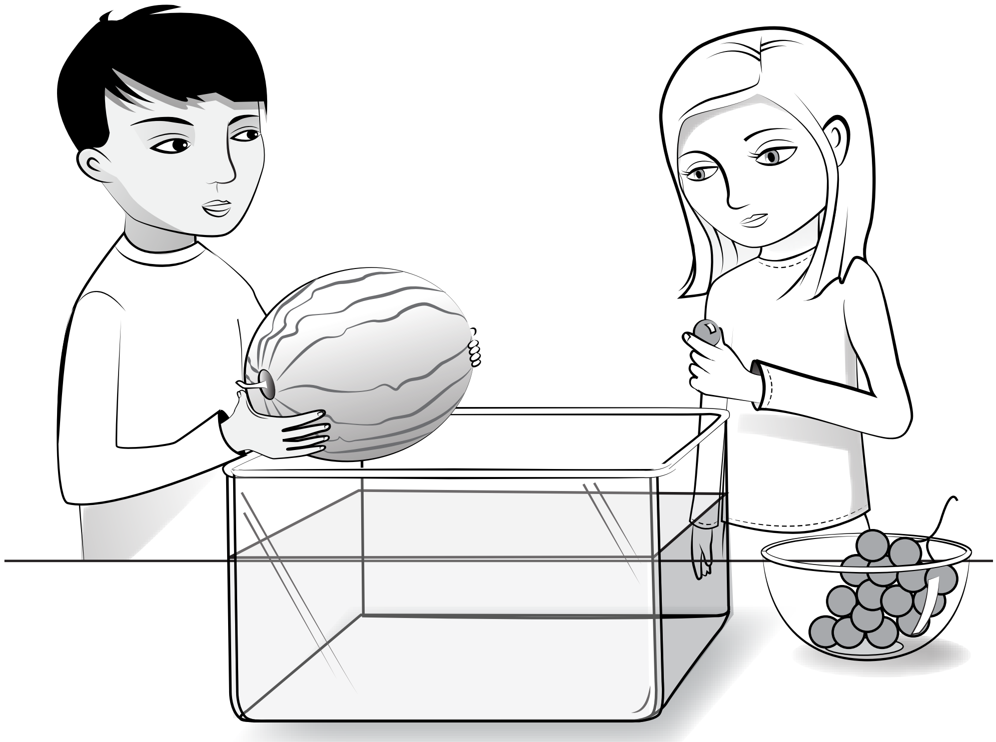
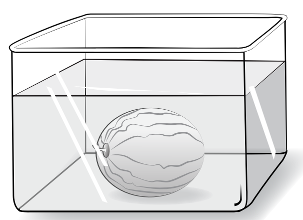
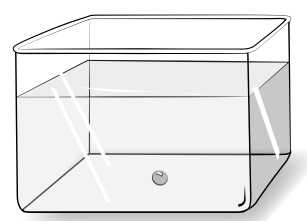
# Watermelon and Grape



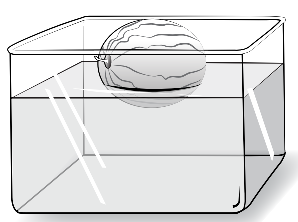
**The watermelon will sink.**



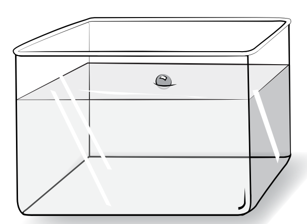
**The grape will sink.**



**The watermelon will float.**



**The grape will float.**



# What are you thinking?

# Watermelon and Grape

## Teacher Notes

### Purpose

The purpose of this assessment probe is to elicit children's ideas about floating and sinking. The probe is designed to find out if children think size is the property that determines whether an object floats or sinks.

### Related Concepts

sinking and floating, physical properties

### Explanation

The best answers are "The watermelon will float" and "The grape will sink." Although the watermelon is much larger than the grape and its "felt weight" is much greater, its mass-to-volume ratio (density) is less than that of a grape. Also, its density is less than water; therefore it floats in water. The grape's mass-to-volume ratio is greater than the watermelon's even though its "felt weight" is much less. The density of a grape is greater than that of the water; therefore it sinks. Denser objects are "heavy for their size," while less-dense objects are "light for their size." An object denser than water sinks; an object less dense than water floats. It is the mass-to-volume ratio that makes a difference, not the size.

### Curricular and Instructional Considerations for Grades K–2

At the K–2 level, floating and sinking provides a context for students to investigate and describe properties of objects such as size, shape, and weight. Students should have a variety of firsthand experiences in observing how objects of various sizes, shapes, weights, and materials float or sink. Although density is a concept that is taught in later grades, students at this level can begin to describe objects as being "heavy or light for their size." It is not important that students know whether a watermelon or grape floats or sinks, nor should K–2 students be expected to use the concept of density. What is important when using this probe is to determine whether students recognize that size alone does not determine whether an object floats or sinks and provide them with experiences to test this, such as big objects that float and small objects that sink, and vice versa.

### Administering the Probe

Start off by asking the students if they have ever seen a watermelon and a grape. Make sure students are familiar with a watermelon and a grape before responding to the probe. If the actual objects are available, students can look at and feel them first. You can show pictures of the objects, preferably someone holding a watermelon so that students can get a sense of the size. You can also ask students to show you with their hands how big a watermelon and grape are before engaging with the probe. Ask students, "What do you think will happen when the watermelon and the grape are dropped in the water?" Make sure students know there are two parts to this probe. First, they select what they think will happen when the watermelon is put in the tub of water and put an *X* in or color the box. Then they make a prediction about the grape when it is placed in the water. *Note:* It is not important that students know the answer to this probe. What is important is the reasoning they use to support their prediction. See pages xxviii–xxxiii in the introduction for techniques used to guide "science talk" related to the probe.

## Related Ideas in *Benchmarks for Science Literacy* (AAAS 2009)

#### K–2 Structure of Matter

- Objects can be described in terms of their properties. Some properties, such as hardness and flexibility, depend upon what material the object is made of, and some properties, such as size and shape, do not.

## Related Core Ideas in *A Framework for K–12 Science Education* (NRC 2012)

#### K–2 PS1.A: Structure and Properties of Matter

- Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured.

## Related *Next Generation Science Standards* (Achieve Inc. 2013)

#### Grade 2: Matter and Its Interactions

- 2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

#### Grade 5: Matter and Its Interactions

- 5-PS1-3: Make observations and measurements to identify materials based on their properties.

## Related Research

- Students' ways of thinking about floating and sinking include the roles played by material, weight, shape, cavities, holes, air, and water (Driver, Squires, Rushworth, and Wood-Robinson 1994).
- A study conducted by Biddulph and Osborne (1984) asked students ages 7 to 14 why things float. The typical response was "because they are light."
- Some students use an intuitive rule of "More A-More B" (Stavy and Tirosh 2000). They reason that if you have a larger object, it must sink more.
- Children younger than age 5 typically ignore an object's size and focus on its "felt weight" (Smith, Carey, and Wiser 1984).
- Piaget's studies (1973) showed that children initially think of a pebble as being "light" but later describe it as "light for them" but "heavy for water." He showed that when children reach ages 9 and 10, they begin to relate the density of one material to that of another material by describing that some materials float because they are lighter than water (Driver, Squires, Rushworth, and Wood-Robinson 1994).

## Suggestions for Instruction and Assessment

- A related probe, "Floating Logs," can be adapted for this grade level to find out if students think a larger object of the same material floats differently (Keeley, Eberle, and Tugel 2007).
- If a watermelon and grapes are available, this probe can be used as a P-E-O (Predict-Explain-Observe) probe to launch into an investigation (Keeley 2008). When students see that their observations do not match their predictions, they can make new claims and support them with the evidence from their investigation. Additionally, a variety of other large and small fruits or other objects can be used to have students make predictions about floating or sinking; explain the reason for their

predictions; and then test, observe, and revise their ideas.

- Extend children's investigations to objects of the same material but different sizes and shapes.

## Related NSTA Resources

Keeley, P. 2010. Formative assessment probes: "More A-More B" rule. *Science and Children* 48 (2): 24–26.

Robertson, W. 2007. Science 101: How can an ocean liner made of steel float on water? *Science and Children* 44 (9): 54–59.

Smithenry, D., and J. Kim. 2010. Beyond predictions. *Science and Children* 48 (2): 48–52.

## References

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American Association for the Advancement of Science (AAAS). 2009. Benchmarks for science literacy online. *www.project2061.org/publications/bsl/online*

Biddulph, F., and R. Osborne. 1984. Pupil's ideas about floating and sinking. Paper presented to the Australian Science Education Research Association Conference, Melbourne, Australia.

Driver, R., A. Squires, P. Rushworth, and V. Wood-Robinson. 1994. *Making sense of secondary science: Research into children's ideas.* London: Routledge.

Keeley, P. 2008. *Science formative assessment: 75 practical strategies for linking assessment, instruction, and learning.* Thousand Oaks, CA: Corwin Press and Arlington, VA: NSTA Press.

Keeley, P., F. Eberle, and J. Tugel. 2007. *Uncovering student ideas in science, vol. 2: 25 more formative assessment probes.* Arlington, VA: NSTA Press.

National Research Council (NRC). 2012. *A framework for K–12 science education: Practices, crosscutting concepts, and core ideas.* Washington, DC: National Academies Press.

Piaget, J. 1973. *The child's conception of the world.* London: Paladin.

Smith, C., S. Carey, and M. Wiser. 1984. A case study of the development of size, weight, and density. *Cognition* 21 (3): 177–237.

Stavy, R., and D. Tirosh. 2000. *How students (mis)understand science and mathematics: Intuitive rules.* New York: Teachers College Press.