This is ACA # 31. 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 ACA31 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. You might want to print the table out before beginning the ACA.

Answer the following questions using the SRP Table.

1. Identify the species (name and/or formula) from the table above that is the most likely to be oxidized.

Li(s) 67%

27% Li^+
6% F_2

Lithium, Li is the most likely species to be oxidized in this table.

2. Identify the species (name and/or formula) from the table above that is the most likely to be reduced.

F2(g) 73%

6% F^-
6% F

Fluorine, F_2 is the most likely species to be reduced in this table.

We can use the Standard Reduction Potential Table to calculate the E° for a reaction. For example, we measured E° for a reaction $Zn(s) + Cu^{2+}(aq) \longrightarrow Cu(s) + Zn^{2+}(aq)$ in a BCE this week. We can calculate the E° the following way;

i) separate the reaction into its corresponding half-reactions;

ii) The oxidation half-reaction occurs at the anode and the reduction half-reaction occurs at the cathode:

iii) look up the E° for the half-reaction in the Standard Reduction Potential Table;

iv) calculate E° using the relationship $E° = E°_{cathode} - E°_{anode}$

So for the reaction $Zn(s) + Cu^{2+}(aq) \longrightarrow Cu(s) + Zn^{2+}(aq)$

the half-reactions are

$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$ (oxidation at the anode)

$2e^- + Cu^{2+}(aq) \longrightarrow Cu(s)$ (reduction at the cathode)

From the SRP Table the E° for the half-reactions are

Half-reaction	E° (volts)
$2e^- + Cu^{2+}(aq) \longrightarrow Cu(s)$	+0.34
$Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$	-0.76

We determine E° for the reaction by using the equation $E° = E°_{cathode} - E°_{anode} = +0.34\ v - (-0.76\ v) = +1.10\ v$

So E° = +1.10 v

3. Using the Table of Standard Reduction Potentials determine whether each of the following reactions has a positive E° (standard cell potential) or a negative E°.

a) $2Cl^-(aq) + Cu^{2+}(aq) \longrightarrow Cl_2(g) + Cu(s)$: E° = -1.05 volts 48%

6% 1.36v Cl_2 only
18% 1.70v adding both.
12% ?
12% 1.02v

Half-reaction	E° (volts)
$Cl_2(g) + 2e^- \longrightarrow 2Cl^-(aq)$	+1.36
$2e^- + Cu^{2+}(aq) \longrightarrow Cu(s)$	+0.34

$Cl^-(aq)$ is being oxidized and $Cu^{2+}(aq)$ is being reduced, then

$E° = E°_{cathode} - E°_{anode}$ = +0.34 v - (+1.36 v) = -1.02 v

A negative (E° = -1.02 V) cell potential for this reaction means it is not thermodynamically favored, it will not occur. So chlorine ion with an E° = -1.36 volts is NOT very reactive.

b) $Mg(s) + Ca^{2+}(aq) \longrightarrow Ca(s) + Mg^{2+}(aq)$: E° = -0.50 volts 53%

18% +0.50v
6% -5.13v
18% ?

Half-reaction	E° (volts)
$Mg^{2+}(aq) + 2e^- \longrightarrow Mg(s)$	-2.37
$2e^- + Ca^{2+}(aq) \longrightarrow Ca(s)$	-2.87

Mg(s) is being oxidized and Ca^{2+}(aq) is being reduced, then

$E° = E°_{cathode} - E°_{anode}$ = -2.87 v - (-2.37 v) = -0.50 v

negative (E° = -0.50 V) this reaction is not thermodynamically favored, it will not occur.

c) $H_2O_2(aq) + 2H^+(aq) + 2Br^-(aq) \longrightarrow 2H_2O(l) + Br_2(g)$: E° = +0.70 volts 66%

12% +2.84v
18% ?

Half-reaction	E° (volts)
$Br_2(l) + 2e^- \longrightarrow 2Br^-(aq)$	+1.07
$2e^- + H_2O_2(aq) + 2H^+(aq) \longrightarrow 2H_2O(l)$	+1.77

Br^-(aq) is being oxidized and H_2O_2(aq) in H^+(aq) is being reduced, then

$E° = E°_{cathode} - E°_{anode}$ = +1.77 v - (+1.07 v) = +0.70 v

positive (E° = +0.70 V) this reaction is thermodynamically favored, it will occur.

4. Will Pb(s) reduce Ag^{+}(aq)? Explain.

Calc. E°

Yes

60%

Yes.

The E° for the reaction is +0.93 volts

Half-reaction	E° (volts)
$Pb^{2+}(aq) + 2e^{-} \longrightarrow Pb(s)$	-0.13
$2e^{-} + 2Ag^{+}(aq) \longrightarrow 2Ag(s)$	+0.80

$2Ag^{+}$ is +1.60 V

Pb is lower on the SRP
Ag is higher " " "

For lead to reduce silver(I) ion, then lead must be oxidized. Lead metal will reduce silver(I) ion, the reaction $Pb(s) + 2Ag^{+}(aq) \longrightarrow Pb^{2+}(aq) + 2Ag(s)$ has a positive E°.

$E° = E°_{cathode} - E°_{anode} = +0.80\ v - (-0.13\ v) = +0.93\ v$

5. Will 1 M HNO_3 oxidized Cu(s)? Explain.

67%

If is oxidized
E° for H is 0

Calculate E°

Y

Yes.

The E° for the reaction is +0.62 volts

Half-reaction	E° (volts)
$Cu^{2+}(aq) + 2e^{-} \longrightarrow Cu(s)$	+0.34
$3e^{-} + NO_3^{-}(aq) + 4H^{+}(aq) \longrightarrow NO(g) + 2H_2O(l)$	+0.96

For HNO_3 to oxidized Cu(s) the HNO_3 must be reduced. The reaction $3Cu(s) + 2NO_3^{-}(aq) + 8H^{+}(aq) \longrightarrow 3Cu^{2+}(aq) + 2NO(g) + 4H_2O(l)$ has a positive E° =+0.62 volts.

$E° = E°_{cathode} - E°_{anode} = +0.96\ v - (+0.34\ v) = +0.62\ v$

6. Will 1 M HCl oxidized Cu(s)? Explain.

67% Cl⁻ will not be oxidized

No

No

Calc E°

The cell potential is -0.34 v

The E° for $Cu(s) + 2H^+(aq) \text{---->} Cu^{2+}(aq) + H_2(g)$ is negative, so the reaction will not occur.

7. Identify a reagent that will oxidize Zn(s) but will not oxidize Pb(s).

Sn^2+ or Ni^2+

40%

Either $Sn^{2+}(aq)$, $Ni^{2+}(aq)$, $Co^{2+}(aq)$ or $Fe^{2+}(aq)$, because the E° for the reaction of any of these ions will produce a positive E° for Zn(s) and a negative E° for Pb(s).

8. Predict the products of the following reaction; $Pb(s) + Cr_2O_7^{2-}(aq) + H^+(aq) \text{---->}$

3Pb(s) + Cr2O7^2-(aq) + 14H^+(aq) ----> 3Pb^2+(aq) + Cr^3+(aq) + H2O(l)

$Pb^{2+}(aq)$, $Cr^{3+}(aq)$ and $H_2O(l)$

30%

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

nothing

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

nothing

Does a greater SRP mean it can or cannot oxidize a substance?

Do mol or molarity dictate how well it oxidizes/reduce

I feel like there is a lot we haven't covered!!

recognize ox/red — Balancing redox rxn

half-rxn has a metal/does not have a metal — Describing/explaining an electrochemical cell

many, many different ways to ask this!! — Calc. $E° = E°_{cathode} - E°_{anode}$