This is ACA # 34. It is OK to use your textbook, but if you can answers the questions without it that is OK too.

I recommend you print out this page and bring it to class. Click here to show a set of five ACA34 student responses, randomly selected from all of the student responses thus far, in a new window.

John , here are your responses to the ACA and the Expert's response.

For this ACA we will use this short version of the Standard Reduction Potential Table. For some of the questions you may need the more extensive SRP Table on page A-14 in Appendix D in your textbook. You might want to print the table out before beginning the ACA.

Answer the following questions using the SRP Table.

1. Write the balanced chemical equation given the following reactants

a) Fe(s) + HNO_3(aq) ---->

H_2 12.5% Fe^{3+} 12.5%

Fe^2+(aq) + NO(g) + H2O(l) 38%

Half-reaction	E° (volts)
$3Fe(s) \longrightarrow 3Fe^{2+}(aq) + 6e^-$	+0.44
$6e^- + 2NO_3^-(aq) + 8H^+(aq) \longrightarrow 2NO(g) + 4H_2O(l)$	+0.96
$3Fe(s) + 2NO_3^-(aq) + 8H^+(aq) \longrightarrow 3Fe^{2+}(aq) + 2NO(g) + 4H_2O(l)$	+1.40

b) Ni(s) + HCl(aq) ----> 50%

Ni^2+(aq) + H2(g)

Half-reaction	E° (volts)
$Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^-$	+0.25
$2e^- + 2H^+(aq) \longrightarrow H_2(g)$	+0.00
$Ni(s) + 2H^+(aq) + 2Cl^-(aq) \longrightarrow Ni^{2+}(aq) + H_2(g) + 2Cl^-(aq)$	+0.25
$Ni(s) + 2HCl(aq) \longrightarrow NiCl_2(aq) + H_2(g)$	+0.25

c) $Cu(s) + H_2O(l) \longrightarrow$

no reaction 17%

Half-reaction	E° (volts)
$Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$	-0.34
$2e^- + 2H_2O(l) \longrightarrow H_2(g) + 2OH^-(aq)$	-0.83
No reaction	-1.17

2.The following liquids or solutions are electrolyzed between inert electrodes. Write the half-reaction that occurs at the anode and at the cathode, and the overall reaction.

a) $CaCl_2(l)$

oxidation half-reaction 2Cl^-(aq) ---> Cl2(g) + 2e^- 37.5%

$2Cl^-(l) \longrightarrow Cl_2(g) + 2e^-$

E° = -1.36 volts

reduction half-reaction Ca^2+(l) + 2e^- --> Ca(l) 37.5%

$Ca^{2+} + 2e^- \rightarrow Ca$ 17%

$Ca \rightarrow Ca^{2+} + 2e^-$ 25%

$2Cl^- \rightarrow Cl_2 + 2e^-$ 12.5%

$Cl_2 \rightarrow 2Cl^- + 2e^-$ 31%

$Ca^{2+}(l) + 2e^- \text{----> } Ca(s)$

E° = -2.87 volts

overall reaction Ca^2+(l) + 2Cl^-(l) --> Ca(l) + Cl2(g) 17%

$CaCl_2 \rightarrow Ca^{2+} + 2Cl^-$ 37.5%

$Ca^{2+}(l) + 2Cl^-(l) \text{----> } Ca(s) + Cl_2(g)$

b) NaI(l)

oxidation half-reaction 2I^-(aq) ---> I2(s) + 2e^-

$2I^-(l) \text{----> } I_2(s) + 2e^-$ 31%

$Na \rightarrow Na^+ + 1e^-$ 25%

E° = -0.53 volts

reduction half-reaction Na^+(l) + 1e^- --> Na(l)

$2Na^+(l) + 2e^- \text{----> } 2Na(l)$ 37%

E° = -2.71 volts

overall reaction 2Na^+(l) + 2I^-(l) --> 2 Na(l) + I2(g)

$2Na^+(l) + 2I^-(l) \text{----> } 2Na(l) + I_2(s)$ 50%

c) When an aqueous solution of $CaCl_2$ is electrolyzed between inert electrodes not only can the cation and anion react, but water can also. Write two possible half-reactions that can occur at the anode and at the cathode and enter the standard cell potential, E^o, for each half-reaction.

half-reaction		E^o
oxidation	2Cl^-(aq) ---> Cl2(g) + 2e^- $2Cl^-(l) \text{----> } Cl_2(g) + 2e^-$ 37.5% 2H2O(l) ---> O2(g) + 4H^+(aq)+ 4e^-	-1.36 v E° = -1.36 volts -1.23 v

	$2H_2O(l)$ ----> $O_2(g) + 4H^+(aq) + 4e^-$ 50%	E° = -1.23 volts
reduction	$Ca^{2+}(l) + 2e^-$ ----> $Ca(s)$ 37.5% 2H2O(l) + 2e^- ---> H2(g) + 2OH^-(aq) $2e^- + 2H_2O(l)$ ----> $H_2(g) + 2OH^-$ (aq) 31.5%	v E° = -2.87 volts -0.83 v E° = -0.83 volts

d) Which half-reaction will occur at the anode? 2H2O(l) ---> O2(g) + 4H^+(aq)+ 4e^-

$2H_2O(l)$ ----> $O_2(g) + 4H^+(aq) + 4e^-$ 31.5%

e) Which half-reaction will occur at the cathode? 2H2O(l) + 2e^- ---> H2(g) + 2OH^-(aq)

$2e^- + 2H_2O(l)$ ----> $H_2(g) + 2OH^-(aq)$ 25%

To select the half-reaction that occurs at either electrode, we identify the half-reaction with the more positive cell potential. So at the anode E° = -1.23 volts is more positive then E° = -1.36 volts, similarly at the cathode E° = -0.83 volts is more positive then E° = -2.87 volts.

3. Is there anything about the questions that you feel you do not understand? List your concerns/questions.

nothing

4. If there is one question you would like to have answered in lecture, what would that question be?

nothing