

# ACTIVITY 1: LAB INVESTIGATIONS

## Overview

The unit opens with scientific investigation of a strange substance called Oobleck, said to come from a newly discovered moon in our Solar System. After a few minutes of free exploration, the class is introduced to the concept of properties and is focused on investigation of the properties of the strange substance. Working in small groups, they discuss and record the physical properties that they observe.

The emphasis in this first session is on direct student investigation of Oobleck. The intense curiosity and positive energy open up a learning gateway into the subsequent activities in the unit. This session sets the stage for more systematic refinement of Oobleck's properties, a challenging design application, a look at real Mars missions, and—always—more questions and investigations. From the opening exploration onward, the unit brings students a deeper understanding of what science is and what scientists do.

### Learning Objectives for Activity 1

- Deepen student understanding of: properties of matter, properties of substances, and properties of solids and liquids.
- Develop student abilities in: observing, exploring using the senses, investigating, communicating, and accurately recording observations and data.
- Cultivate student awareness of what science is, what scientists do, and how students are acting like scientists.

*"Discovery consists in seeing what everyone else has seen, but thinking what no one else has thought."*

*-- Albert Szent-Györgyi, Nobel Prize winner in medicine*

## ■ What You Need

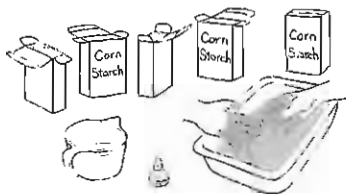
For each team of 4–6 students:

- 1 stable, wide-topped bowl with about 1 ½ cups of Oobleck in it
- 1 work station covered with old newspapers
- 1 felt-tipped marker or crayon
- 1 large sheet of paper or about 10 sentence strips (for recording properties)

*Note:* Sentence strips have the later advantage of allowing the class observations about properties to be sorted in various ways.

For the class:

- 1 equipment station (see # 4 on next page). This is optional but highly recommended.
- water
- paper towels
- a piece of paper (or other familiar object) for discussion of properties
- (optional) dish tubs or bowls for hand rinsing



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If you have eight teams of students, you'd use about 6 boxes of cornstarch, 10 cups (2500 ml) water, and about 20 drops of food coloring.

**PLEASE NOTE:** Different brands of cornstarch may require slightly different amounts of water, so you should always test the Oobleck as follows: the Oobleck should flow when you tip the bowl, and feel watery when you gently dip a finger in it, but feel like a solid when you hit it or rub your finger across the surface. If it is too thick to flow, add a little water. If it is too soupy, add a little more cornstarch. It is better to err slightly on the soupy side since some water will evaporate during class.

On the GEMS web site at [www.lhsgems.org/videos.htm](http://www.lhsgems.org/videos.htm) there is an amusing video about mixing Oobleck, with helpful tips.

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## ■ Getting Ready

1. **Preparation time.** If possible, the first time you mix Oobleck, start mixing it about two hours before class. Although it's quite possible to mix the Oobleck before class in less time, by allowing more time at first you can make any necessary adjustments more easily. In any case, you should allow at least 45 minutes to prepare the Oobleck, and to set up the work stations and the equipment station for the lab investigation.
2. **Prepare the Oobleck.** The proportions used here—4 boxes cornstarch, 6 ¾ cups (1600 ml) water, and about 15 drops of food coloring—will make enough for six teams of students to have about 1 ½ cups of Oobleck each. Keep an additional box of cornstarch on the side to thicken the mixture in case it becomes too soupy.
  - a. To prepare the Oobleck, add 15 drops of green food coloring to 6 ¾ cups (1 liter 600 ml) of water in a dish tub or large mixing bowl. Slowly sprinkle in the contents of four boxes of cornstarch. Swirl and tip the bowl to level the contents.

*Note:* Food coloring should not be added after the cornstarch, because at that stage it is difficult to mix evenly. Also, adding more than the recommended amount of food coloring may cause Oobleck to temporarily stain hands.

- b. Mix the Oobleck with your hands (not a spoon) to ensure an even consistency. Do not try to push through the Oobleck mixture as if mixing batter, as that will prove very difficult. Instead, keep “lifting” the Oobleck from the bottom of the bowl to the top by slipping your fingers under it, until an even consistency is reached.
  - c. A few minutes before you plan to start the activity, mix it one more time if water has separated into a layer on top.
  - d. Pour about 1 ½ cups (350 ml) of Oobleck into each team’s bowl. Then put the bowls aside until after you introduce the activity.
3. **Prepare work areas.** Spread several sheets of newspaper on each table where a group of students will work. If there is a rug, you may wish to spread newspaper on the floor under the edge of each table. (Oobleck can be swept up or vacuumed when it is dry, but the newspaper will make cleanup a little faster. Please see important clean up information below and on page 12.)
  4. **Establish an equipment station (optional).** Students will discover the most important qualities of Oobleck by directly handling it, and by observing it in its container or while it dries on newspaper. If you wish, you can further enrich and extend the testing phase by providing an assortment of materials at an equipment station. The station could be as simple as a selection of wood, metal, and plastic items, such as coins or washers, metal and plastic spoons, scraps of wood, Styrofoam peanuts, and plastic bags.
  5. **If you have dish tubs or bowls for hand rinsing, keep them handy.** It works out better for the teacher or a student to bring tubs of water to student teams rather than have students walk across the room to a centralized wash area—with Oobleck dripping off their hands. Also, to prevent waste of paper towels, you may want to keep them inaccessible and only bring them out when you want students to clean their hands.

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**Optional:** Because students often hypothesize that temperature affects the consistency/behavior of Oobleck, some teachers provide a hotplate and sauceron at the equipment station. Of course, if you do this, make sure you’ve taken all necessary safety precautions and advised students on safe use.

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## ■ Tips on Cleaning Up Oobleck

Oobleck is safe to handle and is easy to rinse off jewelry. When it dries, it can be brushed off clothes and vacuumed or swept off floors.

Oobleck can be covered with plastic wrap and refrigerated overnight, although you will likely need to add a bit more water and will definitely need to mix it a bit the next day. If kept for too long in this manner, Oobleck can become moldy. Some teachers have added a small amount of bleach to help prevent this.

Oobleck can also be left out overnight. Put the bowls of Oobleck aside until the next day so your students can see what it looks like when it dries. Reconstitute one or more of the bowls of Oobleck (by adding a little water, and mixing) for use during the scientific convention in Activity 2. Once dry, Oobleck can be dumped into compost or a wastebasket. Do NOT pour Oobleck into the sink, as it is likely to clog the drain. You can dispose of the newspapers that covered the work stations in the garbage.

When wet, Oobleck can be difficult to clean up, but if allowed to dry it can be brushed off clothing and swept or vacuumed off floors. Do not attempt to mop up a large spill—scoop up most of it first, allow it to dry, then sweep, vacuum, or wipe up the remaining Oobleck with a sponge

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Over the years, teachers have come up with many variations on this opening. In past editions, the space probe came back from a mystery planet "in another star system." While this connects to current telescopic discoveries of "extrasolar planets," it also fosters the misconception that travel to and from such distant systems is possible. In this edition, we've opted for the substance to come from a new moon discovered within our Solar System. Some teachers also ask the class to imagine they are on board a space ship that's near the moon, with their lab work taking place on the space ship.

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## ■ Setting the Scene

1. Tell your students to imagine that they are a group of scientists who have been asked to investigate a strange new substance brought back from a previously unknown moon. The moon is covered with what appear to be large green oceans, and three probes have been sent down. Contact with the first probe was lost, and what happened is unknown. The second probe is stuck on the surface, but the third probe managed to collect a sample of the ocean material.
2. Say that the sample has now been brought back to Earth. As scientists, they have been asked to investigate its properties.
3. Explain that the material has been nicknamed "Oobleck" since it looks a bit like the green rain Dr. Seuss describes in his book *Bartholomew and the Oobleck*. Show your students the bowls of Oobleck, but don't distribute them yet.
4. Mention that preliminary studies have shown that Oobleck is safe to handle. Tell your students that a team of chemists is trying to find out its exact composition, and their results will be revealed when their research is completed.
5. Emphasize again that their job as scientists is to investigate the *properties* of Oobleck. Use the following example to explain what is meant by "property of a substance" and to demonstrate the process of recording these properties. Do not spend longer than five minutes on this exercise, so your students will have most of the session to conduct their investigations of Oobleck.

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One eighth grade science teacher wrote the GEMS project to describe how she introduced this unit: "I read out loud *Bartholomew and the Oobleck* by Dr Seuss. At first my "cool" eighth graders wanted no part of it. They were honors students; they were too old for Dr. Seuss; they were too mature! So many excuses! Yet I persisted and read to them. (They finally gave in if I would close the door so they wouldn't be embarrassed.) They loved it! And the Oobleck meant so much more to them!"

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- a. Hold up a piece of paper (or other object) and tell the students: “Raise your hand if you can describe this paper from what you observe, or from what you have learned by using paper.” Common responses include: “It is white (or whatever color you are using),” “It is thin,” “It’s smooth,” etc.
  - b. List the responses on the board, and number each one. If the students come up with statements based only on the *appearance* of paper, say: “Let’s do a test.” (Tear the paper.) Ask: “What can we say about paper based on this test?” Add their statements to the list.
  - c. Explain that the list on the board describes some of the properties of paper. A *property* of a substance is something that can be seen, heard, smelled, felt by the senses, or detected by instruments—such as microscopes, telescopes, and thermometers—that are extensions of our senses. Sometimes properties are determined through performing tests on the substance. The color, size, shape, texture, weight, hardness, odor, and sound of a substance are examples of its properties.
6. When the group has listed at least five properties of paper, remind them that their job is to determine the properties of Oobleck. Tell them they will soon explore the Oobleck by observing and touching it. Urge them to use all of their senses except taste.

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*Paper is just one of many objects or materials you could use to exemplify what is meant by physical properties. Many familiar objects would serve, such as a piece of chalk, a pencil, masking tape, etc.*

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## ■ Investigating Oobleck

1. Tell students they will be working in lab teams. Organize them into teams of four or five students each. Have each team sit around a table or desk. Have one student cover the table with newspaper.
2. Say that after they’ve had a chance to investigate the Oobleck for a few minutes with just their senses, you will bring around large sheets of paper or sentence strips for each team to record the properties they discover. At that time (if you have set up an equipment station) they may also choose from the items at the station to aid their investigation.
3. Say that each team will have a Recorder, who will number the properties and write them down using large, clear letters. The Recorder for each team will need to wash his or her hands. You may want to have the teams designate their Recorders at this point.
4. Give each lab team one bowl of Oobleck. As the students investigate Oobleck, circulate from group to group encouraging them to touch the Oobleck with their fingers.

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*As appropriate, if you have set up the equipment station, explain any procedures or rules for taking and returning items from and back to the station.*

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*Investigating Oobleck is so engaging that just about the only way to get the attention of the entire class after they have begun exploring it is to remove the bowls. For this reason, going from group to group is often the best way to communicate with the class during this laboratory phase.*

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For example, many students think that Oobleck turns to liquid because of the heat from their hands. Point to nearby pieces of wood or plastic, or containers they might use to test that idea. Does it still act the same when a piece of wood applies the pressure? Help students learn to resolve disagreements by performing simple tests or by discussing ways to describe a property so everyone on the team agrees.

Some teachers also have students—in addition to placing stars—underline the most interesting discovery they made about Oobleck, which may or may not be the same property.

## ■ Recording Properties

1. After the students have investigated Oobleck for about five minutes and discovered some of its weird properties, give each lab group a felt-tipped marker or crayon, and either sentence strips or a large sheet of paper.
2. Help the students start recording the properties of Oobleck. Circulate among the groups, asking questions, such as: “What’s surprising you?” “How does Oobleck behave when you press on it?” “How does the Oobleck behave when you hit it fast and hard?” “When does Oobleck behave like a solid?” “When does Oobleck behave like a liquid?” Suggest that the students test their ideas.
3. Ask each laboratory team to put a star on their list next to the property of Oobleck they believe to be most important in explaining under what circumstances Oobleck acts as a solid or as a liquid.
4. Let students know that in the next class session they will discuss and debate as a class what all the lab groups have recorded as the properties of Oobleck.
5. You may want to end the investigation about 10 minutes before the end of the session so your students can help you clean up.

*Reminder:* Please see “Tips on Cleaning Up Oobleck” on pages 11 and 12. As also noted there, you can put the bowls of Oobleck aside until the next day so students can observe it dry. Then, by mixing in a little more water, you can reconstitute one or more of the bowls of Oobleck for possible use in Activity 2.

