co with Cd^{2+} C. Mn with Co   D. Mn with Cd^{2+} E. Co with Mn^{2+}

4. If we were to make a galvanic cell from the following metals, which would act as the anode and which as the cathode? Refer to table 19.1. Write the half-cell reactions and the overall balanced reaction for each cell. Calculate $E°_{cell}$ for each cell.

   a) Fe(s) and Ni(s)   b) Cu(s) and Ag(s)

   anode rxn: anode rxn:

   cathode rxn: cathode rxn:

   Overall: Overall:

   $E°_{cell} =$ $E°_{cell} =$

5. Use the information in the table below to answer the following questions

Half-reaction	$E°_{red}$
$Au^{3+} + 3e^- \rightarrow Au(s)$	1.50 V
$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$	1.07 V
$Pb^{2+} + 2e^- \rightarrow Pb(s)$	-0.13 V
$Ni^{2+} + 2e^- \rightarrow Ni(s)$	-0.25 V

   a) What will $E°_{cell}$ be if Ni(s) reacts with Au^{3+}?

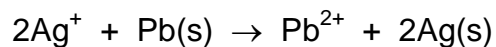b) What will E^o_{cell} be if Pb^{2+} reacts with Br^-?

c) Calculate E^o_{cell} for the following cell: $Ni(s) \mid Ni^{2+}(aq) \mid\mid Br_2(l), Br^-(aq) \mid Pt(s)$

d) Which of the reactions given in parts a-c are spontaneous?

6. Calculate ΔG^o for the $Ni(s) + Au^{3+}$ reaction in problem 5a.

7. Calculate K at 25^oC for the $Ni(s) + Br_2(l)$ reaction in question 5c.

8. A galvanic cell utilizes the following reaction:
$$2Ag^+ + Pb(s) \rightarrow Pb^{2+} + 2Ag(s)$$
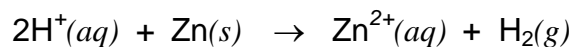
   a) Write the half cell reactions and calculate the cell emf under standard conditions.

   b) Write the short-hand notation of this reaction.

   c) Calculate the cell potential if $[Pb(NO_3)_2] = 0.88$ M and $[AgNO_3] = 0.14$ M.

Electrochemistry Problems

9. A cell utilizes the following reaction and operates at 298 K:

$$2H^+(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + H_2(g)$$

a) Calculate E^o_{cell}. (Look up E^o values).

b) Calculate E_{cell} when $[Zn^{2+}] = 0.050$ M, $P_{H_2} = 0.25$ atm, and $[H^+] = 1.0 \times 10^{-4}$ M.

10. How many grams of Cu can be collected in 1.00 hour by a current of 1.62 A from a $CuSO_4$ solution?

11. A current of 2.00 amps is passed through a solution of $Pb(NO_3)_2$ until 6.35 grams of Pb metal has been deposited. How many seconds did the current flow?