DeSTEMber

WINTER SLIME

Ooey gooey polymers! Observe the physical properties of matter while stirring together a wintery, non-Newtonian fluid.

MATERIALS:

- Bowl
- Contact solution (containing boric acid)
- Glue
- Shaving cream
- Stirring tool
- Washable paint

TEKS:

SCI 4/5.4 A: The student is expected to explain how scientific discoveries and innovative solutions to problems impact science and society.

SCI 4/5.6 A: The student is expected to classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas).

HOW TO:

1. Measure ½ cup of glue and pour it into a bowl.
2. Add 4-5 drops of washable paint, and mix the paint and glue mixture.
3. Then, measure ¾ cup of shaving cream and add it to the glue and paint mixture.
4. Begin to stir the mixture together with your stirring tool until it starts to look fluffy!
5. Add 1½ tablespoons of contact solution. You can add this in slowly as you look for the right consistency.
6. Continue to stir the mixture until it no longer sticks to the sides of the bowl. If it is still sticking to the bowl, add a bit more contact solution to your mixture.
7. Once the slime stops sticking to the bowl, knead it with your hands to fully mix and smooth it out.

8. When the slime is no longer sticky, it is ready to play with!
9. When you are done playing with your winter slime, store it in an airtight container so it will last longer!

STEM EXPLANATION:

Do you think the slime you created is a solid, liquid, or gas? That's a tricky question to answer! Everything on Earth is made up of **matter**, and this matter is made up of tiny particles called **atoms.** Matter takes on different shapes and forms depending on how these atoms are arranged. The three most common forms of matter are solids, liquids, and gases. **Solids** have atoms that are packed tightly together, and solid materials have a definite size and shape. **Liquids** have a definite size, but no definite shape. Atoms in a liquid are more loosely packed and can flow past one another. In **gases**, the atoms are far apart from one another, and gases spread out to fill whatever "container" they are in. Gases have no definite size or shape.

So, to answer the question about the state of matter of the slime, it is pretty easy to rule out gas. The molecules of slime do not expand to fill the room you are in! Slime does behave like both a liquid and a solid, though. When you move slime around in your hands, you can make it into different shapes! But when you put slime into a container, it slowly takes the shape of that container. How is this possible?

Because slime has properties that make it fit into both the solid and liquid categories of matter, scientists put it into a different category: non-Newtonian fluids. **Non-Newtonian fluids** can act like both solids and liquids. Instead of flowing at a constant rate, non-Newtonian fluids flow at different rates, depending on the pressure that is applied to them. Slime flows very slowly and behaves like a solid when you apply pressure to it because the polymers become more tangled. However, when you remove this pressure, the polymers become less tangled and slime flows more quickly, like a liquid. Quicksand and ketchup are both examples of other non-Newtonian fluids… can you think of any more?

CAREER: CHEMICAL ENGINEER

Chemical engineers use chemistry, physics, and math to design products like fuels, medicines, and materials that solve real-world problems.

MEET HELEN TRAN!

Helen Tran is a Professor of Chemistry at the University of Toronto, where she explores how the design and structure of molecules impact the properties of polymers. She holds a Ph.D. in Chemistry from Columbia University and a Bachelor of Science in Chemistry with a minor in Chemical Engineering from UC Berkeley. Beyond the lab, Helen enjoys biking, snow camping, interactive art projections, and caring for over 30 species of plants!

Learn more about Helen!

RESOURCES

https://www.steampoweredkids.co.uk/non-newtonian-fluids/
www.ifthencollection.org/

