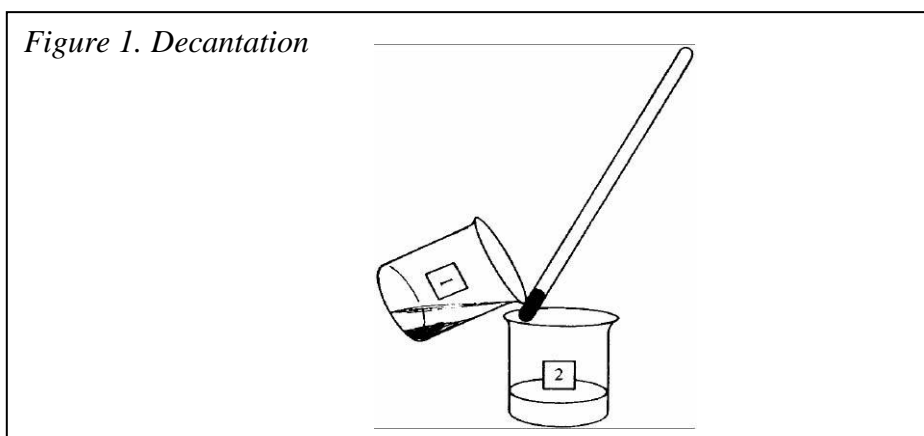


Lab: Separation of a Mixture

Background

Mixtures are not unique to chemistry; we use and consume them on a daily basis. The beverages we drink each morning, the fuel we use in our automobiles, and the ground we walk on are mixtures. Very few materials we encounter are pure. Any material made up of two or more substances that are not chemically combined is a mixture. The isolation of pure components of a mixture requires the separation of one component from another. Chemists have developed techniques for doing this. These methods take advantage of the differences in physical properties of the components. The techniques to be demonstrated in this laboratory are the following:

1. *Extraction.* This uses water to dissolve one component of the solid mixture. With this technique, a solid that dissolves in water can be separated from a solid that cannot be dissolved by water.
2. *Decantation.* This separates a liquid from solid particles by carefully pouring the liquid from the solid without disturbing the solid (Fig. 1).



3. *Filtration.* This separates a solid from a liquid through the use of a porous material as a filter. Paper, charcoal, or sand can serve as a filter. These materials allow the liquid to pass through but not the solid (see Fig. 4 in the Procedure section).
4. *Evaporation.* This is the process of heating a mixture in order to drive off the water in the form of vapor so as to dry off the remaining component.

The mixture that will be separated in this experiment contains three components: common table salt (NaCl), iron filings, (Fe) and sea sand (SiO₂).

Objectives:

1. To demonstrate the separation of a mixture.
2. To examine some techniques for separation using physical methods.

Procedure

1. Obtain a clean, dry small beaker and carefully mass it. Record this weight for beaker 1 on the Report Sheet (1).
2. Obtain a sample of the mixture from your teacher. Place the unknown mixture into beaker 1. Record the mass of the beaker plus the mixture (2). Calculate the mass of the mixture by subtraction (3).
3. Obtain a magnet. Wrap the magnet with clear plastic wrap. Mass the magnet and clear plastic wrap together (4).
4. Move the magnet directly over the mixture. Make multiple passes to collect all of the iron filings.
5. When you have collected all the iron filings on the magnet, weigh the magnet with the filings (5). Calculate the mass of the filings that you separated (6).
6. When done massing the iron filings carefully unwrap the plastic wrap from the magnet and throw away the iron filings and plastic wrap.
7. Add approximately 40 mL of water to the salt and sand mixture left in the beaker. Heat gently and stir for five minutes.
8. Weigh a second clean, dry beaker (7).
9. Place a funnel inside your clean, dry beaker.
10. Fold a piece of filter paper following the technique shown in Fig.5

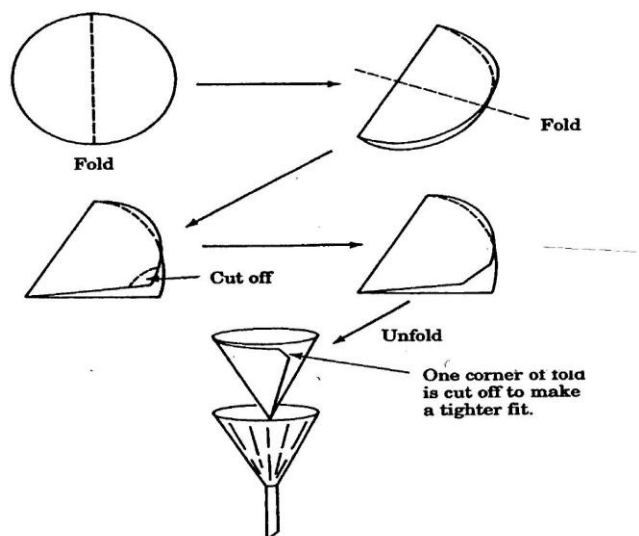


Figure 5. Steps for folding a filter paper for gravity filtration

11. Wet the filter paper with water and adjust the paper so that it lies flat on the sides of the funnel.
12. Pour the mixture through the filter. First pour most of the liquid into the funnel (this is called "decanting") and then carefully transfer the wet mixture into the funnel. Collect all the liquid (called the filtrate) in beaker 2.
13. Rinse beaker 1 with a small amount of water and stir up the remaining mixture. Pour the water and mixture into the funnel. Repeat until you've filtered all of the mixture.
14. Place beaker 2 and its contents on a hot plate. Turn the hot plate up to 300° C (or up to 8 or 9). Watch the beaker carefully to prevent boiling over. If it begins boiling over turn down the temperature. As the volume of liquid is reduced, solid sodium chloride will appear.
15. When all of the liquid is gone, cool the beaker to room temperature (let it sit for 7-10 minutes).
16. Mass the beaker and the salt residue (8). Calculate the mass of the recovered salt by subtraction (9).
17. Transfer the sand from the filter paper to your empty beaker (NOT into the one you just heated).
18. Heat the sand to dryness in the beaker with a hot plate. Heat slowly to avoid spattering. When dry, the sand should be freely flowing.
19. Allow the sand to cool to room temperature (at least 7-10 minutes).
20. Mass the beaker and the sand (13). Calculate the weight of the recovered sand by subtraction (14).

Example calculation

A student isolated the following from a sample of 1.132 g:

0.170 g of iron filings
0.443 g of NaCl
0.499 g of sand
1.112 g solid recovered

The student calculated the percentage yield and percentage of each component as follows:

$$\% \text{ yield} = (1.112 \text{ g solid recovered}) / (1.132 \text{ g original sample}) \times 100 \%$$

$$\% \text{ Fe (iron)} = (0.170 \text{ g naphthalene}) / (1.132 \text{ g original sample}) \times 100$$

$$\% \text{ NaCl (salt)} = (0.443 \text{ g NaCl}) / (1.132 \text{ g original sample}) \times 100 \%$$

$$\% \text{ SiO}_2 \text{ sand} = (0.499 \text{ g sand}) / (1.132 \text{ g original sample}) \times 100$$

Separation of a Mixture Data Sheet

NAME: _____

PARTNER: _____

1. Mass of beaker 1:	_____ g
2. Mass of beaker 1 and mixture:	_____ g
3. Mass of mixture: (2) - (1) :	_____ g
4. Mass of magnet wrapped in plastic wrap:	_____ g
5. Mass of magnet, plastic wrap, and iron:	_____ g
6. Mass of iron: (5) - (4):	_____ g
7. Mass of beaker 2:	_____ g
8. Mass of beaker 2 and salt (NaCl):	_____ g
9. Mass of salt (NaCl): (8) - (7) :	_____ g
10. Mass of beaker 1 and sand (SiO ₂):	_____ g
11. Mass of sand (SiO ₂): (10) - (1) :	_____ g

Calculations

12. Mass of recovered solids: _____ g
(6) + (9) + (11)
13. Percentage yield (% of solids recovered) _____ %
[(12) / (3)] x 100
14. Percentage of iron filings _____ %
[(6) / (3)] x 100
15. Percentage of NaCl _____ %
[(9) / (3)] x 100
16. Percentage of sand _____ %
[(11) / (3)] x 100