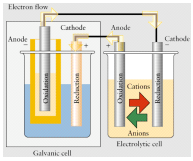
Chemistry 106 Fundamental Chemistry		Electrochemistry Practice Problems

1) Balance the following redox equations by writing the balanced half reactions.

a) $Fe^{+2} + O_2 \rightarrow Fe^{+3} + H_2O$
b) $K + H_2O \rightarrow K^+ + H_2 + OH^-$
c) $Zn + H^+ + NO_3^- \rightarrow Zn^{+2} + NO_2^-$
d) $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$
e) $PbO_2 + Pb + H_2SO_4 \rightarrow PbSO_4$

2) Calculate the standard cell potentials, standard free energy changes and equilibrium constants at 298.2 K for reactions a, b and c in #1.

3) Calculate the cell potentials for the following cells with the reaction quotients, Q, given at 298.2 K.

a) $Zn(s)|Zn^{+2}(aq) \,||Cu^{+2}(aq)\,|Cu(s)$ Q = 0.10
b) $Pt|Fe^{+2}(aq), Fe^{+3}(aq) \,||O_2(g)\,|OH^-|C$ (graphite) Q = 1.6×10^{-34}
c) Half reaction $Pt|H_2(g)\,|\,H^+$ Q = 1.0×10^{-14} (hydrogen pressure = 1 atm; pH 7)

4) Calculate the grams of metal formed for each of the following reductions assuming that a current of 6.00 amperes is applied for 10.0 minutes.

a) $Ag^+ + e^- \rightarrow Ag$
b) $Ni^{+2} + 2e^- \rightarrow Ni$
c) $Cr^{+3} + 3e^- \rightarrow Cr$

Oxidations		Reductions	
	Voltage		Voltage
$K \rightarrow K^+ + e^-$	+2.93	$2HClO + 2H^+ + 2e^- \rightarrow Cl_2 + 2H_2O$	+1.63
$Al \rightarrow Al^{+3} + 3e^-$	+1.66	$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{+2} + 4H_2O$	+1.51
$Zn \rightarrow Zn^{+2} + 2e^-$	+0.76	$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	+1.23
$Cr \rightarrow Cr^{+3} + 3e^-$	+0.74	$Br_2 + 2e^- \rightarrow 2Br^-$	+1.09
$Fe \rightarrow Fe^{+2} + 2e^-$	+0.44	$SO_4^{-2} + 2H^+ + 2e^- \rightarrow SO_3^{-2} + H_2O$	+0.90
$Ni \rightarrow Ni^{+2} + 2e^-$	+0.23	$I_2 + 2e^- \rightarrow 2I^-$	+0.54
$Pb \rightarrow Pb^{+2} + 2e^-$	+0.13	$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$	+0.40
$Fe \rightarrow Fe^{+3} + 3e^-$	+0.04	$NAD^+ + H^+ + 2e^- \rightarrow NADH$	+0.10
$Cu^+ \rightarrow Cu^{+2} + e^-$	-0.15	$NO_3^- + 2H^+ + 2e^- \rightarrow NO_2^- + H_2O$	+0.01
$Cu \rightarrow Cu^{+2} + 2e^-$	-0.34	$2H^+ + 2e^- \rightarrow H_2$	0.00
$Fe^{+2} \rightarrow Fe^{+3} + e^-$	-0.77	$S + 2e^- \rightarrow S^{-2}$	-0.48
$Ag \rightarrow Ag^+ + e^-$	-0.80	$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$	-0.83

Answers

2a) 0.46 V; -1.78×10^5 J/mole O_2; 1.26×10^{31}

b) 2.10 V; -4.05×10^5 J/mole H_2; 9.78×10^{70}

c) 0.77 V; -1.49×10^5 J/mole Zn; 1.07×10^{26}

3a) 1.13 V b) 0.13 V c) 0.414 V

4a) 4.03 g Ag b) 1.09 g Ni c) 0.647 g Cr