

Ooey Goey Physics

Don't forget to make an Achievery account for each student! [Make your account for the Achievery in English](#) or [Make your Account for the Achievery in Spanish](#)

Note: This lesson has the potential to be messy (and fun)! Do it outside or cover surfaces.

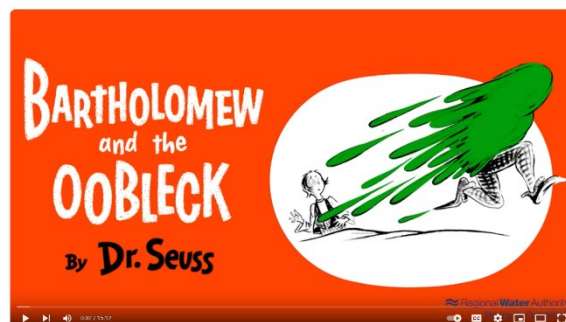
Objective: Students will make observations and measurements and be able to classify materials based on their physical properties. They will understand how a non-Newtonian fluid responds to force. Students will understand that solids, gases, and liquids are forms of matter.

Grade Span: K-12

Subjects: STEM

Lesson Intro: Watch This! Have students watch a read-aloud of *Bartholomew and the Oobleck* by Dr. Seuss. Discuss with students questions such as:

Why does the king get angry at the weather? Why does Bartholomew obey the King even though he disagrees with what King Derwin is doing? Did the oobleck seem like it was good or bad when it fell? Why? Does this have something to do with what was in the magic brew? Does saying sorry automatically grant forgiveness? Why do you think it was so important for the King to say sorry?



Lesson: Stirring Things Up

When you mix cornstarch and water, things get weird: Depending on how it's handled, the solution can act like a liquid or a solid.

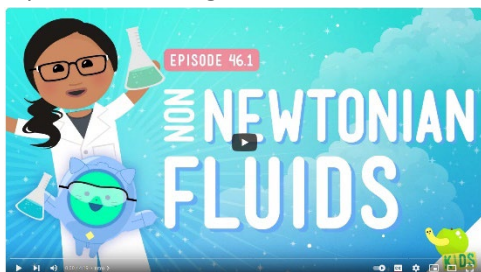
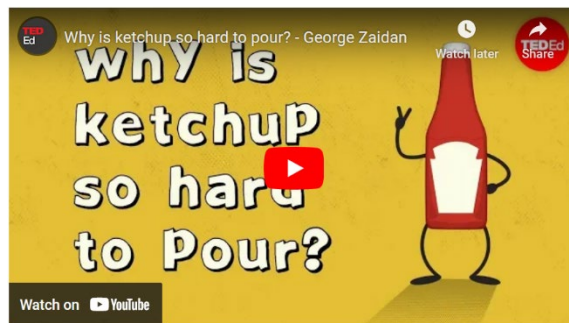
Swish it gently in a bowl, and the mixture sloshes around like a liquid. Squeeze it, and it starts to feel like paste. Roll it between your hands, and it solidifies into a rubbery ball. Try to hold that ball in the palm of your hand, and it will dribble away as a liquid.

If you've ever whacked the bottom of a ketchup bottle to get that tasty tomato goop flowing, you've put some serious physics to work. Ketchup is a non-Newtonian fluid. So are toothpaste, yogurt, shampoo, Silly Putty, and paint. They all change how they flow when under stress. You don't have to take our word for it. Let's test this! *'Shake and shake the catsup bottle. None will come, and then a lot'!*

science
FRIDAY

Use the Student Portal resource Science Friday Lesson Plan [Exploring Fluid Physics: Testing Viscosity Under Stress](#).

Have students watch the Student Portal resource Ted Ed's video: [Why is Ketchup So Hard to Pour?](#) Ever go to pour ketchup on your fries...and nothing comes out? Or the opposite happens, and your plate is suddenly swimming in a sea of red? George Zaidan describes the physics behind this frustrating phenomenon, explaining how ketchup and other non-Newtonian fluids can suddenly transition from solid to liquid and back again.



Have students watch [Oobleck and Non-Newtonian Fluids](#) from Crash Course Kids. Sabrina is going to show us that things can sometimes behave like a solid, and sometimes like a liquid, depending on how much force is applied to them. In this episode of Crash Course Kids, we'll talk about some weird stuff that's still... normal.

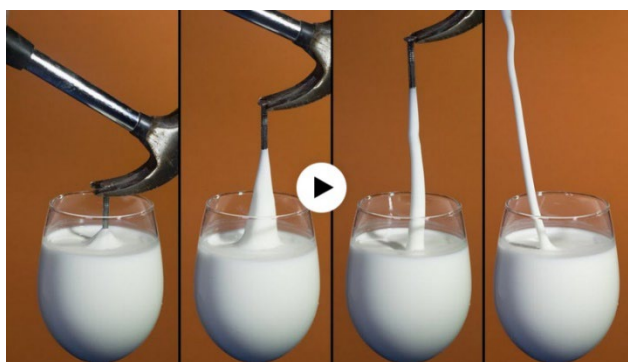
K-2 Incorporate elements of [Investigating Matter, Solid or Liquid: Bartholomew and the Oobleck](#). This activity helps students explore states of matter.

Additional Resources: Explore the following articles, videos, & audio with students.



[Weird Science from Kids Discover: The Accidental Invention of Silly Putty](#). A fun quick read about the history of Silly Putty.

[The Oozy Physics of Oobleck](#): Jaeger and Kim speculate that a better understanding of non-Newtonian fluids could help in the development of new, advanced materials. The potential ranges from flexible speed bumps to impact-resistant clothing.



[Oobleck's weird behavior is now predictable](#): MIT engineers develop a model that predicts how the cornstarch-water mixture turns from liquid to solid, and back again.



Check out this video from the Student Portal resource Science Max! Experiments at Large: [Running on a Liquid Surface](#). Phil fills a giant container with cornstarch mud, a Newtonian fluid. Let's see if he can run across the surface.

Discuss: Aside from predicting what the stuff might do in the hands of toddlers, have students work at

predicting how oobleck and other solutions of ultrafine particles might behave for military and industrial applications. Could an oobleck-like substance fill highway potholes and temporarily harden as a car drives over it? Oobleck armor? Or perhaps the slurry could pad the lining of bulletproof vests, morphing



briefly into an added shield against sudden impacts. What about manufacturing non-clumping paint or concrete?

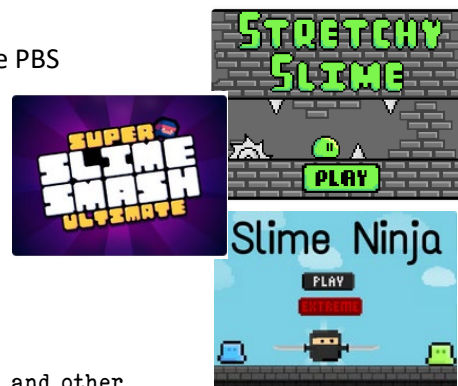
Game Time:



Have students play the Student Portal resource PBS Kids game [Rosie's Slime Shop](#) in English or Spanish to practice slime mixing skills.

Play [Slime Ninja](#), [Stretchy Slime](#), or [other slime games](#) on Scratch. See the code behind the game by clicking 'see inside.' Students

can try crafting their own remixes.



Take it farther! Build on this lesson with additional lesson plans and other resources such as:

Try Popular Science's recipe for [Two-ingredient Silly Putty](#). Easy peasy, putty squeezezy. the chemical properties that make Silly Putty so bendy and durable are shockingly complex, as are its ingredients. The list is long and includes tongue-twister-like names like polydimethylsiloxane and boric acid. Sounds tough to replicate at home. Or is it? This experiment lets students turn two common goods (cornstarch and dish soap) into endless hours of non-Newtonian fun.

POPULAR SCIENCE



Compare and contrast it with the different recipe [Two-Ingredient Silly Putty](#) from the Student Portal resource PBS Kids. Silly Putty was an accidental invention during the Second World War. This rubber-like substance will mold into millions of shapes and even bounce! Make your own using only two household supplies for a project that's also a great chemistry or history lesson!

Understanding deepens as you play more. So go ahead—try as many twists on Silly Putty as you want. It was made to stretch your imagination anyway.



[DIY | How To Make Silly Putty \(JUST LIKE THE ORIGINAL!!\)](#) Use borax, water, and liquid glue (white or clear.)

Make '[Proto Putty](#)' ([Modified Oogoo](#)) This substance that molds like play-dough but hardens into bouncy rubber. **Tip:** It gets stinky at first! Mix it up outside and don't forget the gloves.



[Matter Compilation](#) from Crash Course Kids: Maybe you'd like to just hear about one topic for a while. We understand. So today, let's just watch some videos about Matter. What is matter? What are particles? And why does matter...matter? Did you know that coal can turn into diamonds? Or that some materials don't behave the way we think they should?

Explore the Achievery lesson [Make a Magnetic Nanoparticle Coating](#). Learn what a magnetic nanoparticle is and how it is used to treat cancer. Then design your own coating for a magnet that will pick up different surfaces.