

## Liquid Glass

This messy bit of science is about making some clear slime and then testing its properties.

### Safety considerations:

It is recommended that teachers undertake a [Curriculum Activity Risk Assessment \(CARA\) process](#). It is recommended that students are briefed as to the risks of materials and the use of gloves when handling materials should be considered.

Follow the manufacturer's safety instructions for the use of borax (as it is a cleaning product) and wash hands after use. An adult should supervise the use of borax as part of this activity

### Aim:

To make one or more batches of clear slime and test the viscosity (how runny it is).

### Materials:

Slime - clear glue/gum, borax (cleaning aisle at the supermarket), water, food colour, glitter (optional), disposable spoon or stick, disposable cups and ziplock bag (for keeping the slime).

Testing - glass or tile (something rigid, smooth and flat), funnel and clock or stopwatch.

### What to do:

#### **The Slime**

Into a disposable cup add roughly one part glue to two parts water. The exact amounts don't matter too much, but it is good to note down how much you use so you can keep track of your different slime recipes. Stir the glue and water until fully mixed. If you intend to add colour or glitter, now is the time to stir them in.

In a separate cup, mix approx 1 teaspoon of borax powder with 50 - 100 ml of water. It may not all dissolve, but that is ok, just give it a good stir.

Lastly, slowly dribble some of the borax mixture into the glue mixture while stirring it. It shouldn't take long for the mix to turn to slime. The mixture will continue to react and "slimify" for a good few minutes.

When you are finished playing with or testing it, store your slime in a plastic bag and wash your hands.



#### **The Testing**

To test how well your slime flows you can use a funnel test or a ramp test.

For the funnel test, simply load a set amount of slime (perhaps 100g) into a funnel and time how long it takes to ooze through. If it is thick slime, you may need a funnel made by cutting the top off a soft drink bottle.

For the ramp test, simply load a set amount of slime (perhaps 100g) at the top of a smooth ramp and time how long it takes to flow to the bottom.

### What's going on and what did you find out?

Clear glue contains a polymer (type of plastic) called PVA or Poly Vinyl Alcohol. The PVA molecules are actually long chains, and when dissolved in water, they move around freely. When the borax is added, it begins to link one PVA chain to another in a process called cross-linking. This changes the PVA's properties quite a bit and it thickens up, trapping the water within its network. But these new cross links will break and reform fairly easily, which is why the slime can still be pulled apart but will still merge back together. Generally the more cross links you make, the more viscous the slime will be (not so runny).

### Extension ideas and real world links:

There is yet another way to measure viscosity, and it is very similar to one used in science laboratories. Take a tall skinny container (a measuring cylinder is great if you have one) and add slime into it until it is fairly full. Then add something quite small and heavy in the top (like a fishing sinker) and time how long it takes to sink all the way to the bottom.



It somewhat defeats the purpose of making slime, but dry a little out (leave it in a warm dry spot), to see what the PVA looks like when not dissolved.

PVA plastic has uses outside of glue too. It is used to wrap dishwashing tablets and to make laundry bags used in hospitals. Because it is such a biocompatible polymer (our bodies are fine with it) it also finds uses in cartilage replacement and **contact lenses**.

If you think your slime flows slowly through a funnel, you haven't seen anything yet. There is a long running experiment at The University of Queensland which is measuring the flow of pitch (a substance like bitumen). Pitch appears to be a solid and can be broken into bits, but it turns out it will also flow, so it is in fact a very viscous liquid (like the slime, but more so). About once every 10 years a drop of pitch will drip from the funnel in the experiment, and you can read more about it, including visiting the live webcam [here](#).

Unlike pitch, glass is a solid at room temperature, but it becomes a thick liquid when very hot. Glass blowers use this to mould all kinds of shapes. Sheets of glass (later to be used in windows for example) are made by pouring the liquid glass out to cool slowly on a very flat bed of molten tin.



### Curriculum links:

(ACSSU074) Natural and processed materials have a range of physical properties, these properties can influence their use.

(AC SIS066) Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate.

(ACSSU077) Solids, liquids and gases have different observable properties and behave in different ways.

(AC SIS130) Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions.