

## EXPERIMENT 5

## Chemistry 110

**PURPOSE:** The purpose of this experiment is to determine the percent composition of a mixture.

### COMPOSITION OF A MIXTURE

Most matter is a mixture of many substances. For example, crude oil is a mixture. Most of the foods we eat are mixtures. Often it is a mixture of many different compounds of varying molecular mass. It is separated into its component parts such as gasoline and lubricant oil by utilizing the differing physical properties, in this case boiling point. Most mixtures can be separated by physical change

In today's experiment you will determine the percent composition by mass of a sand ( $\text{SiO}_2$ ) and Copper (II) sulfate ( $\text{CuSO}_4$ ) mixture. It will require separation by physical means. You will use the differences in water solubility to separate the two substances.

Sand ( $\text{SiO}_2$ ) is insoluble in water whereas copper (II) sulfate is water soluble. When water is added to the mixture, the sand will not dissolve, but the copper (II) sulfate will. Then, the sand will be dried. In this way, you will separate sand from the original mixture.



Safety goggles **must** be worn at all times

### PROCEDURE

1. Weigh a clean dry (empty) evaporating dish to the nearest 0.01 of a gram. Record the mass below.
2. Obtain an unknown from your instructor. Weigh the unknown mixture in the evaporating dish. Record the exact mass to the nearest 0.01 g.

Make some visual observations about your

mixture: \_\_\_\_\_

### DATA

	Mass, grams
Evaporating Dish	
Evaporating Dish plus Unknown mixture	

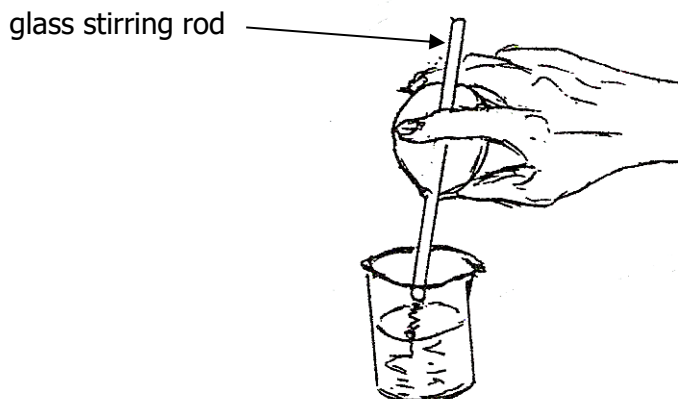
3. Carefully, transfer the **entire** unknown sample into a 400 mL beaker.

**DO NOT PUT ANY EXCESS CHEMICALS BACK INTO THE REAGENT BOTTLES.**

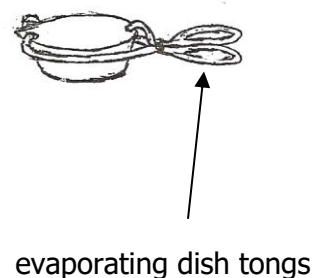
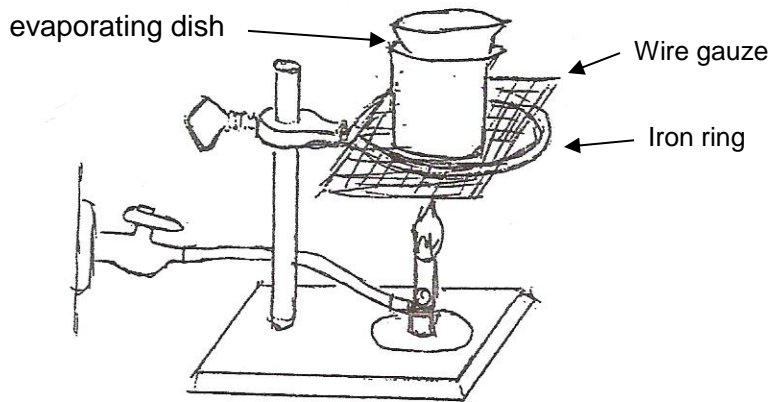
4. Obtain approximately 200 ml of de-ionized water. Pour, with stirring, the water into the beaker. If after stirring for a few minutes there is still solid  $\text{CuSO}_4$ , add 25 ml more water. Make sure all of the copper (II) sulfate is dissolved.
5. Allow the sand to settle, then carefully decant the liquid into a 250 mL beaker. See "How to decant " on the next page. This can be done at your bench. Discard the liquid in the beaker if there was no sand loss.
6. Add about 50 mL of deionized water with stirring to wash the sand. Allow the sand to settle and then decant the wash water into the 150 mL beaker.

## HOW TO DECANT

Decanting means to let the solid settle to the bottom of the beaker. Then, carefully pour off the top liquid layer. Hold a glass stirring rod on top of the beaker to guide the stream of liquid down into another beaker.



- Repeat step 6 with another 50 mL portion of deionized water. (This is to remove the  $\text{CuSO}_4$ ). What color should the liquid be if all of the  $\text{CuSO}_4$  has been removed? \_\_\_\_\_
- What should you do if you think that some  $\text{CuSO}_4$  still remains in the sand? \_\_\_\_\_
- Transfer all the sand to the evaporating dish with a rubber policeman. Use a stream of deionized water to transfer the last particles of sand. Decant the water used in transferring. Use a medicine dropper to draw off as much of the remaining water as possible without removing any of the sand.
- Prepare a steam bath using your 250 mL beaker. Set-up a ring stand with an iron ring. Place your wire gauze on top of the iron ring. Add tap water to a 250 mL beaker until it is about 2/3 full and then warm the water using a Bunsen burner. Dry the sand by heating the wet sand in the evaporating dish over the steam bath.



**NOTE:** Use the evaporating dish tongs (located in the long vertical locker at your lab bench) to handle the hot evaporating dish.

10. Stir the sand when it “looks” dry to check for dampness. If the sand still appears dry, remove it, dry the bottom of the dish, and allow it to cool on the base of your ring stand. Weigh the evaporating dish and sand. Record to the mass to  $\pm 0.01$  g.
11. Reheat the sand for another 5 minutes. Cool and weigh as above. Repeat this process until you have “Dried to Constant Mass” (see below). Two weighings must be within  $\pm 0.2$  grams.

DRY TO CONSTANT MASS

You cannot tell by “looking” at the sand whether or not the sand is really dry. You must heat the sand, weigh it, reheat, and then, reweigh the sand. The heating and weighing process is continued until two consecutive weighings are fairly close. This process is called “Drying to Constant Mass”. This is the only way to know if all of the water has been driven off!

**DATA**

Use the lowest value obtained to calculate the mass of your sand.

	Mass of Evaporating Dish plus Sand
1st Weighing	
2nd Weighing	
3rd Weighing	

12. **After** you have calculated your percent sand and obtained the correct value, dispose of your sand. (If your experimental value is too high your instructor will ask you to reheat and reweigh your sand).

\* **DISPOSAL:** Dispose the sand in the waste container labeled "Waste Sand"

**CALCULATIONS**

1. Calculate the mass of unknown sample.

Answer \_\_\_\_\_

2. Calculate the mass of sand.

Answer \_\_\_\_\_

3. Calculate the mass of copper (II) sulfate ,  $\text{CuSO}_4$ .

Answer \_\_\_\_\_

4. Calculate the percentage (by weight) of sand in the sample. Write this on your report sheet. Then, ask your instructor for the correct sand. (Do this after you calculate your % Sand).

Answer\_\_\_\_\_

Accepted value from instructor\_\_\_\_\_

5. Calculate the percent error.

% Error\_\_\_\_\_

6. Calculate the percentage (by weight) of copper (II) sulfate ,  $\text{CuSO}_4$ , in the sample.

Answer\_\_\_\_\_

Name \_\_\_\_\_

Date \_\_\_\_\_

Lab Section \_\_\_\_\_

Initials \_\_\_\_\_

EXPERIMENT 5

COMPOSITION OF A MIXTURE

**CALCULATIONS:**

**Show all set-ups.**

1. Calculate the mass of unknown sample.

Answer \_\_\_\_\_

2. Calculate the mass of sand.

Answer \_\_\_\_\_

3. Calculate the mass of copper (II) sulfate ,  $\text{CuSO}_4$ .

Answer \_\_\_\_\_

4. Calculate the percentage (by weight) of sand in the sample.

Answer \_\_\_\_\_

Correct % Sand \_\_\_\_\_  
(From Instructor)

5. Ask your instructor for the correct percent sand (take your report sheet). Calculate the percent error.

% Error \_\_\_\_\_

6. Calculate the percentage (by weight) of copper (II) sulfate ,  $\text{CuSO}_4$ , in the sample.

Answer \_\_\_\_\_

**QUESTIONS AND PROBLEMS**

1. Give a reason why (other than calculations) your percentage of sand might be lower than the correct value.

\_\_\_\_\_

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2. Give a reason why (other than calculations) your percentage of sand might be higher than the correct value.

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3. A mixture of  $\text{KCl}$  and  $\text{SiO}_2$  weighed 4.23 g. The  $\text{KCl}$  was dissolved in water and then the solution was decanted and dried leaving only 2.76 g of dry sand. Calculate the percent sand in the sample.  
Set-up:

Answer \_\_\_\_\_

4. What are 2 ways that a mixture of sand and  $\text{CuSO}_4$  is different from a compound like  $\text{K}_2\text{CO}_3$

1) \_\_\_\_\_

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2) \_\_\_\_\_

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