

CHEM 1405 - Separating a Heterogeneous Mixture

Objective:

- To write a detailed step-by-step procedure of the physical processes used to separate the components of a mixture containing iron filings, poppy seeds, NaCl (salt), and SiO₂ (sand) using their differences in physical properties (Sample size of mixture is ~5.00 grams)
- To create a mathematical formula for calculating the percentage of each component in the mixture as well as the percent recovery of the original mixture

Background: Matter can be classified into two main categories: pure substances and mixtures. Pure substances are elements or compounds which have one set of properties. Mixtures contain two or more different pure substances that retain their own properties and can be separated by physical methods.

In this experiment you will write a detailed procedure indicating each step (including laboratory equipment) need to separate the heterogeneous mixture of iron filings, poppy seeds, salt, and sand. Some of the physical processes you may use are magnetism, extraction, filtration, and evaporation to separate each component of the mixture. **Extraction** is a process used when one component of the mixture is soluble in a solvent while the other is not. For an example, you will add water to the mixture which will dissolve the salt but not the sand. **Filtration** is a process that is used to separate a solid and liquid by pouring the mixture onto a porous material, such as filter paper. The liquid, or filtrate, in this case the saltwater, passes through. The solid residue, the sand, is retained on the filter paper. **Evaporation** is a process used to remove the solvent from the dissolved solute. You will heat the saltwater solution to remove the water and leave the salt behind.

To assist you with writing the procedure, watch the following videos:

- Techniques on separating mixtures
<https://www.youtube.com/watch?v=XC1RxloV0Mo>
https://www.youtube.com/watch?v=vi_SJBnxmHo
- Demonstration showing the physical properties of each component in the mixture
(<https://www.youtube.com/watch?v=KNFPetqVsHk>)
- Read sections 3.4 and 3.5 in your e-book (textbook).

Example Calculation of the %NaCl in the Mixture:

1. By subtracting mass of weighing paper from mass of weighing paper and mixture, calculate mass of the original mixture.

2. In a similar manner, calculate mass of the recovered NaCl

3. Calculate percent of NaCl recovered from the unknown mixture: $\frac{\text{mass of NaCl}}{\text{mass of original mixture}} \times 100 \%$

Synopsis

You are given a ~5.00 gram sample of a heterogeneous mixture containing iron filings, poppy seeds, NaCl (salt), and SiO₂ (sand) in a large test tube. The chemistry professor asked you to separate each component of the mixture into 4 separate beakers. You have the following equipment at your disposal:

Analytical Balance	Oven
Bunsen burner	Magnet
2 – 150 mL beakers	Ring stand
5 – 100 mL beakers	Scoopula
Clay triangle	Stirring Rod
Evaporating dish	Weighing paper
Filter paper	Wire Gauze
2 – 125 mL Erlenmeyer Flask	Water

You are to write a step-by-step procedure including equipment on how to separate the heterogeneous mixture into its original four components in order i.e. which component would you separate first, second, etc. including how and why. The components must be separated to its original state of matter.

Write the mathematical formula for calculating the percent recovery for each component in the original mixture and the percent recovery of the original mixture.

Writing a Detailed Procedure

The procedure details the methods used in laboratory experiment. It is so detailed that any other student can follow your procedure and reproduce the process exactly. Procedures include a list of the steps to conduct the experiment, safety procedures, descriptions of equipment, laboratory glassware, and specification of each condition under which the experiment was done. Also, included are diagrams of the experimental setup.

Remember, the procedure should detail enough information such that another student could replicate your experiment

- Use a list format to describe the experimental steps using numbers.
- List safety warnings directly before the procedures or integrate warnings in the steps.
- Include a description of the proper disposal of chemicals if necessary.
- Include a diagram of the experimental setup.
 - Label all parts of setup, including glassware, equipment, and materials in the diagram.
 - Place diagram either to the right of the procedural steps or center in the text (see example below).
 - You may draw your own diagram
- Single space this entire section.
- Use complete sentences.
- Make sure to include the mathematical formulas for calculating the percent by mass of each component recovered of the mixture and the percent by mass of the total mixture recovered
- Make sure to answer the post lab questions at the end of the lab.

EXAMPLE of a PROCEDURAL STEP

Residue was removed carefully from the test tube prior to...

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~~~~~  
~~~~~  
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Experimental Setup for Carbon Testing



Flowchart Example

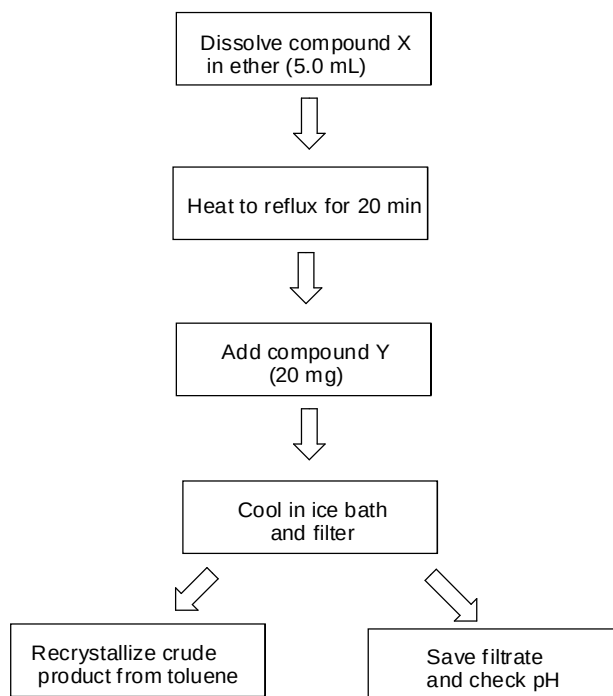


Figure 2: Example of a simple flowchart

Post Lab Questions

1. Give one possible error you could have made in carrying out the experiment (not a calculation error) that would cause your

a) percent NaCl to be too small

b) percent SiO₂ to be too large

2. Solubilities of Compounds A, B and C were determined and summarized in the following table:

	<u>cold water</u>	<u>hot water</u>
A	insoluble	soluble
B	insoluble	insoluble
C	soluble	soluble

a) Describe the process you would use to separate compounds A and B if both compounds were present in a mixture.

b) If compounds A and C were present in a mixture, could they be separated using hot water? Why or why not?

c) Circle correct letter of compound for each step.
You have a mixture of the 3 compounds above, A, B and C.

1) You add hot water to the mixture and filter: A, B, C remains on the filter paper.

2) You chill the solution that passed through the filter paper and filter again:
A, B, C remains on the filter paper.

3) You evaporate the water from the solution in the beaker and A, B, C remains in the beaker. Give reasons for your answers below.