



**Science Unit:** *Matter*

**Lesson 8:** *Density and Mass*

School year: 2004/2005

Developed for: Queen Alexandra Elementary School, Vancouver School District

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Grade level: Presented to grades 1 - 2; appropriate for grades 1 - 4 with age appropriate modifications.

Duration of lesson: 1 hour and 20 minutes with extension activities for 1 hour and 20 minutes

### **Objectives**

1. Review properties of liquids and solids.
2. Learn about density and mass.
3. Learn that solid objects sink or float in liquids depending upon the density characteristics of the solids and liquids.

### **Background Information**

Matter is anything that occupies space. The three states of matter are solids, liquids and gases. All matter is made up of molecules and molecules are made up of atoms and sub-atomic particles. An atom is the smallest particle of an element that can exist either alone or in combination. Molecules and atoms are extremely small and they cannot be seen with a microscope. Properties of matter include mass, weight, volume and density. Mass is the amount of matter in an object and mass is measured in grams. A rock has more mass than a piece of fabric. Weight is the force of gravity pulling on an object. Gravity makes us weigh more on earth than in outer space. Volume is how much space an object takes up. Density is a measure of how tightly packed the matter is in an object is and the weight of the atoms in the object. Iron is more dense than paper because of the weight of the atoms in the objects. Water (a liquid) is denser than water vapor (a gas) because the atoms in water are packed more tightly together in water compared to water vapor.

### **Vocabulary**

Matter: Something (a substance) that occupies space; what something is made of; the three states of matter are solids, liquids and gases; matter is made up of molecules.

Solid: A substance that has its own shape (keeps its form); a solid usually feels firm; the shape of solids can change but the solid material takes up the same amount of space.

Liquid: A substance that flows easily and takes the form of its container; liquids take up the same amount of space regardless of the size and shape of the container.

Gas: A substance that does not have its own shape; it can expand indefinitely or be contained in a container.

Molecule: The smallest particle of a substance that retains all of the properties of the substance; comprised of two or more atoms and sub-atomic particles.

Atom: The smallest particle of an element that can exist either alone or in combination.

Mass: The amount of matter in an object; mass is measured in grams or kilograms.



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<u>Weight:</u>	The force of gravity pulling on an object.
<u>Volume:</u>	How much space the substance or object takes up.
<u>Density:</u>	A measure of how tightly packed the matter is in an object and the weight of the atoms in the object. Density = mass/volume.
<u>Sink:</u>	To go below the surface and travel to the bottom (such as a rock in water).
<u>Float:</u>	To remain on or near the surface of a liquid without sinking. An object floats if the density of the object is less than the density of the liquid.

### Materials

- food coloring
- pairs of objects of similar size but with different densities such as:
  - plastic chip/loonie
  - plastic ball /glass marble
  - wooden/plastic beads
- pairs of identical objects of different sizes:
  - pieces of wood
  - metal washers
  - rubber ring washers

The following objects are needed for each group of students for their density columns:

- tall clear drinking glass
- corn syrup
- water
- canola oil
- bean
- coin
- button
- mung bean seed
- paperclip
- toothpick
- rubber band
- Lego
- long wooden stick
- scissors

### In the Classroom

#### Introductory Discussion

1. Slowly pour the same volumes of liquids one at a time into a tall clear glass in the following order: corn syrup, water and oil. After pouring each liquid, ask:
  - Where does the liquid come from?
  - What do you see?
  - Which liquid looks thickest?
  - What happened? Corn syrup is denser than water, which is denser than oil.
  - What is floating on top of the water?
2. Add drops of food coloring into the density column. Ask students to describe what happened.
3. Select pairs of objects of similar size but different densities. Ask students to predict what will happen when each object is dropped into the density column. Have a student drop the objects and ask students to share their observations.



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4. Select pairs of identical objects of different sizes. Ask students to predict what will happen when each object is dropped into the density column. Have a student drop the objects and ask students to share their observations.
5. Discuss density, mass and other vocabulary words.
6. Give instructions to students for the Density Column activity.
7. Safety rules: Ask questions if you don't understand how to do something in an experiment. Don't put anything in your mouth or near your eyes during the science experiment. Wash your hands after the science activity.

### Science Activity/Experiment

1. Density column: before class, pour corn syrup into a tall, transparent drinking glass until the glass is 1/3 full, then pour the same volume of water followed by slightly less oil so that it reaches approx. 2 cm from the top of the glass.
2. Students will make predictions of where each object will travel to in the density column by pasting the individual words of the objects on a density column activity sheet that illustrates the layers of liquids.
3. The students can then test each object one at a time and record their observations on the backside of the activity sheet in a similar manner.
4. Give a wooden stick to each student group and ask students to gently push objects down in the density column and determine what happens to the objects. Other objects can be gathered from the classroom to test in the density column.
5. Science Journal: Students will record predictions and observations on an activity sheet in their science duo-tang. Follow-up can include students recording what they were surprised by and what they learned from the science experiment.

### Closure Discussion

1. Discuss predictions, observations and results for the Density Column activity.
2. Were your predictions the same as your observations? Promote discussion of density and mass with questions such as:
  - Did the liquids in the density column stay separate? Why?
  - Were some liquids thicker than other liquids?
  - Which objects sank to the bottom of oil, water, and corn syrup? Why?
  - Which objects floated on oil? Why?
  - Were you able to push an object to a different layer in the density column and have it stay in the lower layer?
  - What surprised you?
  - What is density? Do different liquids and solids have different densities?



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### References

1. Hann, Judith. 1991. How Science Works. A Reader's Digest Book. Pp. 13-41. Dorling Kindersley Limited, London, England
2. e.encyclopedia Science, Google. 2004. Matter, pp. 10-17. DK Publishing Inc.
3. <http://www.school-for-champions.com/science/matterstates.htm> States of Matter by Ron Kurtus, (revised November 6, 2003). School for Champions web site.
4. <http://www.msu.edu/~hayessar/friendshop/friendshopscience.htm> Density Column by Sarah B. Hayes – Friendship Elementary Science Activities.
5. <http://www.school-for-champions.com/science/density.htm> Density of Matter by Ron Kurtus. School for Champions web site.
6. <http://www.school-for-champions.com/science/fluidfloating.htm> How Objects Float in Fluids by Ron Kurtus. School for Champions web site.

### Teacher Assessment of Learning

1. The teacher will observe the children and talk to them during the experiment about their predictions.
2. The teacher will observe children referring to density and mass correctly when doing the experiment.
3. The teacher will mark the prediction recording sheet for whether the children used the knowledge gained from the introductory discussion.
4. The teacher will mark the results sheet for accuracy.

### Extension of Lesson Plan

#### Sink or Float

Objects sink or float in liquids based on the density of the object and the density of the liquid. Wood floats on water because it is less dense than water. The water it displaces equals the weight of the wood (not the volume of the wood). Students can experiment by testing a variety of objects to determine if they sink or float in water.

#### **Objective**

The students will be able to predict correctly whether objects will sink or float.

#### **Materials**

- wood block
- craft ball
- plastic cookie cutter
- cork
- container of water
- paper
- rocks
- metal
- macaroni
- recording sheet
- tin foil
- Styrofoam
- Lego
- pencil

#### **Introductory Discussion**

Review the introductory discussion and vocabulary from the Density and Mass lesson (pages 1-3 of this lesson).



### **Science Experiment**

1. Students are organized into groups of 4.
2. Each group has all of the materials.
3. Students write a prediction of whether an object will sink or float.
4. Students take turns putting each object in water and observing whether it sinks or floats. Students record their results.

### **Closing Discussion**

The teacher will ask the following questions:

1. How does density affect an object's ability to sink or float?
2. How does an object's mass affect its ability to sink or float?
3. Did any of your predictions surprise you?

### **Teacher Assessment**

1. Teacher will observe responses to question #3 in the Closing Discussion noting if students were able to explain why their prediction was surprising.
2. Teacher will mark recording sheet and note correct predictions.

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<b>coin</b>	<b>coin</b>	<b>coin</b>	<b>coin</b>
<b>button</b>	<b>button</b>	<b>button</b>	<b>button</b>
<b>lima bean seed</b>	<b>lima bean seed</b>	<b>lima bean seed</b>	<b>lima bean seed</b>
<b>paper clip</b>	<b>paper clip</b>	<b>paper clip</b>	<b>paper clip</b>
<b>toothpick</b>	<b>toothpick</b>	<b>toothpick</b>	<b>toothpick</b>
<b>rubber band</b>	<b>rubber band</b>	<b>rubber band</b>	<b>rubber band</b>
<b>lego</b>	<b>lego</b>	<b>lego</b>	<b>lego</b>

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<b>coin</b>	<b>coin</b>	<b>coin</b>	<b>coin</b>
<b>button</b>	<b>button</b>	<b>button</b>	<b>button</b>
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<b>toothpick</b>	<b>toothpick</b>	<b>toothpick</b>	<b>toothpick</b>
<b>rubber band</b>	<b>rubber band</b>	<b>rubber band</b>	<b>rubber band</b>
<b>lego</b>	<b>lego</b>	<b>lego</b>	<b>lego</b>



Name: \_\_\_\_\_

**WILL MY OBJECTS SINK OR FLOAT?**

<b>OBJECT</b>	<b>PREDICTION SINK OR FLOAT?</b>	<b>RESULTS WHAT I SAW</b>



Name: \_\_\_\_\_

**WILL MY OBJECTS SINK OR FLOAT?**

**I learned that:**


**I was surprised by:**




**I learned:**

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