Chemistry **Name _____**

Lab: Separating Mixtures **Date_____ Period _____**

Introduction

Mixtures, unlike compounds can be separated by physical processes. In this lab, you will use three different methods to separate three different mixtures. You will use a process called chromatography to separate ink from a marker into the colors which are mixed to make a particular color. You will set up a distillation apparatus to remove the salt from a saltwater solution. Finally, you will use a filtration setup to separate a sand-water mixture.

Safety

As with all laboratory experiments, proper shoes, protective goggles, and lab aprons must be worn at all times. Special care must be taken any time the lab burner and glassware are used. The chemicals used in this experiment are generally considered to be very safe, however, you must always be cautious when working in the lab.

DAY 1

Paper Chromatography

Chromatography is a process that can be used to separate mixtures of gases, liquids, or dissolved substances. There are different types of chromatography, but they all involve a stationary phase and a mobile phase. The mixture is moved through the stationary phase by the mobile phase. The mixture is separated because its components have varying attraction for the stationary phase and the mobile phase. In paper chromatography, the stationary phase is the paper and the mobile phase is a solvent (we will use water). The mixture separates because some components absorb onto the paper better and some components dissolve in the water better. Those that dissolve better will be moved farther upward by the water. You are going to perform paper chromatography to see if the ink from a marker is actually a mixture of two or more base colors.

Procedure

1. Cut two 2.5 cm wide strips out of the middle of a piece of filter paper and then cut the rounded ends off of each so that they are rectangular.

2. Choose two different colored markers and make a line across one of the papers with one marker about 1.5 cm from one end. Make a similar line with the other marker on the other piece of paper.

3. Place about 25 mL of water into a 250 mL beaker.

4. Slide the strips of paper into the clip of the marker cap so that it is held in place. If the marker does not have a clip, use tape to hold the paper to the marker.

5. Lay the marker across the top of the beaker so that the end of each strip is in the water but the water should not up to the marker lines.

6. Carefully set the beaker aside to give the water time to move up the filter paper. Check it periodically and write down any changes that you observe

7. Near the end of the period, remove the paper from the water and throw it away. The water may be flushed down the sink. Rinse out the beaker.

Filtration

Filtration is probably the simplest physical technique for separating mixtures. It involves the use of a filter that allows particles of a certain size to pass through. The material that passes through (the filtrate) is separated from larger particles that are held back by the filter. There are filters available commercially for all types of applications from keeping impurities in motor oil from entering your

car's engine to keeping drinking water clean and pure. Our filtration system will be made using a special kind of paper known as filter paper.

Procedure

1. Fill a 250 mL beaker with about 100 mL of water.

2. Add ½ spoonful of sand and a ¼ spoonful of salt to the water and stir it with your stir rod until the salt is dissolved.

3. Attach an iron ring to a ring stand and place your funnel in the ring.

4. Fold a piece of filter paper in half and then fold it in half again. Open up one side of the folded filter so that it makes a cone shape. Place this cone filter down into your funnel. If it does not fit properly, open the cone wider until it fits. Wet down the filter with a small amount of water from your wash bottle to keep it in place

5. Place a 250 mL flask under the funnel and adjust the height so that the end of the funnel is in the mouth of the flask.

6. Pour your water/salt/sand mixture into the funnel and allow the filtering process to begin. You will probably have to add your mixture over several pours. Wash out your beaker into the funnel and then clean and rinse your beaker before putting it away.

7. After the filtering process is finished, add 2 drops of silver nitrate solution to your filtrate and observe.

8. Pour the contents of the flask down the drain. Wash and rinse your flask and put it back into your cabinet. Remove the funnel from the ring and take it to the trash can. Pull out the filter and place it in the trash. Wash and rinse the funnel and put it back in your cabinet.

DAY 2

Distillation

Distillation is a method of separating solutions that is based on the fact that different substances have different boiling points. For example, the boiling point of water is (as I hope you know) 100° Celsius and the boiling point of salt (sodium chloride) is 1413° Celsius. Therefore when you heat a saltwater solution, the water will begin to vaporize when the solution reaches about 100° C but the salt will remain in the solid state at that temperature. The water vapor is then collected in a separate container and condensed back into liquid. Since only the water was vaporized, the water collected should be pure without anything dissolved in it. It is now distilled water.

Procedure

1. Put about 75 mL of water into a beaker. Bring it to the front of the lab and add a spatula tip of salt. Also add 2-3 drops of food coloring. Mix with a stirring rod until the salt is completely dissolved.

2. Use a funnel to carefully pour this solution into the 250 mL filtering flask from up front.

3. Set up the distillation apparatus as shown in class with ice water surrounding the water collection test tube.
SEE PICTURE ON THE NEXT PAGE

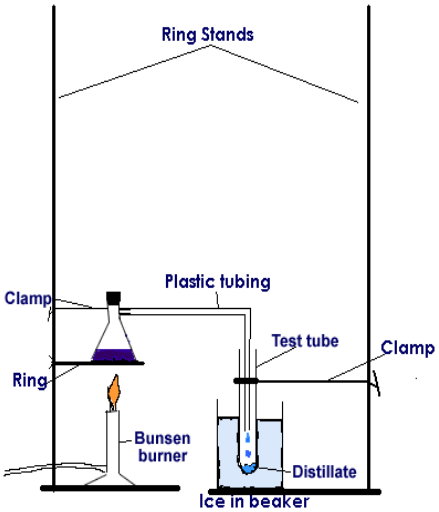
4. Light the burner and place it under the flask to heat the solution.

5. Heat the solution to boiling and allow it to boil for a few minutes. Observe the water collection test tube to make sure that you are collecting the distillate

6. After the collection test tube is about half full, remove the rubber tubing from the test tube and immediately turn off the burner**.** **WARNING: THE TUBING MAY BE VERY HOT!**

7. Let me know that you are finished and I will come around and add a few drops of silver nitrate ($AgNO_3$) solution to the content of your test tube. Write down your observations below.

8. **Cleanup**: all of the water can be poured down the drain. **Be careful of glass and equipment that may be hot**. Return the stoppers, glass and rubber tubing to the front table.



Lab Questions

Chromatography

1. What color markers did you use? 1. _____ 2._____

2. How did the marker lines change over time? _____

_____

_____

3. What colors of ink were found in your markers?

1. _____

2. _____

4. How does chromatography separate the different components of a mixture (i.e. the different ink colors in the marker)? _____

_____

_____

5. This method of chromatography does not work with a permanent marker such as ***Sharpie***. Explain why this is the case. _____

_____

_____

Filtration

1. Describe the appearance of your filtrate before adding silver nitrate_____

_____

_____

2. What happened when you added the silver nitrate? _____

_____

_____

3. What do your answers for questions 1 and 2 tell you about a filter's ability to separate mixtures?_____

_____

_____

4. Filtration separates mixtures based on what property? _____

_____

_____

Distillation

4. Describe the appearance of the water collected in your test tube. (compared to the water in your flask)_____

_____

5. What is the purpose of adding the silver nitrate solution?_____

_____

_____

6. What happened when the silver nitrate was added to your water?_____

_____

7. What might have caused someone's water to turn cloudy?_____

_____

8. Do you think this process could realistically be used to produce fresh drinkable water from ocean water? Why or why not? _____

_____

_____

9. Distillation separates mixtures based on what property?_____

_____