

Polymer Slime

Please feel free to look at the previous VSVS lesson for background and introduction activities on Polymers and phosphorescence. This kit includes sodium polyacrylate (insta-snow) for demonstrating a polymer and getting the students excited. It also contains diapers to show that the same material is used in diapers as well. A plastic water bottle or synthetic fabric can also be held up to show something they are familiar with also has polymers. This kit can also be used for glow-slime instead of just colored slime. If making glow-slime, it might be best to talk about the different kinds of glowing in nature. This background information can be found in the old VSVS lesson. One kit can make 4 class periods of 25 kids.

Kit Contains:

- 120 Popsicle sticks
- 120 Plastic condiment cups
- 2 One gallon jugs of 50/50 glue/water solution
- 2 One-liter bottles of 4% borax solution
- 120 Sandwich Baggies
- 30 Plastic cups
- 6 oz. of glow in the dark paint
- 1 box of food coloring
- 1 Graduated cylinder
- 120 Wintergreen Life Savers
- Extra Borax containers
- 1 $\frac{1}{4}$ teaspoon scoop
- 1 Container of sodium polyacrylate (Insta-snow)
- 1 container of salt
- 2 Diapers

Introductory Activities:

1. Put a about $\frac{1}{2}$ a teaspoon of sodium polyacrylate into a clear plastic cup
2. Slowly add about 3 ounces of water while stirring the mixture.
3. Add water until you cannot add any more water.
4. Show students how much it has expanded and tell them it is due to the special properties of the polymer in the insta-snow.
5. Show students the diaper and tell them that the exact same material is used to keep babies dry
6. If osmosis has already been covered in class it is fun to add salt to the insta-snow and show how it just becomes liquid slush and is not contained by the polymer any more due to osmosis. Otherwise it can just be a cool thing to show the kids, instantly melting snow with no heat.

Making Slime:

1. Pre-lesson: Fill the 2 oz. condiment cups mostly full with the 50/50 glue solution. Shake gallon jug first. Fill enough for all of the students in the class plus one to demo and show each step.
2. Give each student a large plastic cup and a Ziploc bag.
 - a. The large cup should not get messy and be reused and returned with the kit.
 - b. The condiment cups should try to be reused with each class, but can be discarded at the end of the day. Depending on student level, having the students clean their own cups is preferred.
3. Have the students put their Ziploc bag in the big plastic cup with the zipper part hanging over the edge so that the cup is basically a stand for the bag.

4. Give students a glue cup and tell them to carefully add the glue to their Ziploc bag in the cup. Tell them to try to contain the drips as best as they can. It might be a good idea to give each table a few paper towels or have the kids work on paper plates or plastic trays. See the image below.



5. Once all of the students have added the glue. Place $\frac{1}{4}$ teaspoon of glow paint into their glue mixture if making glow slime. Otherwise put food coloring in the Borax solution for colored slime.
6. Have students stir their paint in with a craft/popsicle stick if using the glowing option. Make sure to provide a place where the glue-y stick can rest without making a mess.
7. Next use the same condiment cup that held the students' glue as before and fill $\frac{1}{3}$ to $\frac{1}{2}$ full with the 4% Borax solution.
 - a. Constantly be shaking the Borax solution as it is slightly over saturated and there needs to be an equal amount of borax in each pour.
 - b. Less is more with the Borax solution, students can always be given a little more, but if there is too much

they will have to drain their bags, which can be a mess.

- c. You may choose to have dropped food coloring in the solution ahead of time. If you do this, know that using it with the glow paint diminishes the amount of glow the slime will produce.
8. Have students pour their Borax solution into their glue mixture in the bag.
9. Have them remove the bag from the cup stand and carefully seal it completely.
10. Begin to knead the mixture and continue until you have slime. This means that no more liquid is being incorporated.
11. If necessary have students crack their Bags open a little bit and pour the excess liquid in the sink or trash.
12. Give students a little bit of wax paper to place their slime on.
13. Students can now take their slime out of the bags and finish up kneading it until no longer sticky.
14. Complete worksheet about liquid vs. solid with tables or as a class together
15. Once the activity is complete have students replace the slime to the Ziploc Baggies.
16. Remind students that it is not food and to keep away from pets, siblings, and fabric. They should throw the slime away after 2 weeks, as mold will begin to grow.
17. Have students clean and dry their 2 oz. cups as well as clean any other messes they have made.
18. Pack the kit up and return it completely clean and neat to the CSO

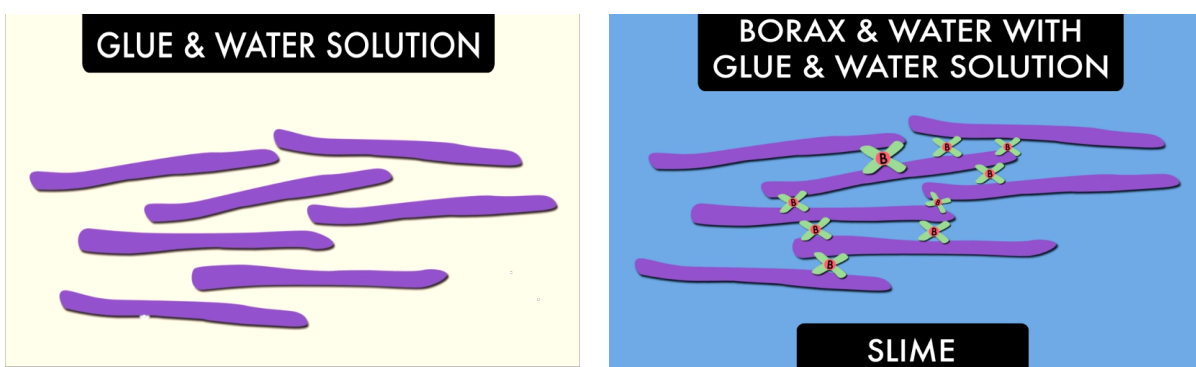
Polymer Slime Properties

Observation Sheet

Name: _____

Most matter can be labeled as a solid, liquid, or gas, but there are some materials that can be a little harder to classify. When something has properties of both a liquid AND a solid, it is called a non-Newtonian liquid.

The glue has long flexible molecules in it called polymers (long chains of repeating molecules). These polymer molecules slide past each other as a liquid, but what happens when we link them together to make a solid?



Borax (a laundry soap) in water forms an ion called the borate ion. When the borax solution is added to the glue solution, the borate ions help link the long polymer molecules to each other so they cannot move and flow as easily.

When enough polymer molecules get hooked together in the right way, the glue solution changes from being very liquidy to a rubbery kind of stuff that we call slime!

Often times polymers cause some interesting physical properties. Today it is your job to determine if the polymer slime is a liquid, solid, or non-Newtonian liquid.

Perform the following actions and observations. After each observation determine if the action demonstrated properties more like a solid or a liquid and put a ✓ in the appropriate column. Make sure to write why you thought the action belonged in that column.

Solid:

- Has Definite Shape
- Can Bounce
- Can break into pieces

Liquid:

- Has the shape of the container
- Flows
- Does NOT break into Pieces

Action	Solid	Liquid	Why?
Pull apart slowly			
Pull apart quickly			
Leave on wax paper for 2 min.			
Put into a cup for 2 min.			
Drop it from 2 feet			
Hit it in Baggie			

Based on the results recorded in this table, is the slime a solid, liquid, or non-Newtonian liquid?

Polymer Slime Properties Answer Sheet

Action	Solid	Liquid	Why?
Pull apart slowly		✓	Flows & stretches Doesn't break
Pull apart quickly	✓		Breaks
Leave on wax paper for 2 min.		✓	Flows
Put into a cup for 2 min.		✓	Flows
Drop it from 2 feet	✓		Bounces
Hit it in Baggie	✓		Breaks

Based on the results recorded in this table, is the slime a solid, liquid, or non-Newtonian liquid?

____ Non-Newtonian Liquid _____

Recipe Page

If at any point you run out of material. Here is how you can make more with supplies from the classroom or the kit.

Glue Mixture:

- 50% Elmer's Glue All
- 50% Water
- Stir well. Has to be Elmer's glue

4% Borax solution:

- 1 Tablespoon Borax
- 1 Cup warm water
- Stir until no more Borax dissolves
- Optional: Add Food coloring