



Science Unit: *Matter*

Lesson 3: *Physical Changes to Matter*

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 the properties of solids, liquids and gases.
2. Learn about physical changes to matter.
3. Learn about permanent physical changes and reversible physical changes to matter.
4. Gain experience making predictions, doing a science experiment, and making observations.

Background Information

Matter is anything that occupies space. The three states of matter are solids, liquids and gases. A solid is a state of matter that has its own shape. 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. Liquids take up the same amount of space regardless of the size and shape of the container. Gases do not always take up the same amount of space and you cannot pick up a gas unless it is contained in something. All matter is made up of molecules, and molecules are made up of atoms and sub-atomic particles. Matter cannot be created or destroyed but it can change. Physical changes can happen to matter, but no new material is produced and the molecules do not change. Some physical changes to matter are permanent whereas other changes are reversible. Heat and cold can change the state of matter (from a solid to a liquid to a gas and back again) and the change in state depends upon temperature and the composition of the matter. Force can be used to change the size, shape, or texture of matter.

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.



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Permanent: Something that stays the same; it does not change.

Reversible: Something that can change and then go back to the original condition.

Materials

- popcorn popping machine
- popcorn
- bowl to hold popcorn
- Ziplock plastic sandwich bags to hold popcorn for each student

The following items are needed for each group of students:

Ice Cube Melting Experiment:

- 3 transparent plastic cups
- two containers, one filled with warm water and the other filled with cold water
- string and tape
- 3 small ice cubes of identical size
- aluminum foil, paper towels, plastic bubble wrap, and fleecy fabric (for wrapping ice cubes)

Changing Matter with Physical Force Activity:

- pipe cleaners
- chalk
- aluminum foil
- paper

In the Classroom

Introductory Discussion

1. Review properties of solids, liquids, and gases.
 - Hold up a solid object, such as a wooden block, and ask what state (or type) of matter it is. Discuss properties of the solid object.
 - Hold up a liquid and ask what state of matter it is. Pour the same volume of water in different clear containers to demonstrate how a liquid flows easily and takes the form of its container.
 - Ask students to blow air out of their mouth onto their hand. What are you blowing? What state of matter is it? Does the gas take up space? Ask students to close their mouth and blow air to puff their cheeks up to help them understand that air is invisible but it takes up space. Crumple a piece of paper, put it in the bottom of a plastic cup, turn the cup upside down and press it into bowl of water to demonstrate that air takes up space and this air keeps the paper dry. Before doing this, describe what you will do and ask students what is in the cup and if the paper will stay dry. Mention that air is also in the cup if this isn't mentioned.
2. Ask questions to promote a discussion about physical changes to matter.
 - How does heat and cold change matter? What happens when water is put in the freezer? What happens when ice cream is left in the sun?
 - What happens when an egg is cooked?
 - What happens when you tear paper into small pieces or shape a piece of clay?
 - Spray water into the air. What happens to the water droplets?



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- What are other examples of physical changes to matter?
 - Introduce the concept of permanent physical changes and reversible physical changes of matter.
3. Describe the ice cube melting experiment.
 4. Review how to do a science experiment.
 - Make an observation and then ask a question OR start with a question: Will ice cubes melt the same if they are treated differently in the experiment?
 - Think about what will happen if ice cubes are treated differently. This is your prediction.
 - Set up an experiment; treat everything the same except for one thing--what you want to test, how the ice cubes are treated in the experiment. The control treatment is an ice cube in an empty cup. The test treatments include placing one ice cube in warm or cold water and wrapping another ice cube in the material of choice and placing the wrapped ice cube in the empty cup.
 - 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.
 5. 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.

Science Activity/Experiment

Activity 1. Ice Cube Melting Experiment:

1. Students will be divided into 5 groups of 4-5 students per group. Students will work as a team to design an experiment to either speed up or slow down the melting of 2 ice cubes.
2. The control treatment is an ice cube placed in the 1st plastic cup without anything else in the cup. Test treatments include an ice cube with hot or cold water in the 2nd cup and a wrapped ice cube in the 3rd cup.
3. Materials such as warm water, cold water, paper towels, bubble wrap, etc. are given to the students, and the students select the objects they want to use for their test treatments.
4. Students will first decide on their test treatments and then discuss and record predictions about which ice cube will melt first, second and third.
5. Students will then raise their hands and they will be given 3 ice cubes to set up their experiments.
6. Students will observe their ice cubes after 30 minutes and record their results for all treatments.

Activity 2. Popcorn popping:

1. While the ice cubes are melting for a 30 minute time period, students will sit in a circle and do a popcorn popping activity.
2. Students will each be given a few popcorn kernels to examine. Discuss popcorn: What is popcorn? Where does it come from? Ask students to close their eyes and use their ears and nose to observe what happens when the popcorn pops.
3. After the popcorn popping is underway, a discussion can follow to record student observations on a flip chart and discuss what happens when popcorn pops. (There is a drop of water inside each



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popcorn kernel. Heat causes the water to turn to a gas (steam) and the gas takes up more space than the liquid and it expands. This causes the corn kernel to burst open.)

4. After all of the popcorn has popped, students can be given bags of popcorn to make observations about how the popcorn changed when heat was used to pop the kernels, and students can eat popcorn during the discussion or save it for later in the day.
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

Discuss predictions and observations for the ice cube melting experiment.

What methods did you use for your test treatment to slow down or speed up melting of the ice cubes? What caused the ice cubes to melt faster or slower? Which ice cube melted fastest? Why did the ice cube melt faster in water compared to the unwrapped ice cube in air? Is ice cube melting a permanent or reversible change? What surprised you during the experiment? How does heat and cold change the state of matter? What happens to molecules in matter when a solid turns into a liquid? What did you learn?

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. 10-17, 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.

Extension of Lesson Plan

Physical Changes in Matter

Students will experiment with permanent and reversible changes to matter by bending, rolling and cutting objects such as pipe cleaners, chalk, aluminum foil, and paper.

Objective

The students will identify, using four objects, whether a permanent or reversible change occurs when the object is bent, rolled or cut.

Materials:

- pipe cleaners
- clay
- paper and tin foil
- scissors
- recording sheet
- pencil

Introductory Discussion

Teacher will review the difference between permanent and reversible changes in matter. For example, ice melting and re-freezing is a reversible change; popcorn popping is a permanent change.



Science Experiment

Changing Matter

1. Students work with a partner, but each student has their own recording sheet. Materials are shared between partners.
2. Each object will be bent, rolled and cut.
3. Students will record whether the change to the object is reversible or permanent.

Classroom Discussion

The students will discuss their findings for each object. Where disagreements occur, the teacher will demonstrate the experiment and explain why it is a permanent or reversible change.

Teacher Assessment

The teacher will make observations of children's individual responses during the closing classroom discussion.

The teacher will mark the recording sheet for correct classification of objects as having gone through a permanent or reversible change.