Experiment
Colorimetric Determination of Copper Ions in Solution

Objective
To become familiarized with the principles of colorimetric analysis

Equipment/Materials
Balance  cuvettes
50 ml volumetric flask  10 ml pipet
Spectrophotometer  Lab Pro/Computer Colorimeter Sensor
Copper (II) Sulfate Pentahydrate  Distilled water

Advanced Study Assignment
1. Copper (II) sulfate is a soluble salt (strong electrolyte). Write a balanced net ionic equation to show the dissociation of this salt in water.
2. Show the calculations for preparing 50.00 ml of 0.250 M Copper 2+ ion solution (which we will refer to as your stock solution) using the salt copper (II) sulfate pentahydrate.
3. The figure below shows the absorption spectrum for Copper 2+ ions in aqueous solution. Identify the wavelength of maximum absorbance and the color of visible light corresponding to this wavelength.

4. Show the dilution calculation for preparing 50.00 ml of 0.0500 M Copper 2+ ion solution from your stock solution.
5. Show sketches of test tubes and calculations for preparing five (8:10) dilutions of your stock 0.250 M Cu 2+ solution.

Procedure
1. Mass out the appropriate quantity of copper (II) sulfate pentahydrate to prepare your stock solution as determined in question 2 of your ASA.
2. Prepare the solution using a 50 ml volumetric flask.
3. Transfer your stock solution to a clean dry beaker to be used in a later step.
4. Rinse and dry your volumetric flask. Use your clean volumetric flask to prepare the solution described in question 4 of your ASA. Transfer 20 ml of this solution to a clean dry test tube to be used in a later step. Return the remainder of this solution to your instructor.

5. Set up 6 clean dry test tubes in your rack. Transfer 20 ml of your stock solution (from step 3) to the first tube, and use this stock to prepare a series of five (8:10) dilutions as described in question 5 of your ASA. Use a beral pipet (plastic dropper pipet) to transfer solution from each of the dilutions (and stock) to cube-shaped cuvettes.

6. Open the Logger Pro program on your computer and open the Beer’s Law experiment found in the Chemistry with Computers file. Follow the steps for calibrating the colorimeter to obtain data for the blue colored Copper 2+ ion solution.

7. Using the computer colorimeter sensor, take absorption readings for your stock and each of your dilutions. Prepare a data table (concentration and absorbance) in your lab notebook to accommodate your data.

The figure above shows a schematic representation of a spectrophotometer.

8. Prepare a standard curve in your lab notebook showing Absorbance vs. Concentration for Copper 2+ ions in solution.

9. Use a beral pipet to transfer solution from step 4 to a clean dry cuvette. Place this sample in the colorimeter and measure its absorbance. Use your standard curve to the theoretical concentration of this solution. Use the figure below as a guide.

10. Comparing your theoretical concentration in step 9 to the accepted value of 0.0500 M (from question 4 of your ASA), determine your simple % Error.