Science Unit: ***Matter***

Lesson 10: ***Mixtures of Matter - Part 2***

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 9, *Mixtures of Matter – Part 1*, available from the Scientist in Residence Program website http://www.scientistinresidence.ca

Objectives

1. Learn about mixtures of matter with a focus on liquid mixtures and liquid + solid mixtures.
2. Discover how to make a solution by dissolving sugar in water.
3. Review that some mixtures of matter can result in a physical change to matter whereas other mixtures of matter may result in a chemical change to matter.
4. Review concepts learned about matter including the states of matter, changes to matter, and mixtures of matter.

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. Most types of matter are mixtures and contain more than one substance or chemical. Many solid objects contain a mixture of substances. For example, rocks are comprised of a mixture of different minerals. The substances in a mixture may or may not be uniformly distributed. Water is a very good solvent. Many types of matter can dissolve in water to form a solution containing tiny particles of matter that are evenly distributed throughout the liquid solution. Solutions can be a liquid dissolved in another liquid, a solid dissolved in a liquid, a gas dissolved in a liquid, or a gas dissolved in another gas. A suspension is a mixture of liquid and tiny solid particles, but these particles can settle out if the suspension is left undisturbed for a period of time. The substances in mixtures can be separated by a variety of methods based on the physical characteristics of the substances. Examples of methods to separate mixtures of matter include using a sieve or a magnet, decanting, filtration, distillation, evaporation, centrifugation, and chromatography.

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.
Mix:	To put together or blend together.

Mixture:	A combination of two or more types of matter.
Dissolve:	To mix a type of matter into a liquid to form a solution.
Solution:	Mixing one or more types of matter to form a uniform mixture; for liquids, a solution is made of uniformly dissolved tiny particles of matter evenly distributed in a liquid.
Solvent:	A type of matter, usually a liquid, that can dissolve another type of matter.
Suspension:	Solid particles that are evenly dispersed or suspended in a liquid but are not dissolved.

Materials

- clear plastic cups
- water
- vinegar
- milk
- wooden sticks
- sugar
- teaspoons
- plastic knives
- large glass baking dish
- corn starch
- plastic bowls
- newspaper
- plastic spoons
- tall, clear drinking glass
- flour
- tablespoon
- plastic bowls

In the Classroom

Introductory Discussion

1. Review physical and chemical changes to matter and reversible and permanent changes (see Matter Unit, Lessons 2 and 3).
   - What is a physical change to matter? Do molecules change with a physical change to matter?
   - What is a chemical change to matter? Do molecules change with a chemical change to matter?
   - What are reversible changes to matter? What is a permanent change to matter?
2. Discuss different types of mixtures of matter (liquid/ liquid; liquid /solid; solid/solid). Pour water into a clear drinking glass. Ask a student helper to describe flour. Ask the student to add a tablespoon of flour into the water and to stir the water.
   - What happened to the flour when it was added to the water? (A suspension was made, the flour did not dissolve in water and a solution was not made.)
   - What does the word suspension mean?
   - What happened last week when sugar was added to water?
   - Review vocabulary words.
   - Ask students to describe different types of mixtures of matter.
3. Two activities will be done during the lesson: Activity 1, making curds and whey; and Activity 2, mixing sugar into water. The first activity will be described, students will complete the activity, and there will be a short discussion of the activity before starting the second activity. The lesson will be extended by having students make and experiment with oobleck.
   - Recite the poem Little Miss Muffett. Describe the curds and whey science activity (mixing vinegar and milk). Discuss predictions of what will happen when the different liquids are added together and record predictions on a flip chart. Ask students to focus on what they see during the activity and to record their observations and whether any changes happen to the liquids.

- Describe mixing sugar into water for the second activity. Discuss predictions of the number of teaspoons of sugar that can be dissolved in water and record predictions on a flip chart. Ask students to add one teaspoon of sugar at a time and mix the sugar with the water before adding the next teaspoon of sugar. Students will keep track of how many teaspoons of sugar can be dissolved in water by placing a check mark under the appropriate number in a list of numbers from 1 – 10.

4. Safety rules: Do not put anything in your mouth or near your eyes. Wash hands at the end of the activity.

Science Activity/Experiment

Activity 1: Curds and Whey

1. Students will mix vinegar and milk together to form curds and whey. Students will be divided into 6 groups of 3-4 students per group.
2. Prior to the experiment, place 2 empty clear plastic cups and a wooden stick on the table for each group of students. Fill one cup half full with milk. Place 2 tablespoons of vinegar in the second cup.
3. Students will add vinegar to the milk and stir the liquids with a wooden stick. Students will tilt the cup to form a film on the inside surface of the cup.
4. Ask students to focus on what they see during the activity and to record their observations. Ask students to think about whether there is a change to the liquids and if the change is a physical change or a chemical change. A chemical change results when milk is mixed with vinegar. Vinegar is an acid, and an acid causes the tiny solid particles in milk (the protein casein) to clump together to form curds. The liquid part of the mixture is the whey.

Activity 2: Mixing sugar and water together to form a solution

1. Sugar dissolves easily in water and a large quantity of sugar can be added to water before a saturated solution is produced. Adding sugar to water is a physical change to matter. Students will be divided into 6 groups of 3-4 students per group.
2. Prior to the experiment, the following items will be placed on the table for each group of students: a plastic cup filled 2/3 full with water, a plastic container filled with sugar, a teaspoon, a plastic knife, and a list of numbers 1-10 with a box under each number for recording a check mark.
3. Students will measure a teaspoon of sugar and level the sugar using the back edge of a plastic knife, add one teaspoon of sugar into the water and mix the sugar and water until all of the sugar dissolves.
4. Students will keep track of how many teaspoons of sugar can be dissolved in water by placing a check mark under the appropriate number in a list of numbers from 1 – 10.
5. Students will repeat the process of measuring out a teaspoon of sugar, leveling the sugar, mixing the sugar with the water until the sugar dissolves, and checking the number on the list, before adding the next teaspoon of sugar to the water. The sugar solutions from each group can be poured into a large glass baking dish and left in the room so that the water evaporates and the sugar crystals remain on the glass surface. This will demonstrate that mixing sugar into water is a physical change to matter and it is a reversible change if the water evaporates. Water evaporation is a method to separate the mixture of sugar and water.

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

Review concepts regarding mixtures of liquids.

1. Activity 1: Curds and Whey
   - What kind of changes did you see when you mixed vinegar and milk together?
   - Is this change a physical change or chemical change?
   - Do you think this change is a permanent change or reversible change?
   - What discoveries did you make while mixing liquids together?
2. Activity 2: Mixing sugar and water together to form a solution
   - What kind of changes did you see when you mixed sugar and water together?
   - Was a solution formed when you mixed sugar and water together?
   - How many teaspoons of sugar dissolved in the water?
   - Is this change a physical change or chemical change?
   - Do you think this change is a permanent change or reversible change?
   - What do you think will happen if the water evaporates from the sugar solution?
   - What surprised you when you mixed sugar and water together?

References

1. e.enclyclopedia Science, Google. 2004. Pp. 10-21, DK Publishing Inc.
2. Hann, Judith. 1991. How Science Works. A Reader's Digest Book. Pp. 14-35. Dorling Kindersley limited, London, England.
3. VanCleave, Janice Pratt. 1989. Chemistry for Every Kid, 101 Easy Experiments that Really Work. Page 114, Curds and Whey. John Wiley & Sons, Inc. New York.
4. http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch18/soluble.php Solubility, Why do Some Solids Dissolve in Water? The Bodner Group, Division of Chemistry Education, Purdue University West Lafayette, Indiana.
5. http://www.sugar.org/facts/what.html Sugar Facts, The Sugar Association
6. http://www.chatham.edu/pti/Kitchen_Chem/BCleveland_01.htm Kitchen Chemistry: Fun Food Activities and Experiments by Christina Blassingame-Cleveland, Curds and Whey.
7. http://student.biology.arizona.edu/sciconn/oobleck/oobleck.html Oobleck and Glurch. Learning about Solids and Liquids, The University of Arizona, Tuscon, AZ.

Teacher Assessment of Learning

1. Teacher will circulate throughout groups and listen to conversations for appropriate predictions and conclusions.
2. The teacher will review recording sheets for accuracy

Extension of Lesson Plan

Oobleck

Have students make oobleck and experiment with this fun mixture of cornstarch and water. Oobleck runs off your hands like a liquid but if you press hard on a handful of oobleck it has the properties of a solid and keeps its shape. Once you open your hand, oobleck turns into a liquid. See Reference 7 for additional information.

Objectives

1. The students will successfully create Oobleck following a scientific procedure.
2. Through exploration, the students will discover that Oobleck can change from a liquid to a solid when pressure is applied.

Materials

- Oobleck recipe (see page 4, Reference 7; add water slowly)
- containers for mixing
- paper towels (can be very messy)
- newspaper
- spoons
- plastic Baggies for storing Oobleck

In the Classroom

Introductory Discussion

Review background information and vocabulary from the Mixtures of Matter Part 2 lesson (page 1 of this lesson). Read Dr. Suess' *Bartholomew and the Oobleck.* After reading the story, ask students, "What were the properties of Oobleck?", "Is Oobleck a solid or a liquid?" Review the procedure for making Oobleck.

Science Experiment

1. Students work individually or in small groups. Materials are shared at their desks/tables.
2. Students will make Oobleck as follows. Put 1/4 cup of room temperature water in a plastic bowl. Begin adding the cornstarch to the water, 1 tablespoon at a time and stir. Keep adding cornstarch and stirring until the mixture gets thick and you can not stir it easily. Students can then pick up a small amount of Oobleck in their hand and make a fist or try to roll the Oobleck into a ball between their hands. Tell students that they have made Oobleck when they are able to roll or press the Oobleck into a shape and then open up their hand and have the Oobleck run off their hand as a liquid. Oobleck acts like a solid and a liquid depending upon the pressure that is exerted on it.
3. Allow students time to explore and play with the finished product (Oobleck).

Closing Discussion

Review properties of a solid and a liquid. Discuss how their Oobleck fits into both states of matter.

Reference

http://student.biology.arizona.edu/sciconn/oobleck/oobleck.html Oobleck and Glurch. Learning about Solids and Liquids, The University of Arizona.

Teacher Assessment of Learning

When students are playing with Oobleck, teacher will ask questions to check for students' ability to identify and explain the properties of Oobleck and how they can be changed.

Name: _____

1.

Curds and Whey

Milk	Vinegar	Milk + Vinegar
What happened when you mixed sugar and water?		

I learned that:

I was surprised by:

2.

Water	Sugar	Water + Sugar
How many teaspoons of sugar did you add to the water?		
What happened when you mixed sugar and water?		

I learned that:

I was surprised by:
