



Science Unit: *Matter*

Lesson 11: *Solutions and Suspensions*

School year: 2005/2006

Developed for: McBride Elementary School, Vancouver School District

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Grade level: Presented to grades 2 - 3; appropriate for grades 1 - 4 with age appropriate modifications.

Duration of Lesson 1 hour and 20 minutes

Objectives

1. Review properties of liquids and solids.
2. Learn about mixtures of matter.
3. Learn to distinguish between two different types of mixtures, a solution and a suspension.
4. Learn about changing states of matter by evaporation.

Background Information

Most matter in the world around us is a mixture, not pure. A mixture is a combination of different substances that are not chemically bonded and usually can be separated easily. Examples are seawater (salt and water) or air (nitrogen, oxygen, carbon dioxide, water vapour, dust etc.), or just about anything we eat! Solutions are a mixture of a solid dissolved in a liquid, such as sugar or salt in water. The solid particles break down into smaller and smaller parts in the liquid, until they are no longer visible. To separate the salt or sugar from the water one can boil the solution until the water has completely evaporated, leaving only the salt or sugar crystals behind. (Salt and sugar both have a much higher boiling point than water.) Suspensions are also a type of mixture, made up of solid particles suspended or floating in a liquid (or gas). In a suspension, solid particles never dissolve in the liquid, such as when sand or soil is mixed with water. The solid particles remain easily visible in the liquid. To separate a suspension into its components, one can use a filter to "trap" solid particles and let liquid pass through.

Vocabulary

<u>Matter:</u>	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.
<u>Mixture:</u>	A combination of two or more types of matter. The ingredients in a mixture are not chemically bonded so they can usually be separated easily.
<u>Dissolve:</u>	To mix a type of matter into a liquid to form a solution.
<u>Solvent:</u>	A liquid that can dissolve another substance or the liquid in which a substance is dissolved.
<u>Solute:</u>	Solid matter, which is dissolved in a liquid.
<u>Solution:</u>	A mixture that consists of a substance dissolved in a liquid. Solid particles are no longer visible.
<u>Suspension:</u>	A mixture of solid particles floating or suspended in a liquid or a gas but are not dissolved.



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Filtration The process of separating a solid from a liquid by trapping the solid particles in a filter that lets only the liquid pass through.

Evaporation The process by which a liquid changes to a gas (often leaving behind the solute).

Materials (the following objects are needed for each group of students):

- sand
- flour
- Kool-aid drink crystals
- sugar
- stir sticks or plastic spoons
- 2 cone coffee filters
- aluminum pie plate
- instant coffee granules
- salt
- water
- 6 plastic transparent glasses or jars
- masking tape and indelible felt pen
- 1 plastic funnel
- 1 extra clean glass

Materials Needed for Demonstration (Rainbow Milk, Solution and Suspension)

- milk
- food colouring (4 different colours)
- aluminum pie plate
- 1 Tbsp brown sugar
- dish soap
- eye dropper
- 2 glass jars or transparent cups
- 1 Tbsp soil or mud

In the Classroom

Introductory Discussion

1. Discuss different types of matter. Are they pure or are they a mixture? Salad dressing, milk, blood, soup are all examples of mixtures. Examples of pure types of matter are oxygen, aluminum, helium in a balloon, silver, gold. Most things on earth are mixtures of different matter. There are solid/solid mixtures (sandwiches, trail mix, raisin bran cereal), liquid/liquid mixtures (chocolate milk – milk and chocolate syrup) and liquid/solid mixtures (seawater – salt and water; soup – water and vegetables), gas/gas mixtures (air – carbon dioxide, oxygen, nitrogen), liquid/gas (soft drinks – water, flavouring, carbon dioxide gas).
2. **Rainbow Milk:** Using milk, food colouring, and drops of dish soap you can demonstrate some liquid mixtures, and make “rainbow milk”. Using a shallow dish or pie plate, pour in a thin layer of milk. Ask students to help put in drops of different food colouring in the milk but not overlapping. Food colouring will very slowly spread out. Now get a student to add drops of dish soap. You should see swirling colours and beautiful patterns occurring in the milk. Why?

The food colouring is less dense than the milk and floats on the surface. Adding the dish soap changes the surface tension of the milk. The dish soap interacts with the fat in the milk and breaks the fat down into smaller molecules. This causes a mixing or swirling of colours.
3. **Solutions and Suspensions:** Ask a student to come and help demonstrate the differences between solutions and suspensions. Using a jar filled with water, ask the student to stir in 2 tsp brown sugar. Ask them to keep stirring 2 minutes and let students observe what happens. Where



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has the sugar gone? Is the sugar still in the jar? Would it taste any different compared to pure water? Lift the jar and show students the bottom of the jar. Is there any sugar left at the bottom?

4. Ask another student to come and stir in 2 tsp of soil into a fresh jar of water. Stir contents for 2 minutes. Observe. Does the soil disappear? Lift the jar up and observe the bottom. Are the soil particles dissolved in the water or are they hanging or being suspended in the water? Soil particles will eventually settle out on the bottom of the jar.
5. Review vocabulary words: solution and suspension.
6. How can we get back the soil from the water? How can we get back the sugar from the water? Discuss filtering techniques (using a coffee filter and funnel for trapping soil particles we can separate water from soil) and evaporation (by pouring our sugar and water mixture into a pie plate and putting it in a warm place the water will evaporate, leaving the sugar crystals behind).
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. Each group will test the six items. Label 6 transparent glasses with masking tape and indelible marker (salt, sugar, coffee, flour, Kool-aid, sand).
2. Fill glasses 2/3 full of water.
3. Add 2 spoonfuls of each item to the corresponding labeled water glass.
4. Mix the item in the water with a spoon for 2-3 minutes. Observe. Is the mixture a solution? (Item is no longer visible) or is it a suspension? (Particles are seen floating or suspending in the water, or with time, settle out at the bottom of the glass.) Lift glass and look at the bottom.
5. Continue with the next item and the next clean, labeled plastic glass.
6. After all six items have been mixed with water and results have been recorded, group the suspensions together and the solutions together. Compare.
7. Choose one solution and one suspension. Pour a thin layer of the **solution** into a pie plate and set in a warm place. Check on the pie plate over the next few days to watch evaporation take place. The solid should be left behind in the pie plate in the form of crystals. Using a coffee filter inside a funnel, and clean glass try to separate the **suspension**. Solid particles should be trapped in the filter while the water passes through the filter.

Closure Discussion

1. Discuss predictions, observations and results for this activity.
2. Were your predictions the same as your observations? Promote discussion of solutions and suspensions with questions such as:
 - Can you think of any other examples of solutions or suspensions?
 - What surprised you?

References

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3. Smith, Alastair et al. 2001. Mixtures and Compounds. The Usborne Internet-Linked Library of Science. Usborne Publishing, London. pp. 6-11.
4. Seller, Mick. 1993. Elements, Mixtures and Reactions. Science Workshop Series. Franklin Watts. London.
5. http://www.chem4kids.com/files/matter_mixture.html
6. <http://www.iun.edu/~cpanhd/c101webnotes/matter-and-energy/elscmpdsmxts.html>
7. www.softweb.vic.edu.au/science/famsci/activity/earlyyr/chemist/CHEY7.htm rainbow milk
8. http://sci_wiz.tripod.com/Coloured_Milk_Pump.htm rainbow milk

Mixing Matter

Solutions and Suspensions

Name: _____

I need: _____

Make a prediction for each item (P= prediction)

I observe:	Solution	Suspension
1- Flour		
2- Salt		
3- Sand		
4- Sugar		
5- Kool- aid		
6- Instant Coffee		

Solution

Suspension

I learned:

How can I separate a solution?

How can I separate a suspension?
