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Mixture Separation Challenge

MIX-100

This Mixture Separation Challenge is an excellent demonstration for density, solubility, and the salting effect. Students will be amazed by the actions of the beads. Due to the unexpected results in the beaker, secondary students have to use science to dissect an explanation for the layering. Great inquiry opportunities for all students. Some teachers never give away the secret! The kit includes additional discussion questions, activities, and explanations.

NGSS Correlations

Our Mixture Separation Challenge and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

2-PS1-1
Students can use this product in an investigation to describe and classify different kinds of materials by their observable properties.

2-PS1-2
Students can analyze data obtained from testing to determine which materials have the properties that are best suited for an intended purpose.

5-PS1-1
Students can use this product to develop a model to describe that matter is made of particles too small to be seen.

5-PS1-3
Students can make observations and measurements of the different materials to identify materials based on their properties.

Middle School

MS-PS1-1
Students can use the Mixture Separation Challenge in an investigation to develop models to describe the atomic composition of simple molecules and extended structures.

High School

HS-PS1-1
Students can use the Mixture Separation Challenge in an investigation to predict properties of elements. Students can use the Periodic Table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS2-6
Students can use the Mixture Separation Challenge in an investigation to communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

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Classroom Activity

Best used for 24 students working in pairs.

Reusable materials included in this kit:

- Mixture of four plastic polymers
- 50 small plastic cups
- 12 plastic spoons

Required, but not included:

- NaCl, common table salt (Kosher salt gives a clear solution.)
- Paper towels

Optional:

- 250 mL beakers, 1 per group

Purpose

This is an elegant demonstration of the property of density, heterogenous and homogenous solutions, and percent composition.

Directions

Each type of plastic polymer included in this kit has a different density, making it possible to separate each type using water and salt. First, give each group of students a small sample of the mixture, making certain that each group receives some of each type of plastic.

Instruct students to observe and weigh the mixture and describe whether it is homogenous (uniform throughout the mixture) or heterogenous (inconsistent throughout the mixture). Since color and shape vary throughout the mixture, the plastics pieces tend to make a heterogenous mixture.

Have students place the mixture in their plastic cup or beaker and add water. This will cause one type of plastic to float and some to sink. Have students gently tap the pieces floating at the top – some pieces will be floating due to air bubbles or surface tension. Eventually only one type of plastic will be left floating. Students can then spoon the plastic pieces off the surface of the water, dry the plastic, and weigh it.

Next, have students slowly add salt to the mixture, while stirring. Eventually, another type of plastic will float to the top. Again, surface tension or air bubbles may cause other plastics to rise, and students should gently tap the floating plastics. The floating plastics that remain should be spooned off, dried, and weighed.

As more salt is added, the third type of plastic will float and can be spooned off, dried, and weighed, leaving the fourth and final plastic resting at the bottom of the beaker. Students can then dry this fourth plastic and weigh it.

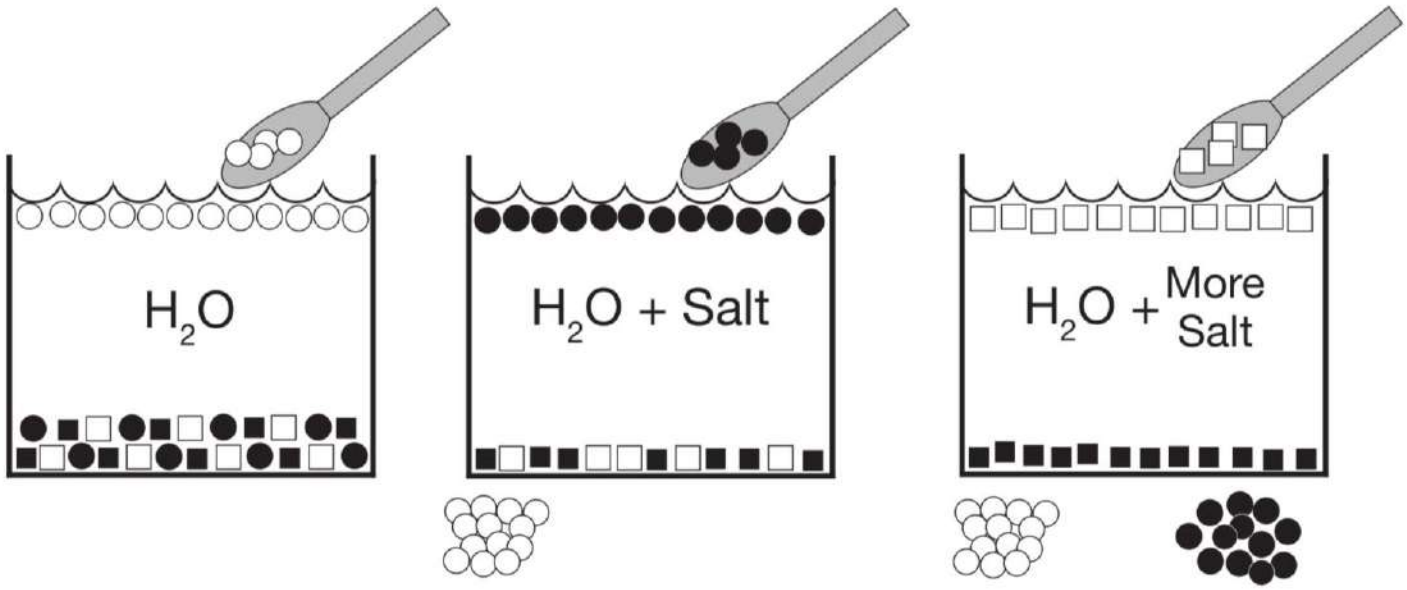
After students weigh each sample they can calculate the percent composition of their mixture.

Compare the different percent compositions from the class. Explain that since each group has a different percent composition, this shows the mixture is heterogenous. If the mixture were homogenous and uniform, each group would have an identical percent composition.

Safety

Standard safety procedure should be observed at all times. Students should wear safety goggles and use caution when working with glassware. Do not attempt to separate the mixture with heat or other chemicals.

Illustrated below are the steps to separate the mixture.



MIXTURE SEPARATION CHALLENGE

Names:_____

Determine the mass of your entire sample by weighing it.
Your mixture weighs: _____

In this experiment you will separate a mixture of four different types of plastic. You will learn about homogenous and heterogenous mixtures. A **homogenous** mixture is uniform, which means that every part of the mixture appears the same. A **heterogenous** mixture is not uniform, and different samples of the mixture will have different properties.

Is your mixture homogenous or heterogenous? _____

Place your mixture in a cup or beaker and add water. Stir the entire mixture. Some pieces of plastic may float to the top. Some of these pieces may be floating because of air bubbles or surface tension. Firmly tap all of the pieces of plastic to make certain pieces with air bubbles sink.

What do you observe? How many types of plastic are floating on top of the water? This is because the plastic floating has a lighter **density** than water. Density is a measure of mass per volume.

Spoon away all of the floating plastic and dry it in a paper towel. Weigh the plastic on a balance.

Plastic #1 weighs: _____

Next, add a spoonful of salt to your beaker or cup and stir. Continue adding salt one spoonful at a time and stirring until you notice another type of plastic float to the surface. Be sure to tap the plastics to sink any that have air bubbles. Spoon the floating plastic out of the water and dry it in a paper towel. Weigh the plastic on a balance.

Plastic #2 weighs: _____

Why did plastic #2 float after adding salt?

_____

_____

Continue to add salt and stir your water. Eventually, the third plastic will rise to the surface. Spoon out this plastic, dry it in a paper towel, and weigh it.

Plastic #3 weighs: _____

The final plastic will be resting at the bottom of your beaker or cup. Carefully pour out the water and collect the final plastic. Dry it in a paper towel and weigh it.

Plastic #4 weighs: _____

The last step in this experiment is to determine the percent composition of your mixture. **Percent composition** will describe the amount of each kind of plastic in your mixture. To find the percent composition, divide the weight of a plastic by the weight of the entire sample, then multiply your answer by 100.

Percent Composition of Each Plastic in the Mixture

The Percent of Plastic #1 in the mixture is: _____%

The Percent of Plastic #2 in the mixture is: _____%

The Percent of Plastic #3 in the mixture is: _____%

The Percent of Plastic #4 in the mixture is: _____%

If you add each percent composition together, what number do you get?

_____

Did everyone in your class have the same percent compositions?

_____

_____

If everyone had the same percent compositions, then the mixture would be homogenous. However, if everyone had different percent compositions, this indicates that your mixture may have been **heterogenous**.

Take Your Lesson Further

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http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

Steel Sphere Density Kit (DEN-350)

Great for teaching the skills of observation and deduction! Although these two shiny, metal spheres have about the same mass, one has a diameter significantly smaller than the other, making their densities vastly different. Seeing the large one float in water seems unbelievable!

Poly Density Kit (DEN-460)

When the 1L bottle is shaken, blue and white beads mix as expected. However, when allowed to settle, the beads separate, white at the top and blue at the bottom. Then, the two separated colored beads slowly come together in the center of the liquid. How often do you see something floating in the middle of the liquid? Great for illustrating so many concepts: solubility, density, miscibility, the salting out effect and more.

Density Paradox (DEN-300)

This is an awesome discrepant event for your most advanced density students! When this solid object is placed in water, it initially sinks. Wait about 60 seconds, and it mysteriously floats to the surface. When removed and placed in different water, it continues to float initially and, in about 60 seconds, mysteriously sinks. How can this be? Great for demonstrating how temperature can affect an object's density! In the experiment described above, the first beaker contained hot water from the tap; the second beaker contained ice water.

Geological Flow Demo (SAND-100)

Rotate the disk and see new sand patterns forming for the next 30 minutes. Students will study it for hours. Great for sedimentary rock formation discussions! Why do some particles seem to form boundary layers between other types of particles? The gold particles seem to always come together in a line, much like a vein of gold found in nature. It is fascinating to observe the flow patterns in the liquid. The final layering is due to differences in particle shape, size, and density.