Electrochemical Cells Worksheet

As you work through the steps in the lab procedures, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Data Table A. Cell Potentials vs a Zn^{2+}/Zn (0.1 M) Couple

Half-Cell	Potential Difference, mV
Ag^{+}/Ag (0.1 M)	
Ag^{+}/Ag (0.1 M)†	
Pb^{2+}/Pb (0.1 M)	
Cu^{2+}/Cu (0.1 M)	

†Leads switched

In your first measurement since the Zn^{2+}/Zn (0.1 M) redox couple is the reference, does your test Ag^{+}/Ag (0.1 M) redox couple have a more positive or more negative reduction potential than zinc?

Given your response to the first question, which half-cell is the anode?

Select all of the following that are true about your Zn-Ag cell. (Select all that apply. *Note: The order of these options may be different in the WebAssign question.*)

- Ag is getting oxidized.
- Zn is getting oxidized.
- Electrons travel away from the Zn half-cell.
- Zn is losing electrons.
- Ag^+ is gaining electrons.
- Electrons travel away from the Ag half-cell.
- Zn^{2+} is getting reduced.
- Ag is losing electrons
- Ag^+ is getting reduced.
- Electrons travel toward the Ag half-cell.
- Electrons travel toward the Zn half-cell.
- Zn^{2+} is gaining electrons.

In your second measurement, how does the voltage differ from the first measurement?

Write a net chemical equation for the overall reaction in the Zn-Cu cell (spontaneous, left to right). (Omit states-of-matter from your answer. Use the lowest possible whole number coefficients.)

Predict whether the potential of the cell using the 0.1 M Zn^{2+} solution and the diluted copper solution will be more positive or less positive than the standard potential you measured in Part A.

Select all of the following that are true about your Zn-diluted Cu cell. (Select all that apply. *Note: The order of these options may be different in the WebAssign question.*)

- The reaction quotient, Q, is greater than 1.
- The amount of a reactant has been reduced so the potential increases.
- The amount of a reactant has been increased so the potential increases.
- The reaction quotient, Q, is less than 1.
- The amount of a reactant has been increased so the potential decreases.
- The cell potential, E_{cell}, is equal to the standard cell potential, E°_{cell}.
- The cell potential, E_{cell}, is greater than the standard cell potential, E°_{cell}.
- The cell potential, E_{cell}, is less than the standard cell potential, E°_{cell}.
- The amount of a reactant has been reduced so the potential decreases.

Complete the following table.

Data Table B. Cell Potentials vs a Zn^{2+}/Zn (0.1 M) Couple

Half-Cell	**Potential Difference, mV**
Cu^{2+}/Cu diluted solution	
Cu^{2+}/Cu after addition of KOH	

Did the potential shift in the direction you predicted in the previous question?

Write a net chemical equation for the reaction that took place when KOH was added. (Remember the solubility rules for precipitation reactions. Omit states-of-matter from your answer. Use the lowest possible whole number coefficients.)

Select all of the following that are true about your Zn-diluted Cu plus KOH cell. (Select all that apply. *Note: The order of these options may be different in the WebAssign question.*)

- The reaction quotient, Q, remained the same.
- $[Cu^{2+}]$ increased.
- The cell potential, E_{cell}, decreased.
- $[Cu^{2+}]$ decreased.
- The reaction quotient, Q, increased.
- The cell potential, E_{cell}, remained the same.
- The amount of a reactant increased so the potential increased.
- The amount of a reactant decreased so the potential decreased.
- The amount of a reactant decreased so the potential increased.
- The amount of a reactant increased so the potential decreased.
- The cell potential, E_{cell}, increased.
- The reaction quotient, Q, decreased.
- $[Cu^{2+}]$ remained the same.

Complete the following table.

Data Table C. Cell Potentials for Ascorbic Acid vs a Cu^{2+}/Cu (0.1 M) Couple

pH	**Potential Difference, mV**
7	
5	

What is the color of lead to copper?

What is the color of lead to graphite?

Write a net chemical equation for the overall reaction for this cell (spontaneous, left to right). The ascorbic acid half reaction is given in the background section of this experiment. Use the chemical formulas for dehydroascorbic acid and ascorbic acid. (Omit states-of-matter from your answer. Use the lowest possible whole number coefficients.)

Select all of the following that are true about your Cu-ascorbic acid cell. (Select all that apply. *Note: The order of these options may be different in the WebAssign question.*)

- The reaction quotient, Q, is equal to $([C_6H_8O_6])/([Cu^{2+}][C_6H_6O_6][H^+]^2)$.
- The reaction quotient, Q, is equal to $([C_6H_6O_6][H^+]^2)/([Cu^{2+}][C_6H_8O_6])$.
- When the pH is changed from 7 to 5, the reaction quotient increases.
- When the pH is changed from 7 to 5, the E_{cell} increases.
- When the pH is changed from 7 to 5, the reaction quotient decreases.
- When the pH is changed from 7 to 5, the E_{cell} decreases.
- The reaction quotient, Q, is equal to $([Cu^{2+}][C_6H_8O_6])/([C_6H_6O_6][H^+]^2)$.