Chemistry 12

Lab: Electrolytic Cells

Name:

Block:

Introduction:

Electrolytic cells require an external source of electrical energy that "forces" a non-spontaneous redox reaction to occur. In electrolytic cells, electrical energy produces a chemical change.

Electrolytic cells are important to the chemical process industries involved in the production of pure metals and gases. Another application of electrolytic cells is in the protection and beautification of metals by silver plating or chrome plating.

For each cell, it will be helpful if you can identify the anode and cathode in advance. In electrolytic cells, the electrodes are determined by the external power supply, which has two terminals, one positive and one negative. Since the negative terminal has a surplus of electrons, it will provide this surplus to any electrode to which it is connected. This electrode consequently becomes the cathode of the electrolytic cell, since reduction can occur only where there is a supply of electrons.

Fill in the Blanks:

Draw the electrolytic cell, including the half-reactions occurring within it:

$NaCl_{(aq)}$ in lead electrodes

Objectives:

1. To electrolyze a $ZnSO_4$ solution using carbon electrodes.

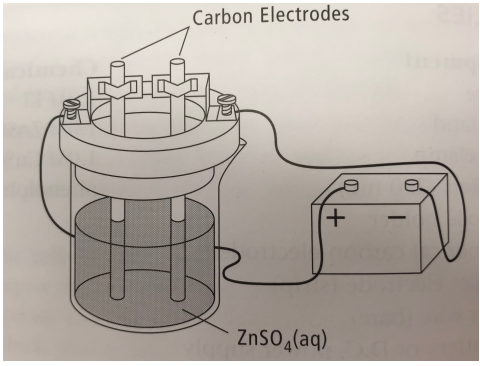
2. To copper plate a metal object.

3. To interpret the products of each electrolytic cell with anode and cathode half-reactions.

Procedure:

Part I: Electrolysis of 1.0M $ZnSO_4$

1. Obtain a clean glass jar and fill it halfway with 1.0M $ZnSO_4$ solution.
2. Clean two carbon electrodes with sandpaper to remove any surface coatings and then wipe the electrodes clean with a paper towel.
3. Insert the cylindrical carbon electrode in each side of the holder. Place the electrode holder on the glass jar.

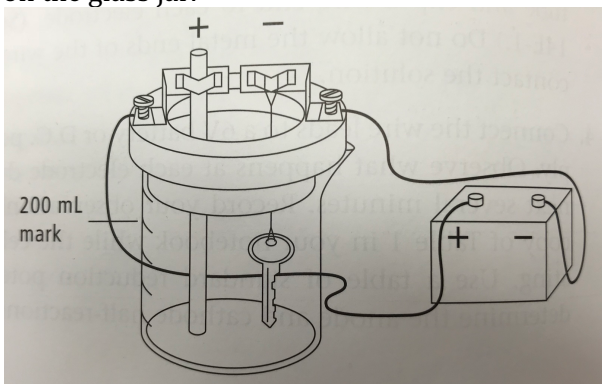


4. Attach wires to the electrode holder. Connect the wires to a power supply.
5. Turn on the power supply.

6. Observe what happens at each electrode during the next several minutes. Do not operate the cell longer than 5 minutes as the carbon electrodes could start to flake apart.
7. Record your observations in the data table provided.
8. Disconnect the wires, first from the power supply, then from the electrodes.
9. Turn off the power supply.
10. Remove the electrodes and use the piece of sandpaper to remove any surface coatings and then wipe the electrodes clean with paper towel.
11. Return the $ZnSO_4$ solution to the containers provided by your instructor.
12. Rinse the glass jar with water. Take a bow! You have finished Part I. You're almost there!!

<u>Part II: Copper Plating</u>

1. Obtain a clean glass jar and fill it halfway with 1.0M $CuSO_4$ solution.
2. Prepare the object you brought for plating by polishing it with sandpaper. Remove any surface film so that the copper plating will adhere more effectively. After cleaning the object, avoid touching it with your fingers.
3. Measure the mass of your object and record the value.
4. Insert a strip of copper metal into one side of the electrode holder.
5. Use the piece of bare copper wire to suspend the metal object from the other terminal of the electrode holder.
6. Place an electrode holder on the glass jar.



7. Attach wires to the electrode holder. Connect the wires to the power supply. **Connect the object to be plated to the <u>negative terminal (black)</u> of the power supply and connect the copper electrode to the positive terminal (red) and turn on the power supply.**
8. Turn on the power supply.
9. Observe what happens at each electrode over the next several minutes and record your observations.
10. Disconnect the wire, first from the power supply, then from the electrodes.
11. Turn off the power supply.
12. Remove both electrodes from the solution.
13. Rinse the plated object and the copper electrode and pat it dry with a paper towel.
14. Measure the new mass of your object and record the value. (There may not be a significant change in mass.)
15. Return the $CuSO_4$ solution to the containers provided by your instructor.
16. Rinse the glass jar and beaker with water.
17. Before leaving the laboratory, wash your hands thoroughly with soap and water.
18. Congratulations! You have completed your final lab for Chemistry 12! Take an even deeper bow and congratulate every person in your class.