



Slime

The science behind slime

Slime is a viscous liquid. A liquid is matter that conforms to the shape of a container in which it is held. Glue's molecules look like pieces of cooked spaghetti--thin, long, strong and flexible, and the loose bonds between them allow them to slip past each other, making glue a liquid. The slower a liquid will stretch and move, the more "viscous" we say it is. Slime made from glue is a viscous liquid.

Cross-links make slime viscous. Adding contact solution and baking soda to the glue forms connections between the glue molecules. Baking soda removes hydrogen atoms from the glue molecules, allowing the boric acid in the contact solution to react with the glue and form a three-dimensional network, (a polymer) that traps water, creating a semi-solid gel. Adding an acid, such as vinegar, to slime breaks the cross-links in the polymer and makes the slime more liquid. Adding baking soda neutralizes the acid and allows the cross-links to reform, making the slime viscous once more.

Slime thickens with force, but breaks when torn. Slime is a "shear thickening" fluid, meaning that the more force that's applied to it the thicker (more viscous) it becomes. If you drop slime it acts like a solid and bounces, but if you slowly squish slime it acts like a liquid and stretches. However, if you tear slime apart abruptly it will break. Squishing allows the cross-links to break and re-form, but tearing severs the cross-links between the molecules.

Slime activities

- 1. Confirm that your slime is a liquid.** Put your slime into three or more containers with different shapes. Observe how the slime moves around over the course of a few minutes to take the shape of its new container.
- 2. Test and change the viscosity of your slime.** Observe the rate at which the slime stretches towards the table when you hold it up high and let gravity pull towards the ground. See if you can figure out how to make it more stretchy or more bouncy by adding either more baking soda or more contact solution. Add a few drops of vinegar (an acid) and observe how your slime becomes more liquid. Then add a little baking soda and observe how the slime becomes more viscous again.
- 3. Test the response of your slime to "shear force."** Drop your slime onto a hard, smooth surface (like a floor or table) from several heights to see how much it bounces from each height. Slowly squish it onto the surface with the palm of your hand with varying degrees of force to see how it gets harder or easier to spread. Rip your slime abruptly into two pieces to observe how easily it tears.

Slime recipe

- 1.5 tsp baking soda
- food coloring
- 1 Tbsp contact lens saline solution
- plastic cup or bowl
- 4 fluid oz Elmer's White school glue
- popsicle sticks for stirring

- Pour the glue into your cup or bowl
- Add the baking soda and mix with the popsicle stick
- Add your choice of food coloring and mix again
- Add the contact lens solution and mix again until slime forms and begins to get harder to mix
- Take the slime out and knead it with both hands. If needed, add 3/4 tsp contact lens solution to make the slime less sticky

