SEPARATION OF A MIXTURE LAB

BACKGROUND

Elements and compounds are **pure substances**. The composition of a pure substance is constant, and thus pure substances have characteristic physical properties that do not change. Examples of *physical properties* that can be used to describe pure substances include solubility, conductivity, magnetism, density, boiling point, and melting point.

A **mixture** results from the combination of two or more pure substances that do not react chemically. The physical properties of a mixture depend on its composition because the amounts of each substance making up a mixture can vary. By taking advantage of the unique physical properties of individual components within a mixture, it should be possible to separate a mixture into its components. Mixtures have the following fundamental properties:
Each component of a mixture retains its chemical identity and hence its own properties.
Composition of a mixture may vary while that of its components is fixed.
Mixtures can be separated into these components by using physical methods like decantation, distillation, evaporation, crystallization, sublimation, and filtration.

For example, if one component in a mixture of two solids is soluble in water, while a second component is not, adding water to the mixture and filtering the residue can separate the water-soluble component from the insoluble component of the mixture. Subjecting the mixture to such a physical change would change the ratio of components of the mixture. This leads to one of the definitions of a mixture: a substance whose composition can be altered by a physical change. Most common materials in our daily life are examples of mixtures, such as rocks, soil, seawater, cement, and wood. Mixtures can be either *homogenous* or *heterogeneous*. This experiment deals with the separation of the components of a heterogeneous mixture.

In order to determine the percent composition of a mixture, it is necessary to separate the components quantitatively (without loss of material) and then measure the mass of each recovered component. Mass percent composition is a convenient way to express the actual composition of a mixture in terms of the amount of each component.

The sum of the mass percentage of all components in a mixture equals 100%.

The mass percentage of each component in a mixture is calculated as follows:

$$\textbf{percent composition} = \frac{\textbf{mass of component}}{\textbf{total mass of mixture}} \times \mathbf{100}$$

Separating a mixture by physical means has many important applications. For example, if a toxic chemical is spilled into a reservoir, the EPA must have a means of extracting it so that the water is safe to drink again.

In this lab you will be given a mixture of rocks, sand, salt, and iron filings. Your objective is to practice important separation techniques to isolate the four (4) components and determine the mass percent of each in the mixture.

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INTRODUCTION

1. What is the PURPOSE of the experiment? (What are you trying to find out or observe)

2. What is your HYPOTHESIS as to the best way to separate this mixture into its original substances (rocks, iron filings, sand, and salt)?

1 ____________________

2 ____________________

3 ____________________

4 ____________________

DATA / OBSERVATIONS:

Write down everything you measured and observed during the experiment.
Data MUST be presented in a table. Show any calculations for the lab.

DATA TABLE

Mass of empty zipper bag	
Mass of zipper bag + mixture	
Mass of zipper bag + rocks	
Mass of empty 1-quart saucepan	
Mass of 1-quart saucepan + salt	
Mass of empty plastic disposable cup and lid	
Mass of cup + lid + iron filings	

CALCULATIONS:

Show ALL your work. The calculation for question 1 is set up for you; <u>show your subsequent calculations in a similar manner</u>

1. Calculate the mass of the mixture

Mass of zipper bag + mixture ____________

Mass of empty zipper bag - ____________

Mass of mixture ____________

2. Calculate the mass of the recovered rocks. **SHOW YOUR WORK.**

____________________ __________

____________________ - __________

____________________ __________

3. Calculate the mass of the recovered iron filings. **SHOW YOUR WORK.**

____________________ __________

____________________ - __________

____________________ __________

4. Calculate the mass of the recovered salt. **SHOW YOUR WORK.**

____________________ __________

____________________ - __________

____________________ __________

5. Calculate the mass of the sand that must have been in the mixture. **SHOW YOUR WORK.**

6. PERCENT COMPOSITION: What was the percent by mass of each component of the mixture?
Show your calculations.

$$\text{percent composition} = \frac{\text{mass of component}}{\text{total mass of mixture}} \times 100$$

SAMPLE	PERCENT COMPOSITION
Rocks	
Iron Filings	
Salt	
Sand	

ANALYSIS QUESTIONS:

1. Draw a pie chart showing the percent composition of the mixture. **Label the wedges with <u>percent and substance.</u>**

2. Think about the lab procedure and what you know about types of matter.
   Classify each sample below as one of the following:
   element, compound, heterogenous mixture, homogeneous mixture

   rocks ______________________________

   iron filings ______________________________

   salt ______________________________

   sand ______________________________

   salt water ______________________________

CONCLUSION

Actual amounts of each substance in your mixture:	
Rocks: 300 g	Sand: 80 g
Iron: 30 g	Salt: 20 g

1. Looking at the actual amounts of each substance in your mixture and comparing that to the masses you calculated, discuss how you could have reduced experimental error in your lab.

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