Science Unit: **Exploring Chemistry**

Lesson 5: ***Slime and Oobleck***

School Year:	2015/2016
Developed for:	Sir Wilfred Laurier Elementary School, Vancouver School District
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Grade level:	Presented to grades 3/4/5; appropriate for grades K – 7 with age appropriate modifications
Duration of lesson:	1 hour

Objectives

1. Manipulate non-Newtonian fluids that behave as both liquids and solids.
2. Review ideas of solids, liquids, mixtures and chemical reactions using chemistry "toys."

Background Information

Students are taught that the properties of solids, liquids and gases: solids maintain a fixed shape and volume, liquids change shape but not volume, and gases change both shape and volume. Some materials, called non-Newtonian fluids, cross the boundaries of these states of matter. When pressure is applied, or they are moved around at different speeds, they change between liquid and solid. Non-Newtonian fluids make fun chemistry toys while reviewing chemistry ideas.

Vocabulary

States of matter:	The distinct physical forms that matter can take: solid, liquid or gas.
Molecules and atoms:	Tiny particles that make up everything around us. Molecules and atoms are too small to see individually, but with enough of them together they make objects we can see. Two or more atoms are bonded together to make a molecule.
Mixture	Mixtures have two or more particle types. The kind of mixture depends on the how clumped the different types of particles are, and whether they can settle out. Solutions, suspensions and colloids are all mixtures. Oobleck is a colloid.
Chemical reaction:	A chemical reaction occurs when molecules break apart and their atoms rearrange to make new molecules. Sometimes the new molecules are a different state of matter, so the chemical reaction involves a state change. Slime is made by a chemical reaction.
Non-Newtonian fund	A somewhat unusual substance that changes viscosity (or how fluid it is) with pressure or agitation. Standard Newtonian fluids only change viscosity with temperature (e.g. as you heat up a solid, it becomes more fluid as it becomes a liquid).

Materials for Slime

- white glue, 50% in water (enough for 2 Tbspns per student)
- Dixie cups (2 per student)
- small sandwich baggies (2 per student)
- borax (1 tspn) in water (1 cup), enough for 1 Tbsp per student
- coffee stir sticks (half stick per student)

Materials for Oobleck

- plastic bowl (one per student)
- 4 Tbspns cornstarch per student, in their bowl
- bowls of water (one per table group)
- popsicle stick (one per student)
- extra cornstarch
- Tablespoon measure (one per table group)

In the Classroom

Introductory Discussion

Tell students that they will make chemistry toys while reviewing ideas of solids, liquids, gases, mixtures and chemical reactions. Review concepts if necessary.

Brief description of science activities in this lesson:

(1) Slime: make slime and play with it to investigate its properties.

(2) Oobleck: make oobleck and

Processes of science that the students will focus on: exploration, curiosity, mechanical manipulation, close observation, classifying and comparing data, inferring, concluding, predicting.

Safety guidelines:

Borax powder is not safe for ingestion or inhalation:

- An adult should measure borax powder using care not to inhald
- Only allow the students to handle borax when it is in solution
- Immediately discard unreacted borax solution.
- Clean desk area and wash hands after making the slime.
- The final product (slime) is safe - the borax is complexed with another molecule.

Science Activities

(1) Activity Title: Slime

Purpose of Activity: To make a chemistry toy.

Methods and Instructions:
Set-up prior to experiment:
Prepare the 50% white glue and aliquot into cups. Prepare the borax solution and aliquot into cups.

Students will work individually.

1. Ask students to pour their borax into their white glue, then mix with the stir stick.
2. Pull out the blob with the stick, place into a baggie. Discard the cup and stick.
3. Massage the baggie until the slime makes one blob, then pull it out and put in a clean baggie. Discard the first baggie and clean hands and desk area (if required).
4. Allow students to play with the slime - make it flow between the fingers, pull it fast to make it snap etc.
5. After making the oobleck in activity 2, ask students to fill out their worksheet.

(2) Activity Title: Oobleck

Purpose of Activity: To make a chemistry toy.

Methods and Instructions:
Set-up prior to experiment: Accurately measure cornstarch into bowls.
Students will work individually.

1. Distribute bowls of cornstarch to students. Ask them to accurately measure out two Tablespoons of water to add to the cornstarch, then stir with the popsicle stick.
2. Help them adjust the amounts if necessary, so that the oobleck behaves like a solid and a liquid: it can be picked up if you scoop quickly, but when undisturbed it flows like a liquid.
3. Allow students to play with the oobleck
4. Ask students to fill out a Venn diagram comparing the properties of slime and oobleck. Prompts: Are they solid or liquid? (They behave like both). Were they formed by a chemical reaction?(slime yes, oobleck no).

Closure Discussion

1. Discuss what students have written on their Venn diagrams, as a way of reviewing the properties of solids and liquids, mixtures and chemical reactions.
2. The chemistry toys were made in different ways. The slime was made by a chemical reaction as the borax reacted with the molecules of the white glue and made new long polymer molecules. The oobleck is simply a mixture (specifically, a colloid) of cornstarch and water - there has been no chemical reaction.
3. Explain that both slime and oobleck are called non-Newtonian fluids because pressure or stirring can change how thick they are (refs. 1 and 2). When they are moved fast they behave like a solid; when they are allowed to move slowly they behave like a liquid. (Standard Newtonian fluids change their viscosity, or how thick they are, only when the temperature is changed.)

4. Quicksand is also a non-Newtonian fluid - if you struggle while caught in quicksand, it will become more viscous, strengthening its hold on you and making it more difficult to escape. If trapped in quicksand, it is best simply to relax, since your body is less dense than quicksand and will easily float in it, and you can very slowly swim.

References

1. <http://www.acs.org/content/dam/acsorg/education/resources/highschool/chemmatters/articlesbytopic/solidsliquidsgases/chemmatters-dec2004-slime.pdf> The Science of Slime. Cheaters by American Chemical Society. Accessed May 18, 2016.
2. <http://www.scientificamerican.com/article/oobleck-bring-science-home/> Oobleck recipe. Bring Science Home by Scientific American. Accessed May 18, 2016.