

Activity 7.2

Comparing the density of an object to the density of water

How can you predict whether an object will sink or float in water?

In this activity, students use tealight candle holders and a student-made balance to compare the weight of equal volumes of wax, water, and clay. Students then apply their understanding of density from *Activity 7.1*, to predict whether the wax and clay will sink or float. Students will discover that since the wax weighs less than an equal volume of water, it is less dense than water and will float. And since the clay weighs more than an equal volume of water, it is more dense and will sink.

Materials needed for each group

Water
1 Clear plastic cup or container
2 Tealight candles in metal containers
Ruler
Tape
Pencil
Permanent marker
Clay

Notes about the materials

- **Be sure you and the students wear properly fitting goggles.**
- It may be difficult for students to pour water into the small metal container of a tealight candle. Using a small cup or a squirt bottle filled with water makes filling this small container easier.
- It is best to use tealight candles in which the wax comes all the way to the top and has a flat surface. Some have rounded tops, which make it difficult to match the height of the wax with an equal height of water in another container.

Preparing materials

- Each group will need 1 ball of clay. Roll the clay into a ball bigger than what will be needed to completely fill the metal container of a tealight candle.
- If you plan to do this activity again, there is no need to pull the clay out of the metal containers. Store the clay-filled containers in a plastic bag until the next use.

Activity sheet



Copy *Activity sheet 7.2—Comparing the density of an object to the density of water*, pp. 406–408, and distribute one per student when specified in the activity.

Assessment

An assessment rubric for evaluating student progress during this activity is on pp. 437–439. For this formative assessment, check a box beside each aspect of the activity to indicate the level of student progress. Evaluate overall progress for the activity by circling either “Good”, “Satisfactory”, or “Needs Improvement”.

Activity 7.2

Comparing the density of an object to the density of water

Question to investigate

How can you predict whether an object will sink or float in water?

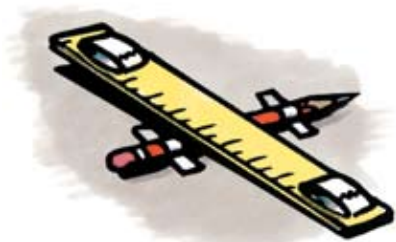
1. Have students construct a simple balance scale.



Distribute *Activity sheet 7.2—Comparing the density of an object to the density of water*. Tell students that in order to predict whether an object will sink or float in water, they will have to know about the density of the object compared with the density of water. Tell students that a balance scale, like the kind they will make, will help them compare these densities.

Procedure

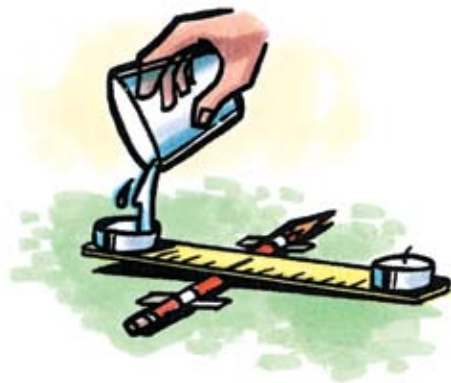
1. Tape the pencil down as shown. Roll two small pieces of tape so that the sticky side is out. Stick each piece of tape to the opposite ends of the ruler.
2. Remove both candles from their metal containers. Place an empty metal container on each piece of tape. Be sure that the edge of the metal container lines up with the end of the ruler as shown.
3. Lay the ruler on the pencil so that it is as balanced as possible. (Don't worry if you can't make it balance exactly.) The spot on the ruler directly above the center of the pencil is your *balance point*. Mark the ruler with a pencil or permanent marker at this point.



2. Have students compare the weight of equal volumes of wax and water.

Procedure

1. Carefully place one of the candles back into its metal container on one end of the ruler. Make sure the same balance point is directly over the center of the pencil.
2. Carefully pour water into the metal container on the other end of the ruler. Be sure to fill the container with water to the same height as the wax fills the other container.



Note: If using a tealight candle with a rounded top, judge how much water to add to the other candle container. This extra volume of wax should be taken into account and a little extra water should be added to attempt to match the actual volume of the wax.

Expected results: The water weighs more than an equal volume of wax and is therefore more dense than wax.

3. Discuss student observations.

Ask students the following questions:

- Which weighs more, the wax or an equal volume of water?
- Which is more dense, wax or water?

4. Ask students to predict whether wax will sink or float in water.

Once students have made a prediction, ask them to explain their reasoning. Then have students test their prediction by placing the wax in a cup of water.



Expected results: The wax floats in water. This is because wax is less dense than water.

Remind students that the *density* of an object has two parts: the volume of the object and how much the object weighs. Tell them that they weighed the same volume of wax and water. Since the wax weighed less than an equal volume of water, the wax is less dense. When students put the wax in water, they noticed that it floated. Objects that are less dense than water will float. The density of an object compared with the density of water will determine whether or not an object will sink or float.

5. Have students determine whether clay will sink or float in water.

Procedure

1. Set up the ruler balance with the empty metal containers on each end. Check your balance point.
2. Fill one metal container with clay and replace it on the end of the ruler. Make sure the balance point is centered on the ruler.
3. Slowly and carefully add water to the empty container until it is filled.



Expected results: The clay weighs more than an equal volume of water and is therefore more dense than water.

6. Discuss students' observations and ask them to predict whether clay will sink or float in water.

Ask students questions like the following:

- Which weighs more, the clay or an equal volume of water?
- Which is more dense, clay or water?
- Do you think clay will sink or float in water? Why?

Students should have some clay left over after filling the metal container. Have students test their prediction by placing this left-over piece of clay in a cup of water.



Expected results: The clay sinks in water. This is because clay is more dense than water.

Note: If some students suggest that the clay could be made to float by changing its shape, tell them that they will investigate the effect of changing an object's shape in *Activity 7.7*.

7. Have students explain, in terms of density, why a very heavy object like a log floats and why a very light object like a pebble sinks.

Ask students:

- Use what you know about density to explain why a heavy object like a log floats and why a very light object like a pebble sinks.
- How could you predict whether or not an object will sink or float?

Students should recognize that a log will float because wood is less dense than water. If you could weigh a large amount of water that has the same volume as the log, the log will weigh less than the water. Therefore, the log floats. A pebble will sink because rock is more dense than water. If you could weigh a small amount of water that has the same volume as the pebble, the pebble will weigh more than the water. Therefore, the pebble sinks.

Students should realize that if an object weighs more than an equal volume of water, it is more dense and will sink; and if it weighs less than an equal volume of water, it is less dense and will float.