

## Properties of Matter-Is it a solid, liquid or a gas? – Grade 5, Level 1

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### Lesson Overview

In this lesson, students will be able to observe physical properties of matter and explain why it is either a solid, liquid or gas.

### Alignment

#### **Standard/Indicator Addressed**

5.P.2: The student will demonstrate an understanding of the physical properties of matter and mixtures.

#### **Performance Indicator**

5.P.2A.1 Analyze and interpret data from observations and measurements of the physical properties of matter (including volume, shape, movement, and spacing of particles) to explain why matter can be classified as a solid, liquid or gas.

#### **Science and Engineering Practices (as appropriate)**

S.1A.4: Analyze and Interpret Data

S.1A.5: Use Mathematics and Computational Thinking

S.1A.6: Construct Explanations

S.1A.8: Obtain, Evaluate, and Communicate Information

### Lesson Plan

**Time Required** – 1 to 2 60-minute classes

**Disciplinary Vocabulary** – solid, liquid, gas, particles, perimeter, length, width, height, volume, displacement

#### **Materials Needed:**

For each group:

- various sizes of boxes and objects for the engage portion of the lesson

(box of cookies, milk carton, balloon blown up)

- metric measuring tape
- calculator
- science notebook/journal
- graduated cylinder
- different size containers of water - such as small cups, jars, etc.
- irregular solid such as marble, rock, or ball of clay.

**Formative Assessment Strategies:**

Students record individual answers in notebook, record group answer in notebook, data collection.

**Misconceptions:**

1. Energy is a thing.
2. Gases are not matter because most are invisible.
3. Gases do not have mass.
4. Mass and volume, which both describe an "amount of matter", are the same property.
5. Particles of solids have no motion.
6. Materials can only exhibit properties of one state of matter.
7. Particles possess the same properties as the materials they compose.
8. Particles are viewed as mini-versions of the substances they comprise

**Safety Note(s):**

Provide paper towels for students to wipe up water spills.

**Engage**

- If you look in a carton of milk, at a balloon, or a box of cookies, you will notice that there are different ways and things that take up space. In the example of the milk carton, the milk inside is taking up space. In the example of the balloon, air or gas is taking up space. When you look at the box of cookies, you will notice that the cookies are taking up space. This shows that solids, liquids, and gases all take up space. Volume is the measurement of the space taken up by solids, liquids, and gases.
- Perimeters are the measurement around an object. (Circumference for circle). These are one dimensional measurements. To measure the surface of something means that you measure the area of the thing. (length x width) To measure what is inside something is to measure the volume of the object. The measurement of volume is three dimensional because it takes into consideration what is inside the thing/object and uses the length x width x height and uses a superscript of <sup>3</sup>, meaning "cubed."

**Explore**

Give each group a solid box to measure. Have them measure the length, width, and height to determine the volume in cubic centimeters (metric system). Allow them to use calculators to arrive at the solution. After measuring their box, have them trade with another group to measure a rectangle and a prism.

Create Data Table to collect data.

Illustrate Object	Describe Object- does it move?	Same shape of container?	Length (cm)	Width (cm)	Height (cm)	Volume (cm <sup>3</sup> )	Mass	Particle spacing	Solid Liquid or gas

Ask students “How could we measure volume of liquids?”

How can we use our knowledge of measuring the volume of liquids to measure irregularly shaped solids?

Students may say to use graduated cylinders, measuring cups, beakers, etc. Give each group a different container of water and have them measure the volume using a 50 mL graduated cylinder. Tell them that today the class will be using graduated cylinders to measure liquid volume. First, model the appropriate way to measure using a graduated cylinder. (Pour the liquid sample into the graduated cylinder and place the graduated cylinder on a flat, level surface to ensure an accurate reading. Find the meniscus of the liquid. The top of the liquid will form a depression inside the graduated cylinder. The lowest point of the depression is the meniscus. Locate the graduated mark corresponding to the meniscus. If the meniscus is not aligned with a marking, find the marking closest to the meniscus).

Set-up next investigation

Place water in various shaped containers. Put the same amount of water in each of the containers. Students should make a prediction as to if the containers contain the same or different amounts of water.

Have students measure the amount of water from the containers using the graduated cylinder and record their findings. Make sure that the amounts of water are less than 50 mL (or less than whichever size of graduated cylinder they are using). After students have practiced measuring the volume of liquids, give students a small rock, marble or lump of modeling clay (must fit inside the graduated cylinder). Ask students to devise a way to measuring the volume of this irregular shape using the water and graduated cylinder. Allow students to experiment. As a class, come up with simple steps to measure an irregular solid.

(Possible steps)

1. Fill the graduated cylinder up to whatever number you wish (ex. 20mL). Record this amount.
2. Put the irregular object into the cylinder (Tip: Tilt the cylinder and gently slide the object to the bottom if it's a glass cylinder) and get the reading in milliliters (mL).
3. Now subtract the old reading by the new reading and you have the volume of the irregular object in milliliters. (If you want to convert the milliliters into cubic centimeters, just remember this: 1 mL = 1 cubic centimeter).

## Explain

Students should summarize their findings in their notebooks by answering these questions:  
How do you know matter is a solid? Liquid? Gas?

Draw a model of the particle spacing of each in your notebook.

## Teacher Notes/Additional Resources

For a review of how to measure the volume of a rectangular solid.

**Go to** [http://www.eduplace.com/cgi-bin/schtemplate.cgi?template=/kids/mw/help/eh\\_popup.shtml&grade=4&chapter=18&lesson=6&title=Volume&tm=tmfe1806e](http://www.eduplace.com/cgi-bin/schtemplate.cgi?template=/kids/mw/help/eh_popup.shtml&grade=4&chapter=18&lesson=6&title=Volume&tm=tmfe1806e)

For a review of how to measure the volume of a liquid.

**Go to** [http://www.bgfl.org/bgfl/custom/resources\\_fpf/client\\_fpf/ks2/maths/measures/index.htm](http://www.bgfl.org/bgfl/custom/resources_fpf/client_fpf/ks2/maths/measures/index.htm)

If your classroom has an interactive white board. This site lets you change the amount of liquid in the cylinder.

**Go to**

[http://www.echalk.co.uk/Maths/dfes\\_numeracy/Assets/measuring\\_cylinder\\_flash.swf](http://www.echalk.co.uk/Maths/dfes_numeracy/Assets/measuring_cylinder_flash.swf)

**Other information on this indicator(s) can be found in the support documents/resources on the SC State Department website.**

*[www.ed.sc.gov](http://www.ed.sc.gov) (Instruction → Standards and Learning → Mathematics or Science → Support Documents and Resources)*

**Content Area (Disciplinary) Literacy strategies and descriptions can be found on the S2TEM Centers SC website:**

*[s2temsc.org](http://s2temsc.org) (Resources → Disciplinary Literacy Virtual Library → Strategy Warehouse)*

**Computational Thinking Reference:**

*<https://csta.acm.org/Curriculum/sub/CurrFiles/CompThinkingFlyer.pdf>*

*<https://csta.acm.org/Curriculum/sub/CompThinking.html>*

### **Additional Information**

Level 1 lessons contain a realignment to the 2014 Science and/or the 2015 Mathematics Standards.

Level 2 lessons contain Level 1 information and Content Area Literacy and Disciplinary Literacy Strategies.

Level 3 lessons contain Level 1 and 2 information and Computational Thinking Connections.

Level 4 lessons contain Level 1, 2, and 3 and integration of at least 2 content areas.