

Discover!

General Science 2

SAMPLE
PDF



LAB
BOOK

The Case of the Non-Newtonian Fluid

Upon completion of the lab, you will be able to:

- identify different states of matter
- create a non-Newtonian fluid
- investigate the influence of pressure on matter

Key Concepts

- Matter has basic properties that can be described, including mass, volume, and density.
- Matter exists in four states: solid, liquid, gas, and plasma.
- The particles within each state of matter vary in shape, volume, and movement.
- States of matter can change from one state to another based on pressure and temperature.
- Atoms can be organized into molecules, elements, and mixtures. Humans interact with many important elements on a daily basis.

Safety

The materials found in this lab are safe; however, they can get messy. It is recommended that you wear an apron to protect clothes, gloves to protect hands, and use a tablecloth to protect surfaces.

Materials

- | | | |
|-------------------|--------------|----------------------------|
| ▪ two large bowls | ▪ apron | ▪ tablecloth or newspaper |
| ▪ corn starch | ▪ gloves | ▪ food coloring (optional) |
| ▪ water | ▪ small coin | |

START!

You've been asked to participate in a show-and-tell at a local elementary school. With your visit to the university fresh in your brain, you know you have to show something that you learned while there. You learned a lot about matter and molecules with Dr. Brown. You begin to search for simple experiments that may interest the elementary students. Your online search comes up with a strange word, Oobleck.

"What in the world is Oobleck?" you think to yourself. You read further down the page and see the description: non-Newtonian fluid.

"Ohhhh, now that sounds like science," you say to yourself. "This is what I'm going to show and tell."



Oobleck is a non-Newtonian fluid.



In the unit, you learned about matter and its different states. Each state of matter has notable properties. For example, solids have low kinetic energy and a fixed shape. Liquids have a higher kinetic energy and take the shape of their container. Gases have high kinetic energy and no fixed shape.

In today's lab, you will explore a non-Newtonian fluid that acts as both a solid and a liquid, depending on the conditions it is under.

What will cause the fluid to change how it behaves?

As you learned in the unit, pressure can cause matter to change its state. When you apply pressure to a non-Newtonian fluid, such as Oobleck, it begins to act as a solid. The molecules of the starch resist motion and trap water between molecules. As pressure is released, it transitions to a liquid since the water molecules are no longer trapped.

Can you write a hypothesis? Use the Lab Notes page to record your predictions about this assignment.



Procedures:

Step 1: Prepare the area by placing either an old newspaper or a tablecloth on the surface.

Step 2: Put your apron and gloves on.

Step 3: Mix equal parts cornstarch and water. (Ex: one cup cornstarch to one cup water)

Step 4: Add one to two drops of food coloring if desired (optional).

Step 5: Record your observations of the mixture without applied pressure.

Step 6: Mix with a spoon vigorously and record your observations.

Step 7: Mix with a spoon slowly and record your observations.

Step 8: Pour the fluid from one container to another and observe what happens. Record your answer.

Step 9: Try to pick up the fluid with your hands. What happens? Record your answer.

Step 10: Squeeze the fluid with your hands. What happens? Record your answer.

Step 11: Add the coin to the fluid. What happens? Does it sink or float? Record your answer.

Step 12: Add half a cup of additional water to the mixture. What happens? Record your answer.

Test	Observation
no applied pressure	
vigorous stirring	
slowly stirring	
pouring from one container to another	
picking up the fluid	
squeezing the fluid	
adding an object	
adding more water	

What is happening during the experiment? Use the Lab Notes page to record your observations about this assignment.

SYNTHESIZE

Create a lab report to explain your findings. Use the data table that you filled in to help you. Your lab report should address the following.

- **Question:** How do non-Newtonian fluids behave under various conditions?
- **Background:** Use information in the lab to help a reader understand non-Newtonian fluids. You may also want to explain the three states of matter.
- **Hypothesis:** What did you think was going to happen before experimenting?
- **Materials/Methods:** What materials and processes did you use to conduct your experiment?
- **Results:** Present your findings. (Hint: Your data table can help you with this section.)
- **Discussion:** Compare your results with your prediction. What was surprising to you? What would you do if you could change anything in your experiment?
- **Conclusion:** Summarize your experiment. Restate your hypothesis and state whether your results supported or refuted the original prediction. Were there any sources of error?

Can you describe any results? Use the Lab Notes page to record your observations about this assignment.

STRETCH

Oobleck is just one example of a non-Newtonian fluid. Many other household items, like ketchup and yogurt, are also non-Newtonian fluids. Research at least three non-Newtonian fluids and explain how they transition from one state of matter to the other. For example, Oobleck moves from a liquid to a solid if you squeeze it.

Non-Newtonian Fluid	Transition
1.	
2.	
3.	

Predict

Before starting this lab, I predict . . .

Observe

While completing the lab, I observed . . .

Explain

Upon completion of this lab, I learned . . .

Keep Going

I still have questions about . . .

