



STEM in the lab

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STAR WARS SWAMP GOO



GRADE LEVELS

This activity is appropriate for grades K-8.



MISSION

Make your own swamp goo.



VOCABULARY

NEWTONIAN: Newtonian fluids have a constant viscosity that doesn't change, no matter the pressure being applied to the fluid.

NON-NEWTONIAN FLUID: a fluid that does not follow Newton's law of viscosity (i.e., constant viscosity independent of stress). When non-Newtonian fluids are under force, viscosity can change to be either more liquid or more solid.

VISCOSITY: the property of a liquid that describes how fast or slow something will flow. You can think of viscosity as how thick a liquid is. A liquid with low viscosity, or that's thin like water, will flow quickly (in other words, it will flow freely).



MATERIALS

- » 2 cups corn starch
- » Large bowl
- » 1/2 cup water
- » Food coloring (green or brown)
- » Lego Star Wars characters
- » Various Star Wars themed objects

ABOUT THIS ACTIVITY



If you've seen Star Wars, you'll know that Luke's journey wasn't easy. After crashing into the swamp-covered planet, Dagobah, his first step to finding Yoda was to escape the quicksand-like swamp. Luckily for Luke, he had science on his side. Using his knowledge about the states of matter, Luke should be able to quickly get out of the swampy quicksand. But first he will have to decide if this quicksand is a solid or a liquid? Or can it be both? In this activity, you will make a substance that is like quicksand, but a lot more fun.

Swamp goo is an example of a non-Newtonian fluid. Viscosity explains how non-Newtonian substances work. Viscosity is how an object resists flow. One example is honey, which has a high viscosity...or resistance to flowing. Water has a low viscosity because it flows easily. Scientist Isaac Newton stated that the viscosity of a fluid can be changed only by altering the fluid's temperature. For example, honey flows more easily once it is heated up. Quicksand is a non-Newtonian fluid. Because of this, it doesn't have the same dependence on temperature. The viscosity of quicksand changes when stress or a force, not heat, is applied. Good luck, and may the force be with you!

INSTRUCTIONS

- 1 Put 2 cups of cornstarch in a large bowl.
- 2 Mix ½ cup of water with a few drops of food coloring.
- 3 Add the colored water to the cornstarch. With your hands, stir the mixture together.
- 4 Once mixed, add more water if the mixture is too dry. Keep adding water until the mixture is wet in appearance, but solid when touched.
- 5 Do not worry, if you add too much water, just add more corn starch to the mixture. When the goo oozes through your fingers when touched, it's ready to be played with.
- 6 Now that you have created the swamp, it is time to explore it. Drop Lego Star Wars characters (or any small Star Wars toys) into the goo. Do they get swallowed up by the swamp, or are they able to use "the force" to stay on the surface?
- 7 Drop different Star Wars objects into the swamp goo and observe what happens. A few ideas:
 - » Lightsabers (toothpicks, red and yellow colored pencils, or crayons)
 - » Droid parts (washers/ nuts/ screws)
 - » Death Star or BB-8 (small bouncy ball)
 - » Kyber crystals (different colored pony beads)
 - » Spaceship parts (lego blocks)

Notes: The swamp goo will not stay mixed together forever. Over time, the water will evaporate, and the grains of cornstarch will form a solid clump. Since the cornstarch will remain, do not pour the mixture down the drain. The mixture will settle in pipes, harden, and clog them completely! Keep the mixture in a sealed plastic bag and toss it into the trash when you're finished with it.

THE SCIENCE BEHIND IT



Swamp goo, or its more commonly known name Oobleck, is a non-Newtonian fluid. It acts like a liquid when poured, but like a solid when a force acts on it. Oobleck and other non-Newtonian substances such as quicksand and silly putty are not a solid or a liquid. Applying pressure to the Oobleck increases its viscosity (thickness). When you squeeze a handful of the Swamp Goo, the particles of cornstarch come closer together and trap the water between them. Its viscosity increases, and it acts like a solid for a split second. When you release the pressure, water fills the spaces between cornstarch particles again, and the goo behaves like a liquid.

EXTENSIONS

- » Read Dr. Seuss's book *Bartholomew and the Oobleck* to learn more about how the substance got its funny name.
- » Find online videos about people who have done crazy things with Oobleck.
- » Experiment with surface area and volume. Find out if smaller objects stay on the surface longer than bigger objects.

RESOURCES

- » **It's a Solid... It's a Liquid... It's Oobleck!**
<https://www.scientificamerican.com/article/oobleck-bring-science-home/>
- » **Non-Newtonian Cornstarch Recipe**
<https://www.stevespanglerscience.com/lab/experiments/non-newtonian-fluid/>
- » **The Science Of Goo: Cornstarch, Quicksand, Oobleck, And Non-Newtonian Fluids**
<https://owlcation.com/stem/Oobleck-Quicksand-Cornstarch-And-Water>

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