

APS Learning Cycle/Inquiry Activity for Elementary School Science

EXPLORING DENSITY

Purpose

To learn the relationship between weight and density of solids and liquids. Also, to develop skills in observation and experimental design.

Objectives: Students will be able to...

- Describe the difference between density and weight.
- Describe how to determine whether different liquids have different densities.
- Describe how to determine whether different solids have different densities.
- Design a density layers bottle with both solids and liquids.
- Present their findings on "Why things float"

Materials: light corn syrup (8 oz per student), golf balls, ping pong balls, apples, balances (or rulers and round pencils to create balances), measuring tapes, salt, tubs or buckets, food coloring, mineral oil or vegetable oil (8 oz per student), 8 oz clear plastic cups, 12-16 oz clear plastic bottles (soda or water), materials to test for density (e.g., paper clips, wire pieces, Styrofoam pieces, peanuts in the shell, plastic beads, glitter, wood chips, aluminum foil pieces, hair pins, toothpicks, plastic bottle caps, junk jewelry)...clean out your junk drawer!!

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ENGAGE

To engage students in their exploration of density of solids and liquids, first pose the questions, "Do heavier things sink and lighter things float?" "Do bigger things sink and smaller things float?" Find out how many students agree with these statements. These are their hypotheses for their first experiments! Divide students into groups and give each student a copy of the data table; each student should mark his/her predictions (hypotheses) on the data table. Give each group a golf ball, a ping pong ball, and an apple. Each group should determine which item is heaviest, which is in the middle, and which is lightest; they should record their findings on the data table. Use the balance for this or create a balance as described in the WonderScience unit, "Float or Sink." They can use a measuring tape to determine the circumference of each item. Students should end the activity wondering why all their predictions weren't correct (a healthy state of confusion!!).

EXPLORE

In this activity, students will begin to explore the concept of density further. First, they should do the water and wax activity in the WonderScience unit, "Float or Sink (pg 2-3). Next, they should get a container of salt water. They should make predictions about many of the small items available to test. They should predict for both plain water and salt water; if desired, use the data page provided. The focal question here is, "What floats and

sinks and does it do the same in salt and fresh water? For some items, they may want to try to predict as they did with the candle; remember that it is the **volume** of water the item pushes aside that is important. Before they finish, students should measure the same volume of salt water and fresh water and see which weighs the most on the balance. Students should write down any questions they have, especially results that don't "feel" right.

EXPLAIN

Review with students the concept of density (I like to use two toy boats or plastic boxes and change the density by adding larger items (such as ping pong balls or cotton balls, then adding smaller items, such as beads, that fit in between). Review why salt water is more dense than fresh water; demonstrate this on the balance. Explain why this allows some things to float that sink in fresh water; use examples such as the Great Salt Lake, the St. Lawrence Seaway, an underwater brine seep, or a pillow that is more and less stuffed. Demonstrate on the balance that a ship floating in salt water can carry more cargo than the same ship floating in fresh water!

Be sure to tell the story of Archimedes. You may want to do the "volume of an orange" activity in the My Health, My World unit. Answer as many of the questions that students generated as possible.

ELABORATE

In this activity, students engage in developing their own inquiry-based exploration of density of solids and liquids. Give students a liquid challenge first: "Create a bottle with 3 liquids that have 3 different densities. First, students should show that they can create three layers by dribbling a little of the 3 liquids they select into a clear plastic cup. They may want to use the balance to show that the liquids have different densities. You can provide "standard" cups with 2 fluid oz of each liquid for students to use on the balance.

Once they create their 3 layers, encourage them to add a little food coloring to their bottle and predict which layer will become colored. The next challenge is to add small items to their bottle so that some items float on each of the layers of liquid. Finally, they should make a "density line" showing their three layers, labeling them most to least dense and adding the solid items, showing where they are on the "density line" created by the liquids. If preferred, students may glue or tape items to their paper or they can draw them.

EVALUATE

- Use student responses on the data tables and the density line report.
- Ask students to create a T-shirt design showing "Why Things Float!"

Related books:

- WonderScience unit, "Float or Sink"
- Other books on ships, swimming, or the Great Salt Lake

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EXPLORING DENSITY

Hypothesis	I predict "Yes"	I predict "No"
Heavier things sink and lighter things float.		
Bigger things sink and smaller things float.		

Do heavier things sink and lighter things float?

Weight	Item	Floated	Sank
Heaviest			
Middle			
Lightest			

Was my prediction correct?
Why or why not?

Yes

No

Do bigger things sink and smaller things float?

Weight	How big around was it?	Item	Floated	Sank
Biggest				
Middle				
Smallest				

Was my prediction correct?
Why or why not?

Yes

No

