This is BCE#31.

I recommend you print out this page and bring it to class. Click here to show a set of five BCE30 student responses randomly selected from all of the student responses thus far in a new window.

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

For this BCE we will use this short version of the Standard Reduction Potential Table. You might want to print the table out before beginning the BCE.

1. The standard cell potential for the reaction

$$Zn(s) + Cu^{2+}(aq) \text{ ----> } Zn^{2+}(aq) + Cu(s)$$

E^o = +1.10 volts. Answer the following questions about this electrochemical cell.

a) Write the half-reaction that occurs at the zinc electrode;

Zn(s) --> Zn^2+ + 2e^- 100%

The half-reaction at the zinc electrode (the anode) is Zn(s) ---> Zn^{2+}(aq) + 2e-

b) Does the mass of the zinc electrode increase, decrease or remain constant when the electrochemical cell discharges?

decreases 81%

The of the zinc electrode must decrease.

c) Explain why the mass changes the way you have indicated in part 1b).

atom of the electrode are oxidized/ose 2 electrons and the ion enters the solution, so th e mass must decrease.

Oxidation of zinc atoms in the solid phase occurs at the zinc electrode. When a zinc atom is oxidized the zinc atom loses two electrons (remember electrons have a very, very small mass) that remain on the electrode and the Zn^{2+} ion that is produced is surrounded by water molecules and moves into the solution. As more Zn atoms are

oxidized this process continues and the mass of the Zn electrode decreases.

2. The equilibrium constant for the reaction in Question 1 is 1.6 x 10^{37}.

a) Which direction does the reaction proceed when the electrochemical cell discharges? Left to right, right to left, or no reaction occurs.

Left to right 55%

The reaction proceeds from left to right as written.

b) Explain why the reaction proceeds in the direction you have indicated in part 2a).

Q = 1 initially, so the amounts of products will increase and the reactant amounts will decrease to increase Q up to K.

Since the initial concentration of Zn^{2+} ions and of Cu^{2+} ions is 1.00 M, then Q = 1. Since K is much, much larger then Q the reaction must proceed from left to right to reach equilibrium.

3. In the table below are data collected during the discharge of the electrochemical cell.

Experiment #	$[Zn^{2+}]$ (M)	$[Cu^{2+}]$ (M)	$\log([Zn^{2+}]/[Cu^{2+}])$	E_{cell}(volts)
	1.00	1.00	0	+1.100
1	1.10	0.90	0.0872	+1.097
2	1.20	0.80	0.1761	+1.095
3	1.30	0.70	0.2688	+1.092

a) What is happening to the E^{o}_{cell} going from Experiment #1 to Experiment #3?

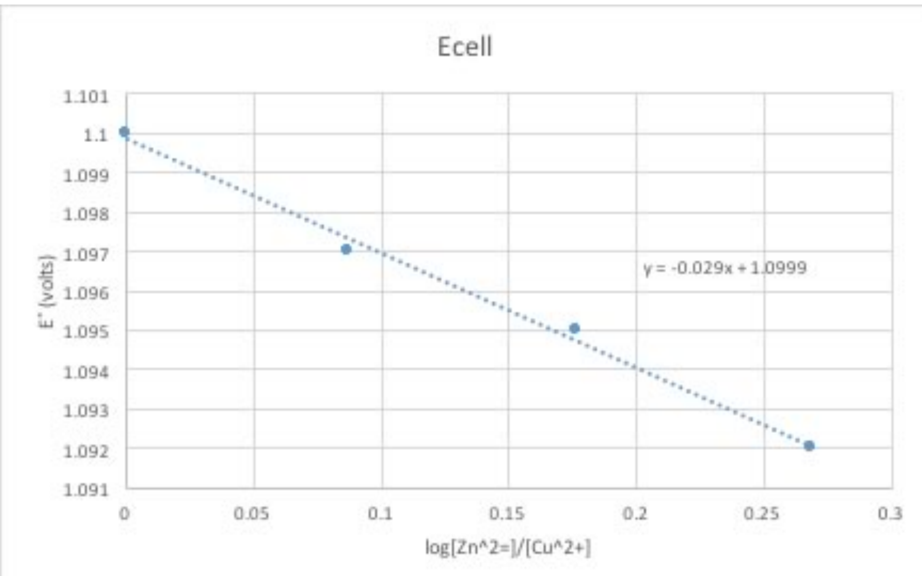
it is decreasing 91%

According to the table, going from Experiment #1 to Experiment #3, E_{cell} is decreasing as the electrochemical cell discharges.

b) What is the slope of the line when you plot E_{cell} (y-axis) versus log([Zn^{2+}]/[Cu^{2+}]) (x-axis). (NOTE: Copy and paste the two columns into Excel and do a 'marked scatter plot', then right click on one of the data points and add the trend line and select the option of showing the equation for the line. You have had to do this about four times in laboratory this semester.)

slope = y = -0.029x + 1.0999 64%

The slope of the line is -0.0291 volts (see the plot below).



c) In another experiment the [Cu^{2+}] = 0.357 M. What is the [Zn^{2+}] in this same experiment?

20% ; .643 the change

[Zn^{2+}] = 1.643 **M** 64%

	Zn(s) +	Cu^{2+}(aq)	---->	Zn^{2+}(aq) +	Cu(s)
Initial	-	1.00 M		1.00 M	-
Change	-				-
Ending	-	0.357 M		?	-

Since the ending amount of Cu^{2+} is 0.357 M, and we know the Initial amount of Cu^{2+} is 1.00 M, the Change amount is -0.643 M. The stoichiometric ratio of Cu^{2+} to Zn^{2+} is 1:1 so the ratio of the Change amounts must be the same, so the Change amount for Zn^{2+} +0.643 M. So the ICE table looks like.

	Zn(s) +	Cu^{2+}(aq)	---->	Zn^{2+}(aq) +	Cu(s)
Initial	-	1.00 M		1.00 M	-
Change	-	-0.643 M		+0.643 M	-
Ending	-	0.357 M		1.643 M	-

d) Using the equation for the line that you obtained when you plotted the data, calculate the E^o_{cell} for the experiment in part 3c.

E^o_{cell}= 1.08 volts 73%

The equation for the line generated by plotting E^o_{cell} (y-axis) versus log([Zn^{2+}]/[Cu^{2+}]) (x-axis) is y = -0.0296x + 1.1

x = log([Zn^{2+}]/[Cu^{2+}]) = log([1.643]/[0.357]) = 0.663

y = -0.0296*(0.663) + 1.1 = 1.080 volts

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

nothing

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

nothing