EXPERIMENT 8 COMPOSITION OF A MIXTURE

Chem 110 Lab

I. INTRODUCTION

In today's experiment you will determine the composition, in percent by mass, of the two compounds in a mixture. The two compounds that comprise the mixture are:

NAME	FORMULA
silicon dioxide (sand)	SiO_2
copper (II) sulfate	$CuSO_4$.

To determine the composition of the mixture will require that you first separate the two compounds. To do this you will take advantage of a difference between the two compounds in one particular physical property—solubility in water. $CuSO_4$ is soluble in water while SiO_2 is not. After determining the mass of the mixture, you will add water to it. The $CuSO_4$ in the mixture will dissolve in the water but the SiO_2 will not. You will then separate the $CuSO_4$ from the SiO_2 by decanting the dissolved $CuSO_4$. The SiO_2 will then be dried and weighed.

You will report the composition of the mixture as percent by mass, which is calculated as follows:

$$\% SiO_2 = \frac{g\ SiO_2}{g\ mixture} \times 100$$

$$\% CuSO_4 = \frac{g\ mixture - g\ SiO_2}{g\ mixture} \times 100$$

II. Experiment

1. Weigh a clean dry evaporating dish and record its mass in Table 7.1 below.

2. Get an unknown mixture from your instructor. (What is unknown about the mixture is the relative amounts of $CuSO_4$ and SiO_2 in the mixture.) Pour the unknown mixture into the evaporating dish.

3. Observe and describe the appearance of the mixture _____

   _____

4. Weigh the unknown mixture in the evaporating dish. Read and record the mass of the evaporating dish plus mixture and record it in Table 7.1.

Table 7.1

	Mass
Evaporating Dish	
Evaporating Dish plus Unknown mixture	

4. Carefully transfer the entire unknown sample into a 400 mL beaker.

5. Add approximately 200 mL of deionized water to the mixture and stir. If after stirring some of the blue $CuSO_4$ remains undissolved, add 25 mL more deionized water and stir. Be sure that all of the $CuSO_4$ dissolves.

6. Allow the SiO_2 (sand) to settle, then carefully decant the liquid into a clean 250 mL beaker. Refer to Experiment 4 if you've forgotten how to decant. Be sure that no SiO_2 is transferred into the second beaker.

7. To wash the sand (remove any remaining blue $CuSO_4$ solution) add about 50 mL of deionized water and stir. Allow the sand to settle and then decant the wash water into the 250 mL beaker.

8. Wash the sand a second time, proceeding as you did in step 6 above. Wash the sand a third time, if necessary, to remove all of the blue $CuSO_4$ solution. When you are certain that all of the $CuSO_4$ has been removed from the sand and that no sand has been transferred to the 250 mL beaker, you may throw out the liquid.

9. Transfer all the sand to the evaporating dish, using the rubber policeman like a spatula. To remove and transfer the last few grains of sand from both the beaker and the rubber policeman to the evaporating dish, use a stream of deionized water.

10. Remove as much water as possible from the sand in the evaporating dish without removing any sand. Do this by first decanting the water into a beaker (not the sink). Then use a medicine dropper to draw off as much water as possible without removing any of the sand.

DRYING TO A CONSTANT MASS

You cannot tell by "looking" at the sand whether or not it is really dry. Therefore, you will "dry to a constant mass". To do this you will heat the sand until it looks dry, allow it to cool, and then weigh it. You will then reheat the sand, allow it to cool, and then reweigh it. If the mass has changed significantly upon reheating, your will heat the sand, cool and weigh a third time. You will continue in this fashion until two consecutive weighings yield similar masses. This is the only way to know that all of the water has been removed.

11. Set up a steam bath as you did in Experiment 4 (and 7). Dry the sand over the steam bath. NOTE: Use the evaporating dish tongs (located in the community locker) to handle the hot evaporating dish.

12. When the sand looks dry, stir it to check for dampness, being careful that no grains of sand stick to the stirring rod. If the sand still appears dry, remove it, dry the bottom of the dish with a paper towel, and allow it to cool completely (to room temperature) on the base of your ring stand. Weigh the evaporating dish and sand. Record the mass in Table 7.2 below

13. Reheat the sand for another 5 minutes. Cool and weigh as above. Repeat this process until you have "Dried to Constant Mass" – that is – until two consecutive weighings **differ by no more than 0.2 grams.**

TABLE 7.2: Drying to a Constant Mass

Weighing #	Mass of Evaporating Dish plus Sand
1	
2	
3	
4	

DO NOT DISPOSE OF YOUR DRIED SAND UNTIL AFTER YOU HAVE COMPLETED ALL CALCULATIONS & RECEIVED THE CORRECT VALUE FROM THE INSTRUCTOR.

* DISPOSAL: Dispose of the sand in the trash can.

III. CALCULATIONS

USE A PENCIL AND ERASER!
Give the complete setup of each calculation, being sure to include all units and to report answers to the correct number of significant figures.

1. Calculate the mass of unknown mixture.

2. Calculate the mass of the SiO_2 (sand) in the mixture. (Be sure to use the lowest mass of sand + dish in your calculations.)

3. Calculate the mass of $CuSO_4$ in the mixture.

4. Calculate the percent by mass SiO_2 in the sample.

5. The "correct" percent by mass SiO_2 (from your instructor). _____

6. Calculate the percent absolute error in your percent SiO_2.

7. Calculate the percent by mass $CuSO_4$ in the mixture.

Report Experiment 8 COMPOSITION OF A MIXTURE

Chemistry 110 Lab

Name _____ _____ Date _____
(last) (first)

Instructor's Initials_____

I. DATA

	Mass
Evaporating Dish	
Evaporating Dish Plus Unknown mixture	
Evaporating Dish plus Sand	

II. CALCULATIONS

1. Mass of unknown mixture.

2. Mass of the SiO_2 (sand) in the mixture.

3. Mass of $CuSO_4$ in the mixture.

4. Percent by mass SiO_2 in the mixture.

5. Correct percent by mass SiO_2 _____

6. Percent absolute error in your percent SiO_2.

7. Percent by mass $CuSO_4$ in the mixture.

III. QUESTIONS:

1. Give one reason (other than calculation error) why your percent by mass of SiO_2 in the mixture might be lower than the correct value.

2. Give one reason (other than calculation error) why your percent by mass of SiO_2 in the mixture might be higher than the correct value.

3. A mixture of KCl and SiO_2 weighed 4.23 g. Water was added to the mixture and only the KCl dissolved. The KCl solution was decanted and the SiO_2 was dried. The mass of the dry sand was 2.76 g Calculate the percent SiO_2 in the mixture.

4. Give two differences between a mixture and a compound.

   a.

   b.