Lab #3: Solution Preparations

Objectives:

1. To accurately prepare solution from a solid solute.
2. To accurately prepare a dilute solution.

Hypothesis / Pre-lab Exercise:

1. Calculate the mass of $CuSO_4 \bullet 5H_2O_{(s)}$ needed to make a 100 mL of 0.375 M solution.
2. Determine the volume of a 0.180 M of $H_2SO_{4\,(aq)}$ needed to dilute the acid to a concentration of 0.00720 M with a final volume of 250 mL.

Materials:

Large Beaker (250 mL)	Funnel	1 Volumetric Flask (100 mL)	$CuSO_4 \bullet 5\ H_2O_{(s)}$
Small Beaker (150 mL)	Stirring Rod	1 Volumetric Flask (250 mL)	$H_2SO_{4\,(aq)}$ (0.180 M)
Electronic Balance	Pipet	Pipet Bulb	Deionized Water
Scoopula	Masking Tape	Wash Bottle	Hot Plate

Procedure:

A. Making 0.375 M of $CuSO_{4\,(aq)}$

1. Place the small 150 mL - beaker on the electronic balance, and calibrate it to zero.
2. Using the scoopula, carefully measured out the mass of $CuSO_4 \bullet 5\ H_2O$ needed for the solution (see Pre-lab exercise 1).
3. Pour about 40 mL of deionized water into the beaker containing the $CuSO_4 \bullet 5\ H_2O$. Using a stirring rod, dissolve as much of the copper (II) sulfate pentahydrate as possible. Leave the stirring rod in the beaker the whole time. Do not take it out.
4. Place the funnel into the 100 mL volumetric flask. Take the stirring rod and wash it thoroughly over the funnel with deionized water from a wash bottle. After washing, place the stirring rod on the table.
5. Carefully pour the content of the beaker into the 100 mL volumetric flask using a funnel.
6. Wash the small beaker and funnel with deionized water from a wash bottle. All washed fluid should be transferred to the volumetric flask during the actual washing. Be careful not to pass the mark on the volumetric flask.
7. Top up the volumetric flask with deionized water up to the mark. Cap the flask and shake. Label your solution with the chemical formula, concentration, and your name.

B. Diluting $H_2SO_{4\,(aq)}$:

1. With the large 250 mL - beaker, obtain around 50 mL of the 0.180 M $H_2SO_{4\,(aq)}$.
2. Using a pipet with the correct volume, wash it twice with the 0.180 M of sulfuric acid. Discard the washed acid as directed by your instructor.
3. Pipet the correct amount to the 250 mL volumetric flask.
4. Top up the volumetric flask with deionized water up to the mark. Cap the flask and shake. Label your solution with the chemical formula, concentration and your name.

Evaluation:

1. Explain why it is necessary to dissolve all the $CuSO_4 \bullet 5\ H_2O_{(s)}$ in the beaker with a significantly smaller volume of water before transferring to the volumetric flask.

2. Why is it necessary to wash the pipet twice with the 0.180 M of $H_2SO_{4\,(aq)}$ prior to the actual diluting? Specify what would happen to the final concentration if this step were omitted?

3. Explain the what would happen to the final concentration of $H_2SO_{4\,(aq)}$ if there is
   a. an air bubble in the pipet?
   b. water present in the volumetric flask when transferring from the pipet?

4. Create two multiple-choice questions. One with making solution out of a solid solute and the other that deals with dilution. Both questions should follow the guidelines below.
   - four choices – all choices must accompany an explanation of how one might arrive that answer.
   - questions do not have to be numerical. Conceptual or lab-technique questions are allowed.
   - correct answer should be indicated.

   Example:
   What is the mass required to make a 250 mL of 0.40 mol/L NaOH solution?
   A. 0.4 g (40.0 g/mol ÷ 250 mL ÷ 0.40 mol/L)
   B. 2.5 g (0.40 mol/L × 250 mL ÷ 40.0 g/mol)
   C. 4.0 g (0.40 mol/L × 0.250 L × 40.0 g/mol) – correct answer
   D. 25 g (40.0 g/mol × 0.250 L ÷ 0.40 mol/L)

Conclusion:
Summarize what you have learned from this lab.