



Science Unit: *Matter*

Lesson 1: *Solids, Liquids, and Gases – Part 1*

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

Notes: Please see the Matter unit, Lesson 2, *Solids, Liquids and Gases – Part 2*; available from the Scientist in Residence Program website <http://www.scientistinresidence.ca>

Objectives

1. Learn that matter occupies space and that every substance in our world is a type of matter.
2. Learn that the three states of matter are solids, liquids or gases.
3. Learn the properties of solids, liquids and gases.
4. Gain experience making predictions, doing a science experiment, and making observations.

Background Information

Matter is anything that occupies space. Four properties of matter are mass, weight, volume and density. The three states of matter are solids, liquids and gases. A solid is a state of matter that has its own shape. You can pick up a solid object. The shape of solids can change but the solid material takes up the same amount of space. Liquids and gases are states of matter that do not have their own shape. You cannot pick up a liquid unless it is contained in something. Liquids take up the same amount of space regardless of the size and shape of the container. You cannot pick up a gas unless it is contained in something. Gases do not always take up the same amount of space. All matter is made up of molecules. Molecules are close together in solids and the molecules can't move freely. The molecules in liquids are spaced farther apart compared to the molecules in solids. The molecules in liquids can move around but they stay in the container holding the liquid. In contrast, the molecules in gases are very far apart. The molecules in gases move a lot and they can move anywhere as long as they are not contained in something. 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.

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



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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.

Materials

- 1 balloon filled with helium
- 1 balloon filled with air
- 1 deflated balloon
- drinking glass
- water
- stiff piece of cardboard larger than the diameter of the glass
- bucket or large bowl

The following items are needed for each group of students:

Dancing Pasta Experiment:

- 2 transparent glass jars (plastic cups don't work as well due to bubbles clinging to the plastic surface)
- ginger ale to pour into one glass jar (half full)
- water to pour into the other glass jar (half full)
- dry spaghetti broken into approx. 1 cm lengths and placed in a plastic container
- teaspoon

Items for scavenger hunt for solids, liquids and gases:

- solids: many objects present in classroom
- liquids: water in plastic bottles (colored with food coloring), liquid food items (vegetable oil, milk, juice, maple syrup, corn syrup, etc.)
- gas: balloons filled with air and helium, empty plastic containers, whoopee cushion, steam (water vapor) from boiling water in an electric tea kettle

In the Classroom

Introductory Discussion

1. Ask questions to guide a discussion about what matter is. Show students a helium balloon. What am I holding? What is inside the balloon? Let go of the balloon and ask the students what happened. Does anyone know what matter is? Everything in the world is made of matter. What is matter? What types of matter are the balloon and helium? What are examples of solids, liquids and gases? What types of matter are your bodies made of? Discuss characteristics of solids, liquids and gases.
 - Ask students to blow in their hand. What do you feel? Does air take up space? Blow up a balloon. What will happen if I let go? Let the balloon go. What happened to the air when I let go of the balloon? Where did it go? Extend concepts about gases.
 - Demonstration with help from student volunteers: Pour water into a glass until it is half full. What will happen if we place a piece of cardboard over the glass and turn the glass plus cardboard upside down? Place a piece of flat, stiff cardboard over the opening of the glass, hold the cardboard tightly against the rim of the glass, turn the glass upside down over a large empty bowl or bucket and then slowly remove your hand from the cardboard. How does the cardboard stay stuck to the inverted glass, and why doesn't the water spill from the glass into the bowl? There is



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water and air inside the glass. The air pressure outside the glass pushing on the cardboard is greater than the water and air pressure inside the glass pushing on the cardboard. Therefore the cardboard stays in place due to the strong outside air pressure. Air takes up space and has its own pressure even though you can't see it. Extend concepts about solids, liquids and gases.

2. Describe and demonstrate the dancing pasta experiment. Before the experiment, have students listen while the ginger ale bottle or can is opened. What do you hear?
3. Introduce how to do a science experiment.
 - Make an observation and then ask a question OR start with a question: Will dry pasta pieces act the same if they are placed in water and ginger ale?
 - Think about what will happen if dry pasta pieces are placed in water and in ginger ale. This is your prediction. Ask students to share their predictions.
 - Set up an experiment, treat everything the same except for one thing--what you want to test, the type of liquid used in the experiment. Test treatments will include placing pasta pieces into water and into ginger ale. Discuss why you only change one thing (a variable).
 - Make observations.
 - Collect data, record and examine results (think about why things happened the way they did).
 - Make conclusions and explain results (compare results to predictions to help you think deeper).
 - Communicate results and conclusions.
4. Safety rules: Ask questions if you don't understand how to do something in an experiment. Don't put anything in your mouth during science experiments. Be careful moving your body during the 'Let's be a Solid, Liquid and Gas' activity and be gentle if you bump into another person.

Science Activity/Experiment

Dancing Pasta Experiment:

1. Students will be divided into 5 groups of 4-5 students per group.
2. Ask students to record their predictions of what will happen when dry pasta is placed into water and into ginger ale.
3. Pour water in one glass jar and carbonated ginger ale in the other glass jar.
4. Students will record observations about the two liquids, add 1 teaspoon of pasta pieces to the jar containing water, make observations for a few minutes, and record observations.
5. Students will then add 1 teaspoon of pasta pieces to the jar containing ginger ale, make observations for a few minutes, and record observations.
6. Science Journal: Students will record predictions and observations on an activity sheet in their science duo-tang.
7. Follow-up can include students recording what they were surprised by and what they learned from the science experiment.

Closure Discussion

Discuss predictions and observations for the dancing pasta experiment.



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Did you see any bubbles in jars containing water and ginger ale? Where were the bubbles? What was inside bubbles in the ginger ale and water? (Carbon dioxide and air, respectively.)

Why did the pasta travel to the surface of the ginger ale and then drop to the bottom of the glass? (Gas bubbles attach to the rough surface of the pasta and cause the pasta to move or rise to the top of the liquid since the gas is lighter than the ginger ale. When the gas bubbles pop, the pasta pieces sink since they are heavier than the Ginger Ale.) Why didn't this happen in water?

What types of matter did you work with today?

Discuss molecules and atoms in a simple way, communicating that molecules are building blocks of matter, and atoms are the building blocks of molecules. Molecules are very tiny particles and they are so small you can't see them under a microscope. Discuss the spacing and movement of molecules in solids, liquids and gases.

Go to the playground or gym for the "Let's be a Solid, Liquid and Gas" activity. The students will form a group and act like a solid (students will hold hands and squish together as tight as they can and try not to move), a liquid (students will continue holding hands but space out as far as possible and change the group shape), and a gas (students will let go of each other and move quickly around the gym and occasionally, very gently, bump into each other). Next, the children will stand alone and the teacher will call out solid, liquid or gas and the students will act like different states of matter (solid: stand as still as possible; liquid: gently sway arms and bend legs but stay in one place; and gas: move quickly around the gym and occasionally, very gently bump into each other).

References

1. Osborne, Louise and Carol Gold. 1995. Solids, Liquids and Gases, Starting with Science series by the Ontario Science Centre. Kids Can Press Ltd.
2. Zoehfeld, Kathleen Weidner. 1998. What is the World Made Of? All about Solids, Liquids and Gases. HarperCollins Publishers Inc.
3. e.encyclopedia Science, Google. 2004. Matter, pp. 10-15. DK Publishing Inc.
4. <http://www.school-for-champions.com/science/matterstates.htm> States of Matter by Ron Kurtus. (Revised, November 6, 2003), School for Champions.
5. http://www.jsf.or.jp/tamatebako/huusen_E_master/index.htm Balloons, Full of Holes, Science Museum, Japan. 2000.

Teacher Assessment of Learning

1. Accurately recorded what happened during experiment.
2. Followed the procedural instructions.
3. Contributed insightful comments in concluding discussion.
4. Recorded their reflections clearly and were able to describe at least one thing they learned.

Extension of Lesson Plan

1. Read the book: What is the World Made Of? All about Solids, Liquids and Gases by Kathleen Weidner Zoehfeld.
2. Purchase three helium balloons.



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- Tie a very long string (kite string is a good idea) to one balloon. Teacher and students go outside and let go of the 1st helium balloon and watch it float as high as it can. Discuss why the balloon continued to float up.
 - Place the 2nd balloon in the classroom for a week and observe what happens to the balloon.
 - Tie the 3rd helium balloon to one end of a short piece of string. Tie a large brick to the other end of the string and place the brick and balloon into a bucket of water in the morning. Have students observe the surface of the balloon a few times during the day. Bubbles will form on the surface. Ask questions so students can discover that the bubbles contain helium escaping from the balloon. Discuss how gases escape through balloons. See reference 4 for additional information.
3. Introduce the students to the water cycle and talk about how water changes from one state to another state during the process. Read a book on the water cycle: [The Magic School Bus Wet All Over](#). (ISBN 0-590-50833-4)
 4. Set up a scavenger hunt for students to find solids, liquids and gases in the classroom. Students can record what they find on an activity sheet. Follow-up discussion can include students mentioning different types of solids, liquids and gases outside and in their home and the characteristics of solids, liquids and gases.

Scavenger hunt in the classroom for solids, liquids, and gases

Objective

The students will be able to name examples of each state of matter using objects in the classroom.

Background Information

Prior to the lesson, introduce the 3 states of matter and have children complete pages 14/15, 38/39 and 49/50 in resource called Physical Science Series Matter and Materials by S&S Learning Materials (ISBN 1-55035-673-9).

Materials

- steam from boiling kettle
- foaming shaving cream
- plant mister
- aerosol spray can
- hand lotion
- various classroom objects
- bottle coloured water
- helium balloon, whoopee cushion
- liquid food items

Introductory Discussion

Review the properties of the three states of matter and play a short game of I Spy using sample objects in the classroom.

Science Activity

1. Place students in groups of three students per group. Show students the three recording sheets.
2. Explain that each student will be responsible for recording the objects found for one state of matter. At least five objects from each state must be identified and recorded.
3. Each group of three students will walk around the room and discuss whether an object is a liquid, solid or gas and record the objects on provided sheets.
4. Afterwards, the groups will come back to the carpet and the teacher will ask each group member to find and categorize one object as solid, liquid or gas. Teacher will record on chart stand paper under appropriate heading.



Teacher Assessment

1. During the final class discussion, the teacher will observe each student's selection and classification of an object in the room for correctness.
2. The teacher will mark recording sheets to make sure objects are classified under the correct state of matter.

Name: _____

Dancing Pasta Experiment

**What will happen?
(My prediction)**

**What happened
(My results)**

Tap water + pasta

Tap water + pasta

Ginger Ale + pasta

Ginger Ale + pasta

I learned that:

I was surprised by:

Name: _____

I found these solids in the classroom!

Name: _____

I found these liquids in the classroom!

Name: _____

I found these gases in the classroom!
