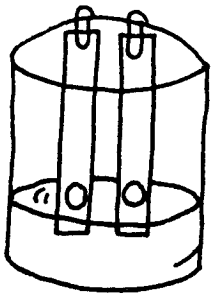


MOBILE MIXTURES

BENCHMARK and TASK
SC.A.1.2.4 The student knows that different materials are made by physically combining substances and that different objects can be made by combining different materials.

- The student separates a mixture by sorting, sifting, filtering, and evaporating.

KEY QUESTION
How can a mixture be separated? (chromatography)

BACKGROUND INFORMATION
An **element** is the simplest form of matter. All matter is made up of **atoms.** Each **element** is made of atoms of the same type. Two or more elements that have combined chemically are called a **compound.** A compound can be separated only by chemical means. Table salt is an example of a compound.

A **mixture** is a combination of two or more substances that have not combined chemically. A mixture can contain elements, compounds, or both, and in any amounts. Because the substances in a mixture are not combined chemically, they keep their unique properties and can be separated by physical means. Mixtures can be separated using processes that depend on their different properties:
Sorting: To separate by arranging according to class, kind, or size
Evaporation: To convert or change into a vapor, usually leaving only the dry, solid portion of the mixture
Sifting: To separate fine particles from coarse particles
Filtering: To separate suspended matter in a liquid or gas.

Different types of matter can be combined; colors can be mixed to get new colors. Inks and dyes consist of molecules of coloring substances that are dissolved in a liquid base. When color is applied to a filter and placed in contact with water, the color molecules dissolve and are carried up the strip. Different colors get carried along faster and farther than others because some color molecules are bigger and/or heavier than others. This color separation process is called *chromatography.*

MATERIALS

Teacher
1 black, water soluble marker
1 sheet of paper

Per group
1 coffee filter
1 saucer or Styrofoam plate
paper clips
1 black, water-soluble marker
1 green, water-soluble marker
1 orange, water-soluble marker
water

TEACHING TIP

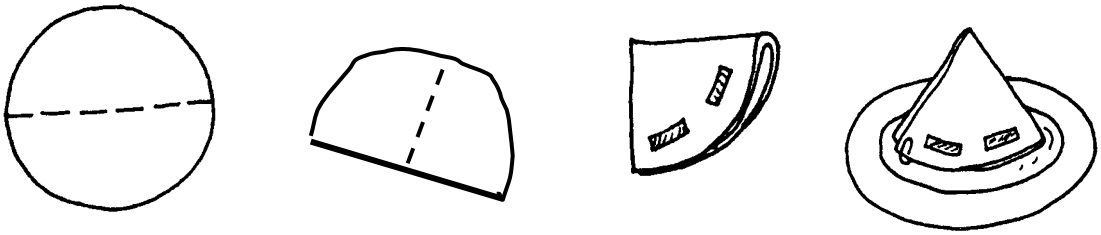
Have other colors of water-soluble markers and coffee filters available. (Brown markers usually show an amazing array of colors when filtered!)

ENGAGE

Review by asking:
What is an example of a mixture?
What are some ways that you have learned to separate mixtures?
With a water-soluble marker draw a black line on a paper. Ask: *Is this a mixture?*
Tell students they will have a chance to find out.

EXPLORE

1. Distribute the materials to each group.
2. Show students how to fold the coffee filter in half, and in half again.



3. One student in the group should use the dark green marker to make a mark about one inch from the rounded edge of the folded filter.
4. Have another student use the black marker to make a mark about one inch from the rounded edge. (This is the edge that will be set in water.) The two marks should not touch each other, but need to be on the same side.
5. Tell students to secure the edge of the filter with the paper clip so that a cone is formed, as shown in the illustration.
6. Fill the plate with water and place the rounded edge of the cone in the water. Be sure the water does not touch the colored marks.
7. Allow the paper to stand undisturbed while students observe for 10 minutes.

EXPLAIN

What happened to the two marks made on the filter?
What caused the marks to separate into different colors? (The molecular attraction of the liquid tends to pull the surface molecules back into the liquid. This surface tension causes the liquid to act like a stretched membrane. When this liquid comes into contact with a solid, as in the filter paper, it moves up the solid. Different colors get carried along faster and farther than others because some color molecules are bigger and/or heavier than others.)
How does this show that colors are mixtures? (Marking pens are combinations of several basic colors, and we can see them separate.)
What colors were contained in the black mark?
What colors were contained in the green mark?

Do you think the black mark I made on the sheet of paper at the beginning of the activity is a mixture? Why or why not? (Yes, because black ink is a mixture of all colors.) Place the strip in a cup of water and find out whether or not it really is a mixture.
If we were to place an orange mark and a brown mark on the filter, what colors do you think might appear on the filter? (Try it and find out!)

EXTEND/APPLY

Show a color wheel and have the students discuss how the arrangements of colors are related to the chromatography experiment.

ASSESSMENT

1. Make several different mixtures:
   - salt water
   - sand, popcorn kernels, and paper clips
   - corn starch and water
   - brown marker
   - sand, salt, and baking soda
   - box containing different kinds of seashells or rocks
2. Have a materials table which contains magnets, coffee filters, sifters, water, plastic cups, dark construction paper, saucers, etc.
3. Give each group a different mixture to separate. Tell students to decide as a group how to separate their mixture, gather the appropriate materials, and perform the separation. After successfully separating the mixture, each group needs to describe the method used. Encourage students to use the vocabulary they learned during their study of mixtures in their discussions.