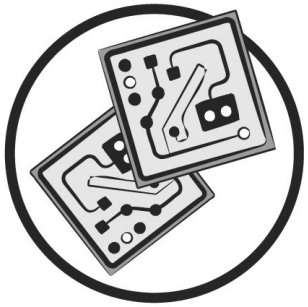


Choose Your Ooze

Learning Objectives: *Students learn how changing ingredients in a recipe affects the results.*

GRADE LEVEL

K–8

SCIENCE TOPICS

Physical Properties
Chemical Reactions
Industrial Chemistry

PROCESS SKILLS

Comparing and Contrasting
Predicting
Classifying
Inferring

GROUP SIZE

2–3

SNEAK PEAK inside …

ACTIVITY

Students mix white glue and detergent in various proportions to make different versions of ooze.

STUDENT SUPPLIES

see next page for more supplies

white glue
Borax detergent
Staflo starch
paper cups
craft sticks, etc.…

ADVANCE PREPARATION

see next page for more details

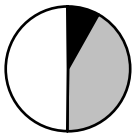
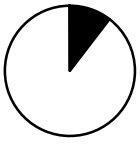
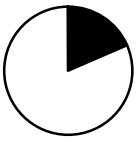
Make Borax solution
Make starch solution, etc.…

OPTIONAL EXTRAS

DEMONSTRATION
Polymer Games (p. F - 7)

EXTENSIONS
Evaluate Your Ooze (p. F - 13)
Ooze Invention Convention (p. F - 13)

TIME REQUIRED

Advance Preparation	Set Up	Activity	Clean Up
			
5 min (procedure A or B) 30 min (procedure C)	**5 minutes**	**40 minutes**	**10 minutes**

SUPPLIES

There are three different suggestions for how to run the activity:

- **Procedure A—**Best for young students. Students investigate and compare the properties of two different ooze recipes, Flubber and Glarch. (See p. F - 16.)
- **Procedure B—**Older students recommended. Students make Glarch. Then they repeat the experiment by using different ratios of ingredients. Students compare the resulting oozes and make inferences about how different ratios of ingredients affect the result. (See p. F - 17.)
- **Procedure C—**Older students recommended. Students make many ooze recipes by substituting different solutions. Students should compare the different resulting oozes and make inferences about how each ingredient affects the result. (See p. F - 18 to p. F -21.)

Item	Amount Needed
Procedure A	
liquid white glue (e.g., Elmer's™)	1 bottle (4 oz.) per group
Borax™ detergent	1 teaspoon per class
water	2¼ cups per class
Stāflo™ liquid starch	¼ cup per group
Procedure B	
liquid white glue (e.g., Elmer's)	1 bottle (4 oz.) per group
Stāflo liquid starch	½ cup per group
Procedure C	
white glue (e.g., Elmer's)	1 bottle (4 oz.) per group
Borax detergent	1 teaspoon per class
water	4½ cups per class
Stāflo liquid starch	¼ cup per group
liquid clear glue (e.g., Elmer's)	1 bottle (4 oz.) per group
cornstarch	¼ cup per class
General Supplies	
Pop-top squeeze bottles (e.g., water or sport drink) for distributing solutions	1–4 per group (see Set Up notes)
plastic spoons	2 per group
wooden craft sticks **and** wax paper cups (e.g., Dixie™), 4 oz. for mixing **OR** sealing plastic bags (e.g., Ziploc™) snack size	3–5 per group
vinegar (for clean up)	2 cups per class
cafeteria trays	1 per group

For Extension or Demonstration supplies, see the corresponding section.

ADVANCE PREPARATION

Supplies Preparation

Note:
Before you start to make solutions, decide which procedure you will follow. Then, have the procedure sheet in hand to help you understand which solutions you need to make.

Borax Solution (for Procedures A and C):

- Borax detergent is normally sold under the name 20 Mule Team Borax and found in the detergent section of the grocery store. Look for the ingredient "sodium tetraborate."
- Measure 2¼ cups of water. Add a scant teaspoon of Borax detergent and mix well.
- Fill pop-top squeeze bottles with ¼ cup of Borax solution.
- Label the bottles "Borax Solution."

Stāflo Solution (for Procedures A, B, and C):

- Stāflo liquid starch solution is found in the detergent section of the grocery store. Look for the ingredients "starch" and "Borax " or "sodium tetraborate."
- Fill pop-top squeeze bottles with ¼ cup of Stāflo solution.
- Label the bottles "Stāflo Solution."

Starch Solution (for Procedure C):

- Use this solution as a substitute for Stāflo liquid starch in the ooze recipe.
- This solution is a little tricky. About the same difficulty as making a smooth gravy. Read all directions before making the solution.
- Heat 4 cups of water to boiling. Lower the heat to keep the water just below boiling.
- In a separate container, mix ¼ cup cornstarch with ½ cup of water. Stir this solution to mix completely.
- While stirring the boiling water constantly, slowly add the starch mixture to the hot water.
- Continue to heat and constantly stir the solution until it is translucent, about 5 to 10 minutes.
- Remove the solution from the heat and allow it to cool to room temperature.
- Bacteria will grow in the starch solution unless it is refrigerated. It should last about a week in the refrigerator. Store this solution in the refrigerator until use.
- When you are ready for the activity, fill pop-top squeeze bottles with about ¼ cup starch solution.
- Label the bottles "Starch Solution."

Teacher's Secret Solution (for Procedure C):

- This solution is made from water, Borax, and starch so is a generic form of Stāflo.
- Use this solution as a substitute for Stāflo liquid starch in the ooze recipe.
- Measure 2 ¼ cups of starch solution (above). Add a scant teaspoon of Borax detergent and mix well.
- Bacteria may grow in the Secret Solution unless it is refrigerated. It should last about a week in the refrigerator. Store this solution in the refrigerator until use.
- When you are ready for the activity, fill pop-top squeeze bottles with about ¼ cup Secret Solution.
- Label the bottles using your name and "Secret Solution."

Notes and Hints

- Give each group a cafeteria tray to do their experiments on. This keeps spills and messes contained.
- To further contain messes, use sealable plastic bags to mix the ooze ingredients. For procedures B and C, paper cups and craft sticks are a cheaper option.

SETUP

Procedure A

For each group

- 1 bottle of white glue
- Borax solution in pop-top squeeze bottle
- Stāflo liquid starch in pop-top squeeze bottle
- plastic spoons
- cafeteria tray
- **Either** wooden craft sticks and wax paper cups
  Or sealable plastic bags

At a central location (or with the teacher)

- vinegar
- towels and sponges for clean up

Procedure B

For each group

- 1 bottle of white glue
- Stāflo liquid starch in pop-top squeeze bottle
- plastic spoons
- cafeteria tray
- **Either** wooden craft sticks and wax paper cups
  Or sealable plastic bags

At a central location (or with the teacher)

- vinegar
- towels and sponges for clean up

Procedure C

For each group

- 1 bottle of white glue
- 1 bottle of clear glue
- Borax solution in pop-top squeeze bottle
- Stāflo liquid starch in pop-top squeeze bottle
- starch solution in pop-top squeeze bottle
- imitation Stāflo solution in pop-top squeeze bottle
- plastic spoons
- cafeteria tray
- **Either** wooden craft sticks and wax paper cups
  Or sealable plastic bags

At a central location (or with the teacher)

- vinegar
- towels and sponges for clean up

INTRODUCING THE ACTIVITY

Let the students speculate before offering answers to any questions. The answers at right are provided for the teacher.

Choose questions that are appropriate for your classroom.

Depending on what procedure you choose for your class, you may need to introduce the activity differently. All procedures focus on comparing the properties of oozes from different recipes. These questions focus on properties students can evalauate.

No matter what procedure you choose, take time to discuss with students why the experiment is designed the way it is. Each procedure uses different recipes, and students should compare the ingredients and infer how the recipe results in different ooze properties.

For more information about experimental design, see the section ***Science Inquiry*** in the beginning of the Guide.

What are some things you know that are solid? What are the properties of a solid?
Rocks, desks, gold. They are hard, they don't change shape, they have a fixed volume.

What are some liquids you know? What are the properties of a liquid?
Water, juice, milk, oil, syrup. They change shape to fit in a container, they have a fixed volume.

Can you think of some things that act like a solid and a liquid or seem to be somewhere in between?
Clay, silly putty, play-doh, toothpaste, peanut butter.
What properties do these materials have?
These all keep their shape to some extent but also can flow like a liquid. Some will stretch, but some will break. After breaking apart, they will re-form together. Some will bounce.

In this activity, students will create different mixtures that have properties of both a liquid and a solid. They will investigate the characteristics of oozes made from different ingredients.

TEACHER DEMONSTRATION

Polymer Games

This works well to introduce students to the activity. Students model long glue molecules that become ooze when Borax solution is added.

Supplies

- large open area
- 4–6 pieces of elastic or rubber tubing, each about 2 yards long and each tied into a loop

Demonstration

- Divide the students into three groups. Each group should make a long line of students holding hands. Each line of students represents a glue molecule.
- Glue molecules are called **polymers**. A polymer is a long molecule made of repeating smaller molecules.
- Instruct the students to keep holding hands and to move their molecules around the room and around each other. This is the liquid glue they use in the activity.
- Introduce the loops of elastic or tubing. These are molecules of sodium borate, the active ingredient in Borax detergent.
- Two students should step into each loop of elastic or tubing. Preferably, two students are from different glue molecules. The glue molecules have now been **cross-linked** together by the sodium borate.
- Instruct the students to move their molecules again. They should try to pull apart the molecules without breaking free of the elastic. This is the ooze they create in the activity.

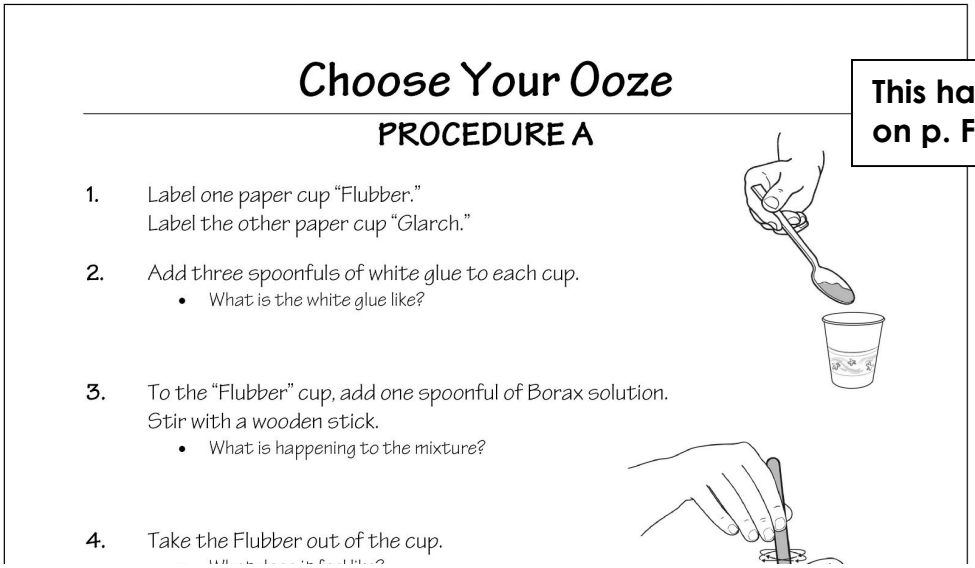
Explanation

Glue molecules are long chains of molecules known as polymers. The sodium borate in the Borax solution cross-links the polymers together. This creates a network of glue molecules that act like an ooze—sharing some properties of a solid and some like a liquid. When the glue molecules are cross-linked, they can still slide past each other, but it is more difficult.

CLASSROOM ACTIVITY

Have students follow the Scientific Procedure of your choice.
Procedure A on p F - 16, Procedure B on p. F - 17, Procedure C on p. F - 18 to F - 21.
Below are suggestions to help the teacher facilitate the activity.

NOTES



Choose Your Ooze

PROCEDURE A

1. Label one paper cup "Flubber."
   Label the other paper cup "Glarch."
2. Add three spoonfuls of white glue to each cup.
   - What is the white glue like?
3. To the "Flubber" cup, add one spoonful of Borax solution.
   Stir with a wooden stick.
   - What is happening to the mixture?
4. Take the Flubber out of the cup.

This handout is on p. F - 16.

This activity features recipes for two different oozes, Flubber and Glarch. In Procedure A, students make these basic recipes and compare the results. In Procedures B and C they also make variations to the recipes to create different oozes.

You may want to instruct students to write their answers on a separate sheet of paper so they will have more space to write.

Running Suggestions

- This activity can get very messy very quickly. Ideas to minimize the mess include:
  - Each group should experiment on a cafeteria tray and keep all their materials on the tray.
  - Mixing the oozes in sealable bags contains the mess well and also provides a container for students to take their ooze home. However, it can be expensive.
  - Vinegar dissolves all forms of ooze made in this activity.
- Students can use any sized spoon to add the ingredients to the cups. The exact amount does not matter as long as the same sized spoon is used for all the solutions.

- **Procedure B:** The last recipe uses 8 spoonfuls of glue and 2 spoonfuls of Stāflo liquid starch. This volume is a bit large and may require a slightly larger cup.
- **Procedure C:** Introduce your "Special Solution." Explain to students that your solution is just like the name brand Stāflo liquid starch, but without the fragrance or conditioners.

Ongoing Assessment

- Does the ooze stay the same as you continue to work with it? How do its properties change? *(As the Borax continues to react with the glue, the ooze becomes firmer and less sticky. It also may become less stretchy.)*
- Which ooze do you like best? Why? What are the properties of a good ooze?

Safety and Disposal

- All materials may be thrown in the trash.
- Students may take their ooze home in a plastic bag if they wish. All the ooze can be mixed together into a large airtight container and stored for up to a month.
- Vinegar dissolves ooze from carpet, clothing, hair, and other materials.

CAUTION: Do not allow any ooze to be placed in the sink. It will clog the drains.

CLASSROOM DISCUSSION

Ask for student observations and explanations. Let the students guide the discussion and present their hypotheses before discussing explanations.

Choose questions that are appropriate for your classroom.

After experimenting with different recipes, invite the students to report on their findings.

How did you investigate the oozes that you made?
Pulled them apart quickly to see if they would break. Pulled them slowly to see if they would stretch. Smashed them to see how sticky they were. After they broke apart, pushed them to see if they would go back together. Left it on the counter to see if it would hold its shape. Dropped it on the table to see if it would bounce.

Which ooze was your favorite? Why?
Answers will vary. Extension A provides some categories for students to use to evaluate their ooze recipes.

EXPLANATION

This background information is for teachers. Modify and communicate to students as necessary.

This activity features recipes for two different oozes, Flubber and Glarch. In Procedure A, students make these basic recipes and compare the results. In Procedures B and C they also make variations to the recipes to create different oozes.

BACKGROUND FOR ALL GRADES

Flubber Basics

The ingredients for Flubber are white glue, water, and Borax. Each of these three ingredients serves a different purpose. Together, they interact to make an interesting substance. Depending on the ratio of ingredients, the Flubber created can be very slimy, sticky, and stretchy, or it can be very firm, smooth, and brittle.

Properties of Glue

Both white glue and clear glue are made from the same kinds of **molecules.** One molecule of glue will be a chain of 4000 to 6000 carbon **atoms**. (Connected to this chain are other oxygen and hydrogen atoms.) These molecules are **polymers** because they are made of repeating smaller units. When these glue polymers are dissolved in water, the molecules slide past each other and act as a liquid.

Borax Detergent and the Creation of Flubber

When students add Borax solution to the glue, the mixture begins to stiffen. In this situation, Borax is a **cross-linking** agent. Each molecule in the Borax solution reacts with two different glue molecules, linking them together. Just like in the Teacher Demonstration, the cross-linked glue molecules cannot slide past each other as easily.

As the Borax continues to react with the glue, the glue molecules become increasingly connected, or cross-linked. Over time, the Flubber will become firmer and not stretch as easily.

When students pull the Flubber slowly, the molecules are able to slide past each other, and the Flubber stretches. When students pull the Flubber quickly, the cross-linked molecules cannot slide as easily and the Flubber breaks apart.

Add Starch to Make Glarch

The standard Glarch recipe uses white glue and Stāflo liquid starch. Stāflo contains water, Borax, and starch, so the only difference between Flubber and Glarch is the addition of starch to the mix. Students should notice that Glarch is easier to stretch than Flubber. Even when Glarch is pulled quickly, it tends to stretch instead of break.

Starch is also a polymer. Long molecules of starch are made of smaller sugar molecules linked together. The long starch molecules do not cross-link to the glue molecules or to the molecules in Borax solution. Instead, the starch molecules weave themselves in the

cross-linked network of glue and Borax. These starch molecules slide past each other and help the cross-linked glue molecules to also slide. Thus, Glarch is stretched more easily than Flubber.

Experimental Design
Chemists often need to find out what ingredients in a mixture are causing a certain **chemical reaction**. To do this they need to test each ingredient of the mixture separately. Chemists can either separate out each of the ingredients of the mixture and test them individually, or they can carry out their tests while changing only one variable at a time.

In Procedure A, students compare two recipes to find what happens when an ingredient (Borax solution) is replaced with another (Stāflo liquid starch). By keeping the amounts of ingredients the same, they can be sure that any difference in the results can be attributed to this substitution.

In Procedure B, students use the same recipe but alter the ratios of ingredients. By keeping the amount of glue the same and changing only the amount of Stāflo liquid starch, they can see what affect the Stāflo has on the properties of Glarch. As more Stāflo is added, students should notice that the Glarch increases in its ability to stretch.

In Procedure C, students conduct a variety of experiments to understand what role each component of Flubber and Glarch plays in the reaction.

- When students substitute clear glue in both recipes, they should see that the resulting oozes do not stretch as easily as when they are made with white glue. Since this happens for both Flubber and Glarch, students should understand that the type of glue is important for deciding the amount of "stretchy-ness."
- When students substitute different solutions in the recipe for Glarch, students should notice that some combinations result in making an ooze, and some do not.
  - The teacher's Special Solution works just as well as Stāflo. This shows that there are "extra" ingredients in regular Stāflo that are not necessary for the reaction.
  - Starch by itself does not create a new substance. This shows that the starch and glue are not reacting to one another.
  - Borax by itself does create a new substance. This shows that Borax is a necessary ingredient and creates the cross-linked network.
  - When students compare the results of adding Borax by itself to the results from adding Stāflo and the Secret Solution, they should see that adding Borax alone makes a firmer ooze. Starch makes the resulting ooze stretch more easily.
  - Finally, because Stāflo and the Secret Solution are both still liquids, this shows that the Borax and starch do not react with one another.

For more information about experimental design, see the section ***Science* Inquiry** in the beginning of the Guide.

BACKGROUND FOR OLDER STUDENTS

Molecules of Ooze

White glue and clear glue are polymers made from repeating units of vinyl acetate (see Figure 1). So another name for these glues is **polyvinyl acetate**. The acetate parts stick out of the long chain of the molecule so are available to react.

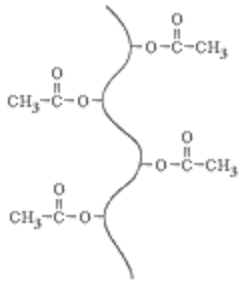


Figure 1 A long molecule of glue is made of smaller units of vinyl acetate.

Borax detergent has the chemical name **sodium tetraborate** (NaB_4O_7). In water, the molecules of sodium tetraborate separate into sodium (Na^+) and borate $B(OH)_4^-$ ions. The borate ion is formed like a large letter "X" with a boron atom in the center and four oxygen and hydrogen groups (–OH groups) extending from it.

The borate ion is reactive and connects two different glue molecules. The –OH groups on the borate ion connect to acetate groups in the glue molecule. When this reaction happens across two glue molecules, the glue becomes cross-linked, and the glue molecules cannot slide past each other as easily. This makes the liquid glue change from an easily flowing liquid to a stiff ooze.

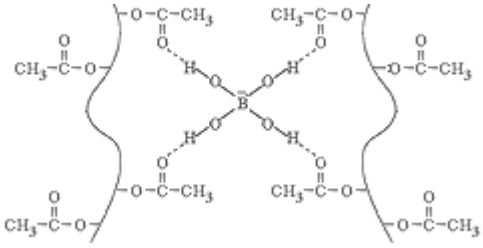


Figure 2 The borate ion cross-links two glue molecules.

Hydrogen Bonds Make it Stretchy

When oxygen is bonded to another atom, the electrons between oxygen and the other atom are not shared equally. Oxygen has a greater hold on the electrons. This makes the oxygen have a small negative charge, and the other atom have a small positive charge. For this reason, the bond between oxygen and its partner is called a **polar bond**.

For more information about polar bonds, see the Explanation section of ***Salting Out***.

In acetate, oxygen is doubly bonded to carbon, so oxygen has a small negative charge and the carbon has a small positive charge. In every –OH group, the oxygen has a small negative charge and the hydrogen has a small positive charge.

The small charges on one polar bond attract the small charges on another polar bond. This attraction helps the glue molecules stay attracted to each other and slide past each other. The attraction of –OH groups to one another or to other polar bonds is called **hydrogen bonding**. (Even though oxygen is a necessary player, it doesn't seem to get credit for this attractive force.)

When borate ions $B(OH)_4^-$ react with glue, they decrease the amount of hydrogen bonding available. When Flubber is pulled apart slowly, there is still enough hydrogen bonding to allow the molecules to stay attracted, and the Flubber stretches. When the Flubber is pulled quickly, the hydrogen bonding is not enough to keep the molecules attracted, and the Flubber breaks.

Add Starch to Make Glarch, part 2
Starch is also a polymer. Long molecules of starch are made of smaller sugar molecules linked together. (See Figure 3.) Sugar molecules have many –OH bonds and contribute a lot of hydrogen bonding. When the starch molecules interweave with the molecules in Glarch, they increase the amount of hydrogen bonding available. This is why Glarch is able to remain intact even when it is stretched very quickly.

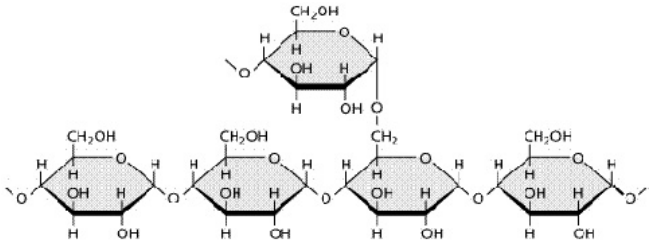


Figure 3. Each sugar molecule is a ring with many –OH groups extending from it. Many sugar molecules (networks of 100's) link together to form starch.

EXTENSIONS

Extension A: Evaluate Your Ooze
Now that students have made different recipes of ooze, they probably have an opinion of which they prefer. Use a ranking system to evaluate and judge the different ooze recipes.

Extra Instructions
- As a class, define categories to judge the characteristics of ooze. For instance, stretchiness, stickiness, bounciness, ability to retain its shape.
- After defining different categories, students can rank each ooze in all the categories.

Extension B: Ooze Invention Convention
Be truly adventurous and allow students to create their own ooze recipe. Supply them with all the ingredients given for Procedure C. Instruct students to keep careful track of their ingredients and formulas for their own ooze creations. You may wish to supply them with measuring spoons for more accurate recipes and records.

CROSS-CURRICULAR CONNECTIONS

LANGUAGE ARTS

Ooze Brochures

Give the students supplies to make posters, brochures, or other advertising to convince people to buy their brand of ooze. They should come up with a good name for their product, and state all its properties.

Oobleck

Another ooze, Oobleck was made famous by the story *Bartholomew and the Oobleck* by Dr. Seuss. Read the book in your class, then make Oobleck by mixing 1 cup of cornstarch with ½ cup of water. This mixture is a suspension of solids in a liquid and has unusual properties. When a great force is applied, it acts like a solid—you can even walk on it. When little force is applied, it acts like a liquid—it will run through your fingers.

COOKING

Recipe Substitutions

Make cookies, muffins, or bread but eliminate some of the ingredients. What happens if you don't put in sugar? What if you don't put in baking soda? What if you use milk instead of eggs? By eliminating, substituting, or changing the proportions of ingredients, students can find out the purpose of each ingredient in a recipe.

RESOURCES

Web – http://www.omsi.edu/flubber

The official OMSI recipe for making Flubber.

Web – http://www.chemheritage.org/educationalservices/faces/poly/activity/resin.htm

This Web site contains specific chemical information about the reaction between Borax and glue. Gives more suggestions for making Flubber, which is called Glüg in the site. The images of the polyvinyl acetate and the cross-linked polyvinyl acetate and borate ions come from this site.

Web – http://www.youtube.com/watch?v=fazPiaHvFcg

This video, "Kid Science Episode 1: Cornstarch Suspension" is one of the favorites in the Chemistry Lab at OMSI. The host, Blake (age ~9), makes a suspension of cornstarch in water and explores some of its properties. He also discusses the three types of matter. We eagerly wait for future episodes from this young scientist.

Web – http://www.youtube.com/watch?v=yHlAcASsf6U

This video titled "People Run on a Pool of Oobleck" shows two men running across a suspension of cornstarch in water. The pool is about 3 feet deep, and you can see how the suspension compresses under their weight under high force. This video is not in English but still quite entertaining.

Dr. Seuss, *Bartholomew and the Oobleck*
Reading level: kindergarten to 4th grade

This is a sequel to The 500 Hats of Bartholomew Cubbins, a page to King Derwin in the kingdom of Didd. King Derwin orders something more interesting to fall from the sky and gets Oobleck, a sticky, green substance. Discusses the importance of owning up to your mistakes.

VOCABULARY

cross-link: to connect many molecules together in multiple places creating a large network of molecules

hydrogen bonds: attractive forces between molecules that each have a hydrogen and oxygen bound together (–OH group) and extending from the molecule

liquid: a state of matter in which atoms or molecules move relatively freely and fill their container

molecule: a group of at least two atoms held together in a definite arrangement

polar bond: connections between atoms where the electrons are not equally shared; molecules with these bonds tend to have a small electrical charge

polymer: a large molecule made of many repeated molecules

polyvinyl acetate: the active ingredient in liquid white glue and liquid clear glue

sodium tetraborate: the active ingredient in Borax detergent

solid: a state of matter in which atoms or molecules are closely and rigidly packed and resist changes in shape or volume

starch: long chains of sugar molecules; plants create this molecule as a way to store energy

.

Choose Your Ooze

PROCEDURE A

1. Label one paper cup "Flubber."
   - Label the other paper cup "Glarch."

2. Add three spoonfuls of white glue to each cup.
   - What is the white glue like?

3. To the "Flubber" cup, add one spoonful of Borax solution. Stir with a wooden stick.
   - What is happening to the mixture?

4. Take the Flubber out of the cup.
   - What does it feel like?
   - Does it bounce?
   - Does it stretch?

5. To the "Glarch" cup, add one spoonful of Staflo solution. Stir with a wooden stick.
   - What is happening to the mixture?

6. Take the Glarch out of the cup.
   - What does it feel like?
   - Does it bounce?
   - Does it stretch?

7. Clean up your area.
   - Follow your teacher's directions.

Choose Your Ooze

PROCEDURE B

1. Label five paper cups #1 to #5.
2. Add white glue to each cup according to the chart.
3. To cup#1, add two spoonfuls of Staflo solution.
   - Stir with a wooden stick.
   - What is happening to the mixture?
   - Write your answer in the data table.
4. Take the ooze out of the cup.
   - What does it feel like? Does it bounce? Does it stretch?
   - Write your observations in the table.
5. Repeat steps 3 and 4 for the rest of the cups.
   - What properties of the ooze change as the amount of glue changes?
6. Clean up your area
   - Follow your teacher's directions.

cup	1	2	3	4	5
white glue	4 spoonfuls	5 spoonfuls	6 spoonfuls	7 spoonfuls	8 spoonfuls
Staflo	2 spoonfuls	2 spoonfuls	2 spoonfuls	2 spoonfuls	2 spoonfuls
notes					

Choose Your Ooze

PROCEDURE C

Glue Substitution in Flubber

1. Label two cups "Flubber" and "Clear Flubber."

2. Add white glue or clear glue to each cup according to the table.

	glue	Borax	notes
Flubber	3 spoonfuls white glue	1 spoonful	
Clear Flubber	3 spoonfuls clear glue	1 spoonful	

3. To the "Flubber" and "Clear Flubber" cups, add 1 spoonful of Borax solution.

4. Stir with a wooden stick.
   - What is happening to each mixture?
   - Write your answer in the table.

5. Take the two kinds of Flubber out of the cups.
   - What do they feel like? Do they bounce? Do they stretch?
   - Write your answers in the table.

6. Compare the properties of Flubber and Clear Flubber.
   - How are they the same?

   - How are they different?

7. Clean up your area.
   - Follow your teacher's directions.

Choose Your Ooze

PROCEDURE C

Glue Substitution in Glarch

1. Label two paper cups "Glarch" and "Clear Glarch."

2. Add white glue or clear glue to each cup according to the table.

	glue	Staflo	notes
Glarch	3 spoonfuls white glue	1 spoonful	
Clear Glarch	3 spoonfuls clear glue	1 spoonful	

3. To the "Glarch" and "Clear Glarch" cups, add 1 spoonful of Staflo.

4. Stir with a wooden stick.
   - What is happening to each mixture?
   - Write your answer in the table.

5. Take the two kinds of Glarch out of the cups.
   - What do they feel like? Do they bounce? Do they stretch?
   - Write your answers in the table.

6. Compare the properties of Glarch and Clear Glarch.
   - How are they the same?

   - How are they different?

7. Clean up your area.
   - Follow your teacher's directions.

Choose Your Ooze

PROCEDURE C

Staflo Substitution in Glarch

1. Label four paper cups from #1 to #4.
2. Add 3 spoonfuls of white glue to each cup.
3. To cup#1, add one spoonful of Staflo solution.
   - Stir with a wooden stick.
   - What is happening to the mixture?
   - Write your answer in the data table.

4. Take the ooze out of the cup.
   - What does it feel like? Does it bounce? Does it stretch?
   - Write your observations in the table.
5. Repeat steps 3 and 4 for the other cups.
   - Substitute a different solution for Staflo in each cup according to the table.
6. Compare all the different versions of Glarch.
   - Can you use a "Secret Solution" to make Glarch?
   - **Explain:** How do you know?

   - Which makes the glue turn into ooze—starch or Borax?
   - **Explain:** How do you know?

   - What property does starch create in the ooze?
   - **Explain:** How do you know?

   - **Choose your ooze:** Which recipe of Glarch to you like best?
   - **Explain:** Why is this choice the best?

7. Clean up your area.
   - Follow your teacher's directions.

Choose Your Ooze

PROCEDURE C—DATA TABLE

Staflo Substitution in Glarch

	1	2	3	4
	Glarch	Secret Solution Glarch	Glarch, no Borax	Glarch, no starch (Flubber)
glue	3 spoonfuls white glue	3 spoonfuls white glue	3 spoonfuls white glue	3 spoonfuls white glue
Staflo	1 spoonful			
Secret Solution		1 spoonful		
starch			1 spoonful	
Borax				1 spoonful
notes				

This worksheet is also available online at **www.omsi.edu/k8chemistry**.

Choose Your Ooze

Recommended group size: 2–3

Number of Students: ☐ Number of Groups: ☐

Supplies	Amount Needed	Supplies on Hand	Supplies Needed
Procedure A			
white glue (e.g., Elmer's™)	1 bottle (4 oz.) per group		
Borax™ detergent	1 teaspoon per class		
water	2¼ cups per class		
Stāflo™ liquid starch	¼ cup per group		
Procedure B			
white glue (e.g., Elmer's™)	1 bottle (4 oz.) per group		
Stāflo™ liquid starch	½ cup per group		
Procedure C			
white glue (e.g., Elmer's™)	1 bottle (4 oz.) per group		
Borax™ detergent	1 teaspoon per class		
water	4½ cups per class		
Stāflo™ liquid starch	¼ cup per group		
clear glue (e.g., Elmer's™)	1 bottle (4 oz.) per group		
cornstarch	¼ cup per class		
General Supplies			
Pop-top squeeze bottles (e.g., water or sport drink) for distributing solutions	1–4 per group (see Set Up notes)		
plastic spoons	2 per group		
wooden sticks **and** wax paper cups (e.g., Dixie™) (4 oz.) for mixing **OR** resealing plastic bags (e.g., Ziploc™) snack size	3–5 per group		
vinegar (for clean up)	2 cups per class		
cafeteria trays	1 per group		
Extension A			
no extra supplies needed			
Extension B			
same as Procedure C			
Teacher Demonstration			
elastic or rubber tubing, each about 2 yards long and each tied into a loop	4–6 pieces per class		