

# TO SINK OR NOT TO SINK, THAT IS THE QUESTION

GRADES 3-5

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**TIME ALLOTMENT:** 55-minutes

## OVERVIEW:

The ability of an object to float is generally controlled by two properties: its density and its displacement. Objects that have a density greater than water tend to sink. Objects that are less dense than water tend to float. If an object displaces its own weight in water, it will float regardless of its density.

**SUBJECT MATTER:** Science

## LEARNING OBJECTIVES:

The learner will:

- estimate the volume of irregularly shaped solids
- predict whether objects will float or sink, based upon their observations and calculations
- calculate the density of objects, using displacement method

## STANDARDS:

### National Science Education Standards

<http://bob.nap.edu/html/nses/html>

Content Standard B:

Properties of objects and materials

### Louisiana Science Framework: State Standards for Curriculum Development

<http://www.lcet.doe.state.la.us/doe/assessment/standards/SCIENCE.pdf>

**PS-E-A1:** Observing, describing, and classifying objects by properties (size, weight, shape, color, texture, and temperature).

**PS-E-A2:** Measuring properties of objects using appropriate materials, tools, and technology.

**PS-E-A3:** Observing and describing the objects by the properties of the materials from which they are made (paper, wood, metal).

## MEDIA COMPONENT:

### Video:

Dr. Dad's PH3: *Buoyancy & Density*

### Web sites:

[http://sm3a.gsfc.nasa.gov/hst\\_sm3A\\_gallery\\_nbltesting.htm](http://sm3a.gsfc.nasa.gov/hst_sm3A_gallery_nbltesting.htm)  
Astronauts prepare for space missions by training under water.

<http://crawfishaquatics.com/swimming1.htm>  
This site relates the importance of buoyancy to our bodies ability to swim & float.

<http://www.ph.utexas.edu/~phy-demo/demo-txt/2b40-30.html>  
This site provides directions for developing a cartesian diver.

## MATERIALS:

### Per Class

- 3 Wide Mouth Graduated Cylinders (500 mL)
- 3 Large clear containers (pickle jars work well)
- 3 large non-breakable pans (pie pans, cake pan, etc.)
- Various fruits & vegetables
- 3 small toys
- 9 Miscellaneous small objects for measuring
- 3 tape measurers
- 3 balances
- 3 rulers
- 300 pennies or marbles
- 1 roll aluminum foil

### Per Group

- Clipboard
- Activity Sheet
- Pencil
- Water

### Per Student

- 1 – 12 inch sheet aluminum foil

**PREP FOR TEACHERS:**

1. **CUE** tape to the opening slates for the Dr. Dad video, just pass the “Mark Twain” clip.
2. Prepare 3 stations:

<i>Station 1</i>	<ul style="list-style-type: none"> <li>• Large clear container half filled with water</li> <li>• Fruits</li> <li>• Balance</li> <li>• Tape measure</li> <li>• Ruler</li> <li>• Non-breakable pan</li> <li>• Graduated cylinder</li> </ul>
<i>Station 2</i>	<ul style="list-style-type: none"> <li>• Large clear container half filled with water</li> <li>• Vegetables</li> <li>• Balance</li> <li>• Tape measure</li> <li>• Ruler</li> <li>• Non-breakable pan</li> <li>• Graduated cylinder</li> </ul>
<i>Station 3</i>	<ul style="list-style-type: none"> <li>• Large clear container half filled with water</li> <li>• Toys/common objects</li> <li>• Balance</li> <li>• Tape measure</li> <li>• Ruler</li> <li>• Non-breakable pan</li> <li>• Graduated cylinder</li> </ul>

3. Duplicate activity pages

**INTRODUCTORY ACTIVITY:****SETTING THE STAGE**

Students will work in small groups and visit 3 activity stations.

1. Students should be in their cooperative groups. Give the recorder in each group a clipboard, activity sheet and pencil.
2. Students should be give one minute at the beginning of each rotation to predict whether the objects at the station will sink or float. Each group should come to consensus and the answer recorded on the activity sheet.
3. When the students have made their predictions, they are now ready to begin experimentation. The designated student should slowly place one object at a time in the large, clear glass container of water. They should also test each object more than once. Record results.
4. Additional tools are placed in each station for students do make additional discoveries. They should record their findings.
5. Compare each group results. What are the similarities and differences?
6. Ask students WHY they think that some of the objects floated and some sank. Write their answers on the board or on flip chart. Do not tell them the answer. Tell them that in the video, Dr. Dad's daughter was given that exact same question to answer in school and that they are going to find out the answer by watching the video.

**LEARNING ACTIVITIES:**

1. **START** the Dr. Dad tape and **PLAY** until Dr. Dad says, "What should we do? (5:12). **PAUSE**. Ask students what they think should be done to the sinker to make it float? **RESUME** video. **PAUSE** just before Olivia actually puts the flattened sinker in the water. (5:55) Ask students if they think that the flattened sinker will float or sink? **RESUME** video and **PAUSE** at (6:18). Let students discuss what happened. **FAST FORWARD** the video until Dr. Dad says, "While we were talking..." (11:06). **RESUME PLAY** until Dr. Dad completes weighing both of the sinkers and says, "Let's take a look." (11:35) **PAUSE** the video. Ask students to predict whether or not the flattened sinker will sink or float. **RESUME PLAY** until the girls float their clay boat. **STOP** video.
2. Tell students that they are not going to build a clay boat like Olivia and her friends, but an aluminum boat instead.
3. Give each student a 12 inch long sheet of aluminum foil. If students wish to work in pairs, that is acceptable. The challenge is to build a boat that will hold the most pennies and still float.
4. Test the boats in the shallow pans.
5. Have students discuss why some designs floated and others did not and why some carried more pennies than others.

**CULMINATING ACTIVITY:**

1. Give each student a copy of the Density worksheet.
2. First have the students estimate the volume of each of the objects. Record results.
3. Have students to fill the graduated cylinder about half way with water and record the amount in milliliters.
4. Have students determine the true volume of each object by carefully placing it in the water and seeing how much the water rises above the starting mark. After removing each object from the water, remind them to fill the cylinder back up with any lost water and record any change in starting volume.
5. After calculating the volume, have students determine the mass of each item by placing it on the gram scale or balance.
6. Students should calculate the density of each object by using the formula  $\text{Density} = \text{Mass} / \text{Volume}$ .
7. Students should discuss their findings and make predictions as to whether other objects will float or sink.

**CROSS-CURRICULAR EXTENSIONS:**

**Social Studies:** Investigate the construction of Native American canoes and the different materials used to build them.

**COMMUNITY CONNECTIONS:**

- Many universities have spring “concrete canoe races.” Contact the engineering department at a nearby university and ask if someone from their department would talk to the class about the boat design.
- Invite local boat and marine store managers to talk to the class. The Department of Wildlife & Fisheries is also a good resource on boating.

**STUDENT MATERIALS:**

- **Sink or Float** Worksheet
- **Density** Worksheet

**Sink or Float**

List the name of the objects in each station. What do you think will happen to each object when placed in water? Write yes in the sink column if you think the object will sink. If you predict the object will float, write yes under float. Slowly place each object in the container. Record the results. Compare your predictions with the actual results.

Name of Object	Sink		Float	
	I Think	I Know	I Think	I Know



Density Worksheet

Object Name	Volume (mL) estimated	Volume (mL) actual	Mass (grams)	Density $\frac{M(g)}{V(mL)}$