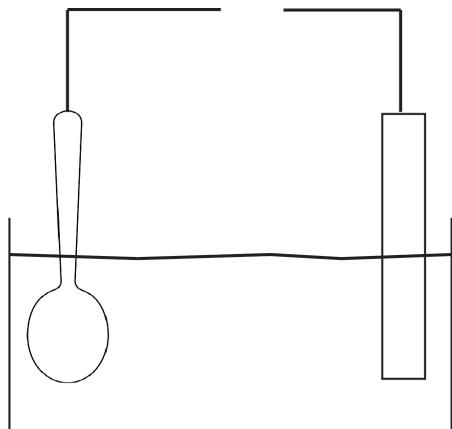


Model 6: Diagram of an electrolytic cell and some standard reduction potentials.



Standard Reduction Potentials at 25°C

| | $E^\circ(\text{V})$ |
|---------------------------------------------------------------------------|---------------------|
| $\text{Au}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Au}(\text{s})$ | +1.50 |
| $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$ | +0.80 |
| $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$ | +0.34 |
| $\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$ | -0.44 |
| $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$ | -0.76 |
| $\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Al}(\text{s})$ | -1.66 |
| $\text{Mg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mg}(\text{s})$ | -2.37 |

2. A _____ metal electrode and a copper spoon are placed in 1.00 M aqueous zinc nitrate solution. The electrodes are connected to a battery capable of passing a current of 8.00 amperes. The goal is to plate zinc metal on the copper spoon. Go to the Experiment section of the *Electrolysis Computer Simulation* and set up an electrolysis cell designed to deposit zinc metal onto copper. Use the computer simulation to help you diagram the components of your cell (above) and to help answer the following questions.

a. Write the chemical reaction representing copper metal reacting with 1.00 M zinc nitrate to produce zinc metal and copper(II) nitrate. Calculate E°_{cell} for this reaction. Is this reaction spontaneous or nonspontaneous?

b. Write the half-reaction occurring at the spoon electrode.

c. In order to plate zinc metal onto the spoon, which terminal of the battery (positive or negative end) will you connect the spoon? Indicate this on the diagram. Explain.

d. In order to plate zinc onto the spoon, the other electrode should be what type of metal? Which terminal of the battery (positive or negative end) will you connect this electrode? Put this information on your diagram. Write the half-reaction occurring at this metal electrode.

e. Run your computer simulation and use it to diagram your electrolysis cell. Indicate on the diagram above i.) the cathode, ii.) the anode, iii.) the direction of electron flow in this cell, iv) what hops on or hops off at each electrode (click-on the magnifying glass symbol), v.) which electrode gains mass, which loses mass.

f. Calculate the mass of zinc deposited when 8.00 Amps are forced into the cathode for 15.0 minutes. Compare this mass to the mass you calculated in 1f. Compare these moles to the moles you calculated in 1f. Comment?