3M Young Scientist Lab

Classroon Activity | Grades K–2

In the Mix

GUIDING QUESTION

- How can separating mixtures help create clean water?

LEARNING OBJECTIVES

Students will be able to:

- use tools to sort objects based on properties.
- work in teams to develop a solution to a technology problem.

OVERVIEW

Young children spend a lot of time sorting objects by hand. However, tools can also be used to separate mixtures. In this lesson, students explore how knowledge of the properties of objects (mainly size) can be useful for separating mixtures. In this lesson, students cooperate as engineers to solve a real-world problem. Given a container filled with water mixed with soil, Styrofoam, pebbles, and leaves, students use a variety of filtering tools to create a cleaner water sample.

NEXT GENERATION SCIENCE STANDARDS

- PS1.A: Structure and Properties of Matter
  - Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2-PS1-1)
  - A great variety of objects can be built up from a small set of pieces. (2-PS1-3)
- ETS1.A: Defining and Delimiting an Engineering Problem
  - A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (K-2-ETS1-1)(secondary to KPS2-2)
  - Asking questions, making observations, and gathering information are helpful in thinking about problems. (secondary to K-ESS3-2)

- Before beginning to design a solution, it is important to clearly understand the problem.

- ETS1.B: Developing Possible Solutions
  - Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-1)(secondary to K-ESS3-3)(secondary to 2-LS2-2)
- ETS1.C: Optimizing the Design Solution
  - Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-1)(secondary to 2-ESS2-1)

LESSON TIME FRAME

Two 45-minute lessons

BACKGROUND INFORMATION

The world is made of matter. Young children often love to explore matter by combining and separating objects. Mixing up concoctions in a pretend kitchen or sifting sand and shells at the beach are just two examples. When matter is combined to make a mixture, it can be separated using physical means.

A mixture contains two or more substances that are not chemically joined together. Even though the composition of a mixture is variable, each component retains its characteristic properties. Solid objects mixed together in a tossed salad, solutions such as sugar and water, suspensions such as oil and vinegar salad dressing, and colloids such as milk are all examples of mixtures.

To separate a mixture, it is helpful to know some of the properties of the components. Are any of the objects magnetic? Do any of the objects float? What size are the particles? Do any of the substances dissolve? These are all questions that touch on the physical properties of objects. Thinking about these properties helps scientists to determine strategies for separating mixtures. For example, using a magnet to separate mixtures of magnetic and non magnetic metals at a recycling plant may be a more efficient method than separating the objects by hand. Objects that float when placed in water can be easily skimmed off the surface to separate them from a mixture. The particle size of objects will affect the size and type of filters that can be used to separate them out from a mixture. Using filters, evaporation, distillation, and absorption are just a few of the methods industries use to separate mixtures.

From oil spills to the need for clean drinking water, scientists are constantly trying to find creative ways to separate mixtures. Filtering impurities from water is a practical way students can explore a real-world connection to the concept of combining and separating mixtures. While this lesson focuses on using simple instruments such as strainers and funnels to separate particles by size, many home water filtration systems may use more advanced methods to

clean water. For example, some filtration systems use charcoal to absorb harmful chemicals from water. By understanding how simple tools can be used to separate mixtures, students in this primary lesson will be gaining a foundation for understanding more advanced methods of filtering.

MATERIALS

Teacher Materials/Prep

- Container of dried beans
- Container of sand
- Empty container for mixing dried beans and sand
- Broom and dustpan for spills
- Print Student Resources (1 per student):
    - Print/cut Stoplight Exit tickets for students
    - Print Student Capture Sheet: Clean it Up!
    - Print Home Connection Resource: In the Mix

Student Materials

- Student Capture Sheet: Clean it Up!
- Home Connection Resource: In the Mix
- Science journal
- Pencil

Materials per Student Group

- Objects good for sorting by size (e.g. buttons, beans, or blocks)
- Containers of dried beans and sand
- Strainers
- Containers of “polluted water” (water with Styrofoam, soil, leaves, and pebbles)
- Cheese cloth
- Coffee filters
- Funnels
- Cotton
- Spoons and other scoopers
- Mesh screens with safe edges
- Bins or boxes for catching filtered materials

CLASSROOM ACTIVITY

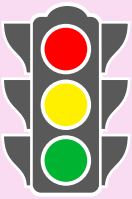
1. Divide students into small groups. Provide students with a group of objects to sort by size (e.g. buttons, dried beans, or blocks of different sizes).
2. Discuss how a mixture is a combination of two or more substances that are not chemically joined together. Just as students separated the group of objects based on physical properties, mixtures can be physically separated.
3. Show students a container of dried beans and a container of sand. Allow students to observe and describe the physical properties of the beans and the sand. Tell students to watch as you mix together the beans and sand. Ask: What are some strategies that could be used to separate the beans and sand? Allow students to brainstorm some ideas. Which strategies would be the most efficient? (e.g. Strainers would be more efficient than separating the mixture by hand.)
4. Show students a strainer. Allow students to predict what might happen if the mixture is poured into the strainer. Students should explain the reasoning behind their predictions. (e.g. The sand would fall through the holes while the beans would remain on the surface because the beans are larger than the holes.) Provide students with the opportunity to test their predictions. Be sure to discuss methods for catching the filtered materials to avoid too much mess.
5. Discuss how scientists use knowledge about separating mixtures to solve real world problems. Humans and other animals need clean water to survive. Sometimes, water can get polluted from litter, oil spills, soil erosion, etc. When water is polluted, often scientists look for ways to clean the water. Show students a container filled with "polluted" water. Tell students that the water is a mixture of soil, pebbles, leaves, and Styrofoam.
6. Divide students into small groups. Show students a variety of materials (strainers, mesh screens with safe edges, cheese cloth, coffee filter, funnel, cotton, spoons, etc.) Give students the task of finding a way to separate the components of the mixture to obtain the cleanest water sample they can using the materials provided. After groups have created a plan, allow them to sketch the plan, carry out the plan and record the results using the Student Resource Page: In the Mix.
7. Provide students the opportunity to practice communication skills as they share the results of their investigations with the rest of the class. Which strategies and materials obtained the best results? Why? How did the properties of the objects affect how the mixture could be separated? (The size of objects affected the ability of the object to fit through strainers of different sizes. Some objects, like Styrofoam, floated to the top and could be easily removed by skimming the surface.)
8. Discuss how a filter is a tool used to separate mixtures. Ask students to think about other examples of filters they have seen and why they are used (e.g. coffee filters, water filters, air filters, etc.) Students should describe in their science journals an example of a mixture and how it can be separated.

9. Bring closure to the lesson by allowing a few students to share their journal responses.

REFLECTION

Distribute one Stoplight Exit Ticket to each student. Students will complete the Stoplight Exit Ticket to show their understanding of the lesson. On their Stoplight Exit Ticket handout, students will color in the section of the stoplight that explains their understanding of the lesson.

Refer back to the Guiding Question for the lesson: How can separating mixtures help create clean water? Tell the students they should keep this question in mind while filling out their exit ticket.



Stoplight Exit Ticket

- **Red:** I do not understand today's lesson.
- **Yellow:** I almost understand today's lesson.
- **Green:** I get it! I understand today's lesson.

HOME CONNECTION

Send home the Home Connection Resource: In the Mix with the students. They may choose one or complete both of the activities provided:

- Students may work with their family to make predictions about mixing salt and warm water, test their predictions, and record the results.
- Students may search for examples of combined substances around their house with their family.

Engineers use technology to solve problems. Work as a team to solve the problem below:

Problem: Help!

Some water has become polluted with extra soil, trash, and other materials. Find a way to clean up the water sample you have been given using materials provided by your teacher.

1. Plan

Draw a sketch of your plan for cleaning the water in the space below. Be sure to label your sketch.

2. Test

3. Results

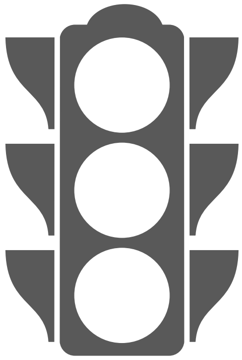
Use words and/or pictures to describe what happened after testing out your plan.

Evaluate. Is there any part of the plan you would have changed? Explain.

STOPLIGHT EXIT TICKET

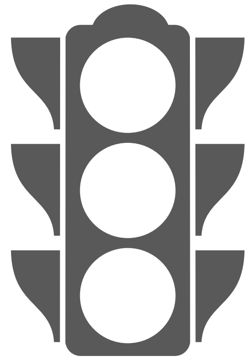
Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



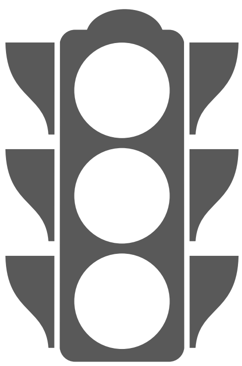
Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



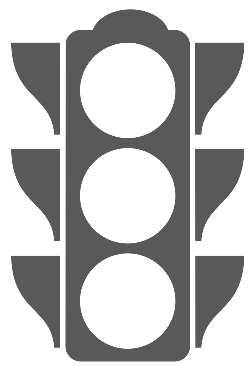
Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



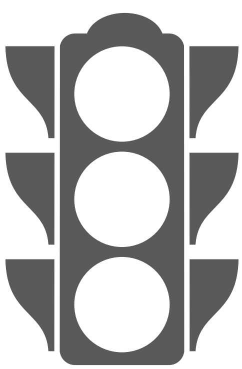
Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



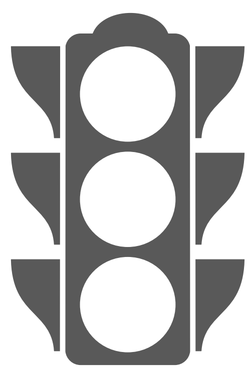
Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



Color in the stoplight to show your understanding of today's lesson.

- **RED:** I do not understand today's lesson.
- **YELLOW:** I almost understand today's lesson.
- **GREEN:** I get it! I understand today's lesson.



HOME CONNECTION RESOURCE: IN THE MIX

Dear Parent or Guardian,

Your young scientist has been learning about properties of materials and how they can be mixed and separated. They worked on an engineering team to develop a filtering system for "polluted" water. Select one of the following tasks to complete together with your young scientist to help reinforce and apply their understanding of science concepts:

- Predict what will happen when salt and warm water are mixed together then test to determine the results. (The salt will dissolve in the water.) Place the salt and water mixture in a shallow bowl and place it in direct sunlight. Observe and discuss what happens to the contents of the bowl. (The water will evaporate, leaving behind the salt.)
- Search for everyday examples around the house where substances are combined (mixed) and/or separated and record these examples as a list. (e.g. separating pasta and water when cooking, combining drink mixes with water, air and water filters, etc.

For more detailed directions, please see the *In the Mix Family Activity*, and more activities found at: https://www.youngscientistlab.com/parents/family-activities.

We hope you continue learning together with us about the power of science.

See you in science class!