

Lesson 4: Properties of Plastic

Grade Level:

Grades 3-5

Concepts Taught:

Density, heating/cooling

Activity Time:

30 minutes

Essential Questions:

- What is a property in science?
- What are some properties of plastic?
- How might the effect of a refrigerator or a microwave have on plastic containers?
- Can plastic float? Sink?
- How might plastic effect oceans, streams, lakes, or rivers?

NCCore/Essential Standards:

Grade Three: Math Standards 3.MD.2—3.MD.4; **Grade Four:** Math 4.MD.4; Science 4.L.1.1, 4.L.1.3

Materials:

Pieces of cut up plastic bottles number 1-7
 1-container of water for each student group
 prediction worksheet
 aluminum foil
 #1 2-liter plastic soda bottle w/ cap
 #2 1-gallon milk jug
 hot tap water
 4 thermometers
 Styrofoam coffee cup
 1-liter plastic bottle with the neck cut off
 paper cup
 disposable plastic party cup
 pieces of fabric-OPTIONAL (fur, flannel, silk, cotton, synthetic fabrics)

Objectives:

students will investigate how different numbered plastics have different properties: such as the ability to sink or float; the ability to change shape or be malleable when heated and insulated.

Procedure:**Sink/Float display:**

1. Using some common objects found in the classroom and a clear container filled with water, demonstrate that some objects sink and some float. Those that have a greater density than water will sink and those that have less density than water will float. Plastics also behave the same way. Show students the cut up pieces of plastic. Explain to students that some of these plastics will sink and some will float. Using the attached chart, have students predict which pieces will sink and which will float. Allow students to examine the plastic in small groups.

a.#1: sinks

b.#2: floats

c.#3: sinks

d.#4: floats

e.#5: floats

f.#6: sinks if condensed (party cups, etc.); floats if "expanded" (polystyrene coffee cups, etc.)

g.#7: some will sink and some will float since it is an unpredictable mixture of plastics



2. Put all plastic pieces in the water and record observations.

3. Have students answer the questions on the sheet.

Heating and Cooling:

1. Explain to students that when heat is applied to substances, they can change state. When heat is applied to ice (a solid), it will melt into liquid water and will remain a liquid at room temperature. When wax is heated by the wick of a candle, it melts from a solid to a liquid. However, when it is allowed to cool at room temperature, it returns to a solid.

2. Plastics behave more like wax when heated. To demonstrate this, pour hot water (as hot as your tap allows) into a clean, empty, 2-liter soda bottle. Fill $\frac{3}{4}$ full and cap. Using gloves, demonstrate to the students that the bottle becomes more flexible when it is heated

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by gently squeezing the sides of the bottle.

3. Note that the plastic used in the above step was a number 1 plastic bottle.

4. Repeat the same experiment using a plastic milk jug, a number 2 plastic. Allow students to predict the results. The milk jug will not become as malleable when hot water is added.

5. Continue this line of thinking by arranging four containers for the students: a Styrofoam coffee cup, a 1-liter plastic bottle with the neck cut off, a paper cup, and a plastic picnic-style disposable cup.

6. Using hot tap water, fill each container with 50 mL of water. Immediately put a thermometer in each container and record the temperature.

7. Using the worksheet, have students predict which container will be the best insulator after 15 minutes and write one sentence to explain their reasoning.

8. During the 15-minute wait time, discuss with students the transfer of energy that occurs when something cools.

9. After 15 minutes, note the temperature in each container for students.

10. Have students complete the data collection and answer the critical thinking questions.

11. Discuss with students how to increase the insulation value of different plastics. They could wrap material around each one (fur, flannel, silk, cotton, synthetic fabrics) and retest results. Also, they could stack the cups in different ways to increase heat retention. Retest ideas if desired.

Extensions for Grades 3-5:

1. Discuss with students how the shape of an item can affect its ability to float or sink. Demonstrate with an empty soda bottle with the cap on. Why does it float? Now take the cap off and fill it with water? Why does it sink?

2. Have students use pieces of aluminum foil and make "boats" that will float.

3. Discuss why floating litter would be a problem for aquatic animals.

4. How would the plastics behave if the water was very salty (like the ocean)? To test this, add several heaping tablespoons to the water and stir well. Retest plastics.

5. Discuss how to keep warm on a cold day. What kind of clothes do we wear? Investigate animals that must have insulation. How do you think they would adapt to a warmer climate considering the amount of insulation they have? How do humans adapt to a warmer climate?

Name _____

Will it Float?

	Kind of Plastic						
	1	2	3	4	5	6	7
Do you think it will float? Write yes or no.	yes						
Did it really float? Write yes or no.	no						

Name _____

Will it Float?

	Kind of Plastic						
	1	2	3	4	5	6	7
Prediction: Will it float							
Results: Did it float or							

- Which pieces float: number 1 or number 2? _____
 - How many of your predictions were correct? _____
 - Did number 3 plastic sink or float? Why? _____
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Which cup insulates best?

	Plastic bottle	Coffee Cup	Paper Cup	Picnic Cup
Prediction: Put a check under which cup you think will keep the water warmest.				
Starting temperature				
Temperature after 15 minutes				

- Which cup was the best insulator (kept the water warmest)? _____
- Which cup was the worst insulator (did not keep the water warm)? _____
- What was the difference in temperature between the best and worst insulator? _____
- What is one way you could help the picnic cup keep the water warmer? _____