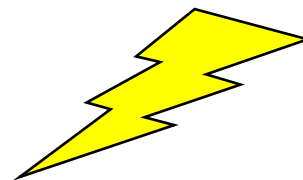


Electron Charge Lab



Name _____

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Introduction

Electrochemistry deals with the relation of the flow of electric current to chemical changes. It also deals with the conversion of chemical to electrical energy and electrical to chemical energy. The two main branches of electrochemistry are electrolysis and the electrochemical cell. During electrolysis, electrical energy is converted to chemical energy. During the operation of an electrochemical cell, the reverse takes place; chemical energy is converted to electrical energy.

In this lab we will calculate the experimental charge on one electron. We will set up an electrochemical cell with copper electrodes. A circuit will be constructed that allows a constant amount of current to pass through the cell. The charge on an electron may be calculated by plating copper ions for a specific amount of time. One ampere is equal to one coulomb per second.

$$\text{One Ampere} = \frac{\text{One Coulomb (C)}}{\text{Second}}$$

Therefore, the charge administered to the plate is equal to the current multiplied by the time in seconds. A digital multimeter will be used to measure the current level throughout the experiment. A computer power system will be used that delivers a steady 5.00 volts at less than 1.00 ampere of current. Computer power supplies give excellent current readings over long periods of time with very little over heating of the circuit. These power supplies are very inexpensive and can be found in any desktop computer. A built in fan cools the power supplies. As the load on the fan increases the fan spins faster minimizing over heating effects.

Purpose

Experimentally determine the charge on an electron and compare your observed value with the expected value.

Safety

Lab goggles are required for this lab and should be worn during the plating process.

Procedure

- 1) Mass the center copper electrode and record its value in the data table.
- 2) Set up the circuit shown in the diagram. Fill the glass cup about three-quarters full of copper (II) sulfate solution. (Ten milliliters of 0.1 M sulfuric acid has been added to 1 L of the copper (II) sulfate solution to enhance the conductivity of the solution.)
- 3) Turn on the power supply and set the digital multimeter to read in amperes. Continue to watch the ammeter to be sure the amperage remains steady throughout the entire experiment. Record the average ammeter reading for the time you plated copper. You may also measure your current readings using a TI calculator and a Vernier current probe.
- 4) Allow the plating process to continue for 15 to 20 minutes.
- 5) After 15 to 20 minutes turn off the power supply and carefully remove the negative electrode. The electrode should appear a bright copper color indicating that copper has been plated to the electrode. Allow the negative electrode to dry then mass the electrode on the digital balance. Record the new mass in the data table and complete the calculations that follow.

Calculations

Mass of Plate #1 before plating: _____ g Mass of Plate #2 before plating: _____ g
Mass of Plate #1 after plating: _____ g Mass of Plate #2 after plating: _____ g
Mass of Cu on Plate #1: _____ g Mass of Cu removed from plate #2: _____ g
Record the Ampere Reading: _____ A Plating Time: _____ seconds

1) Convert grams of Cu plated to moles of Cu.

2) Convert moles of Cu to atoms of Cu.

3) Convert atoms of Cu^{2+} to total electrons plated.

4) Calculate the total charge on the plate based on the time in seconds and the ampere reading on the meter.

$$\text{One Ampere} = \frac{\text{One Coulomb (C)}}{\text{Second}}$$

5) Divide total charge on the plate by the total electrons plated to calculate the charge on one electron.

