LAB **30 pts** **Name** _____
Separation of a Salt/Sand Mixture **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 SiO_2 (silicon dioxide or sand), the water dissolves the NaCl (a physical change), leaving the sand behind:

$$NaCl\ (s), Sand + Water \rightarrow NaCl\ (aq)\ [salt\ water], Sand$$

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 H_2O 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
- 125 mL Erlenmeyer flask
- Thin-stem funnel
- Balance precise to 0.01 g
- Distilled H_2O
- Glass stir rod
- Filter paper
- Wash Bottle
- 100 mL beaker
- Iron ring and ring stand
- Oven or hot plate
- 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]

1. [2 pts] Determine your experimental mass of sand and mass of salt separately.
2. [1 pt] Determine the total mass of sand and salt combined that you collected.
3. [1 pt] Determine the total amount of mass lost or gained in the procedure.
4. [2 pts] Calculate the % of total mass lost or gained (indicate which) in your experiment:

$$\left(\frac{\text{Total Mass Gained/Lost}}{\text{Total Mass at Start}} \times 100\% \right)$$

5. [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: _____

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

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

1. [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. [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. [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!)*
4. [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).