

LAB
Separation of a Salt/Sand Mixture

30 pts

Name _____

Lab Partner _____

Date _____ Period _____

Purpose: To determine the mass of salt and the mass of sand in a mixture.

INTRODUCTION

Mixtures are defined as physical combinations of two or more substances where each substance retains its own chemical identity. For example, in muddy water (a mixture of dirt and water), both the dirt and the water maintain their chemical identity. Mixtures can be classified as either homogeneous or heterogeneous. Homogeneous mixtures have the same composition throughout the mixture. Homogeneous mixtures are often called *solutions*. Vinegar and household ammonia are examples of homogeneous mixtures. Heterogeneous mixtures have varying composition throughout the mixture. Muddy water and rocks are examples of heterogeneous mixtures.

Chemists often need to separate a mixture into its components. They use physical properties to separate a mixture. *Solubility* is an example of a physical property used to separate mixtures. When water is added to a mixture of salt and sand, the salt dissolves, but the sand does not. The mixture can then be separated by a simple filtration. Neither the salt nor the sand has been chemically changed. In this laboratory, you will be using physical and chemical properties to separate the components of a binary (two substances) mixture. You will also determine the amount of each substance in the mixture and the percent error in recovering each substance.

When water is added to a mixture of NaCl (sodium chloride) and SiO₂ (silicon dioxide or sand), the water dissolves the NaCl (a physical change), leaving the sand behind:



The mass of the sand can then be determined by filtering the salt water/sand mixture (like using a coffee filter) to remove the sand from the solution, drying the pre-massed filter paper with the sand on it, then measuring the mass of the dried sand/filter paper combination. The mass of the NaCl is determined by evaporating the H₂O from the solution in a pre-massed Erlenmeyer flask, and measuring the mass of the remaining NaCl and flask combined.

Prelab [2 pts] (Answer on a separate sheet of paper)

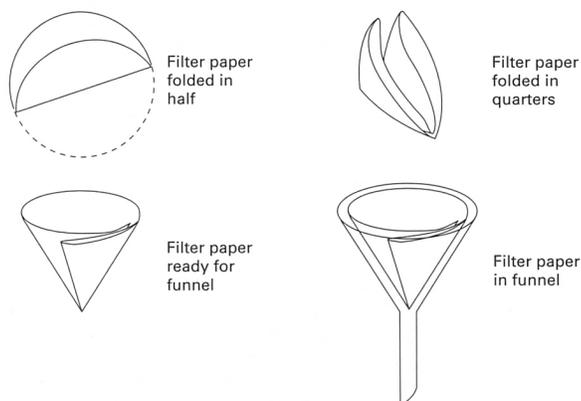
The mass of a weighing dish and a mixture of sand and NaCl (salt) is 13.770 g. The mass of the weighing dish is 10.715 g. Water is added to the mixture, and the mixture filtered to remove the sand. After the sand and filter paper are dried, their total mass is measured as 2.939 g. The mass of the filter paper was earlier determined to be 1.369 g. The salt water is placed in the weighing dish and the water evaporated to leave only NaCl. After the water is evaporated from the remaining residue, the mass of the salt and weighing dish is 12.200 g. What is the total mass of the mixture? Determine the mass of sand and mass of NaCl in the mixture.

Materials:

- | | | |
|--|------------------------------|----------------------------|
| • Sand (SiO ₂) and Salt (NaCl) mixture | • Distilled H ₂ O | • 100 mL beaker |
| • 125 mL Erlenmeyer flask | • Glass stir rod | • Iron ring and ring stand |
| • Thin-stem funnel | • Filter paper | • Oven or hot plate |
| • Balance precise to 0.01 g | • Wash Bottle | • Watch Glass |

Procedure

1. Obtain sample and record sample number in data table.
2. Mark Erlenmeyer flask with names/initials using wax pencil (write on glass).
3. Mark filter paper with names/initials along outside edge using regular pencil.
4. Measure masses of full vial, marked flask and marked filter paper & record in data table.
5. Put sand/salt mixture into beaker and take mass of empty vial. Record in data table.
6. Add just enough water to dissolve salt (about 10 mL), swirling beaker to facilitate dissolving.
7. Set up filter apparatus, locating the Erlenmeyer flask beneath funnel to catch salt water (see below). Fold filter paper, with names/initials on *inside*, place it in funnel & wet slightly with wash bottle to keep in place.
8. Pour sand & salt water into filter & wash beaker with 2-3 squirts of water to remove all salt water.
9. After water has drained from sand, wash once more in funnel for 2-3 seconds to wash salt water from sand.
10. Put sand/filter paper onto a watch glass and into oven to dry.
11. Note if there is any sand in your salt water. Put flask with salt water onto a hotplate set to High to evaporate water.
12. Mass sand & filter paper, flask & salt when dry. Poke sand with stir rod to observe if there is any sign of salt in the sand. Are there salt crystals on the watch glass?
13. Discard sand & filter paper. Rinse flask with water.

**Data [6 pts]**

Object	Mixture # _____ Mass
Mass of Vial with Sand/Salt Mixture*	g
Mass of Empty Sample Vial	g
Mass Sand/Salt Mixture	g
Mass Filter Paper*	g
Mass Dried Filter Paper + Sand	g
Mass 125-mL Erlenmeyer Flask*	g
Mass 125-mL Erlenmeyer Flask + Salt	g

*Make these measurements before starting!

Observations [2 pts]

Record your observations here as you work. Pay attention to any signs of *unexpected or significant events*: spills, contamination (especially sand in the salt water or salt in the sand or on the watch glass).

Do the remainder of the laboratory report on a separate sheet. When submitting the report, remove this page and attach your work behind the first page of the lab.

Calculations: *Must show all work!! Use correct Sig Figs and units!* [10 pts total]

- [2 pts] Determine your experimental mass of sand and mass of salt separately.
- [1 pt] Determine the total mass of sand and salt combined that you collected.
- [1 pt] Determine the total amount of mass lost or gained in the procedure.
- [2 pts] Calculate the % of total mass lost or gained (indicate which) in your experiment:
$$\left(\frac{\text{Total Mass Gained/Lost}}{\text{Total Mass at Start}} \times 100\% \right)$$
- [2 pts] Obtain the actual masses of sand and salt in your mixture from your teacher, then calculate the % error for your experimental mass of salt and the % error of your experimental mass of sand.

From Teacher: Actual Mass Sand: _____ Actual Mass Salt: _____

$$\% \text{Error} = \frac{|\text{Experimental Mass} - \text{Actual Mass}|}{\text{Actual Mass}} \times 100\%$$

Conclusions: (You must write in complete sentences.) [10 pts total]

- [2 pts] Were you able to successfully separate the salt from the sand? Explain by referring to your data and comparing the expected (actual) masses of salt and sand to the experimental masses.
- [2 pts] Did you lose or gain salt? Sand? Was your total mass close to the actual total mass? Was one of the components high and the other low or were both components high or both low?
- [3 pts] Discuss likely reasons for why you got the results you obtained. For example, if your sand value was too low and salt too high, discuss reasons for why this could be: what possible sources of experimental (systematic or random) error were there that could account for your results? Use your observations to support your conclusions. If you had no error, discuss two possible systematic errors and their effects on the masses of sand and salt. (*Note: calculation mistakes are NOT experimental error! Check your calculations!*)
- [3 pts] Think of at least 2 changes that could be implemented to improve the procedure if you were to perform a follow-up experiment or redo this experiment. Word them in the form of a hypothesis (“If _____ was done/changed then it would be expected that _____.” [what would happen?]). Perhaps you’re curious about investigating how different materials would work or how you could change part of the procedure that gave you problems, but you must consider what the results of the change *might* be (i.e. you don’t have to be right, but you must have a reason for your hypothesis).