Active Learning Community Partnership

Slime Challenge

STEM Focus Area: Properties of Materials

Learning Goal: Youth will investigate how combining two different materials can create a new substance that has different properties than the original materials.

LEARNING ENVIRONMENT

Activity Duration: 60 minutes
Class Size: Large or Small
Type of Space: Indoor
Age of Youth: 3rd-4th (ages 9-11)

Guiding Question: *What is the question to explore OR the problem or challenge to solve?*
Can you create a slime substance that meets these two challenges?

Challenge #1: How far can you make your slime stretch before it breaks?
Challenge #2: How high can you make your slime bounce?

Through this activity, youth will:

- Observe and describe the properties of different materials;
- Experiment with mixing two different materials to change the properties of the new resulting substance; and
- Create their own slime recipe to meet specific challenges of stretchiness and ability to bounce.

Facilitator Checklist in the Learning Environment:

- ✓ **Predict and hypothesize**
- ✓ **Develop and use models**
- ✓ **Measure materials**
- ✓ **Observe**
- ✓ **Investigate**
- ✓ **Record observations**
- ✓ **Analyze and infer**
- ✓ **Share and communicate data**
- ✓ **Interpret data**
- ✓ **Test and revise**
- ✓ **Draw conclusions and relationships**
- ✓ **Have voice and agency, make decisions and guide their own learning**

PREPARATION

Facilitator prep:
Everyone loves slime! Mixtures, substances, polymers, states of matter, elasticity, and viscosity are just a few of the science concepts that can be explored with homemade slime. You'll need to prepare a batch of slime before you begin with activity with youth and share your simple 3 ingredient slime recipe.

How does slime work? Check out this simple explanation from the "Little Bins Little Hands" website! https://littlebinsforlittlehands.com

> *The borate ions in the slime activators (sodium borate, borax powder, or boric acid) mix with the PVA (polyvinyl acetate) glue and forms this cool stretchy substance. This is called cross-linking!*
>
> *The glue is a polymer and is made up of long, repeating, and identical strands or molecules. These molecules with flow past one another keeping the glue in a liquid state. Until…*
>
> *You add the borate ions to the mixture, and it then starts to connect these long strands together. They begin to tangle and mix until the substance is less like the liquid you started with and thicker and rubbery like slime! Slime is a polymer.*
>
> *Picture the difference between wet spaghetti and leftover spaghetti the next day. As the slime forms, the tangled molecule strands are much like the clump of spaghetti!*

Literacy Connection:
If you can find time to read a Newberry award chapter book to your group before you ever begin your Slime Challenge STEM activity, The End of the Beginning: Being the Adventures of a Small Snail (and an Even Smaller Ant) by Avi is a wonderful chapter book about a snail and an ant and sets the stage for youth to begin to wonder about how a snail moves without legs. *(available on Amazon).*

Once you've got youth hooked on snails, you can read Everything You Should Know About Snails by Anne Richards to provide some context for why slime is important in nature. *(available on Amazon)*

Materials

Facilitator will need to prepare the following materials before the science activity. To enable youth to gather their own materials when the activity begins, set up a "Slime Ingredient Table" with everything they'll need.

- Prepare a batch of slime for youth to examine made from the following recipe;
  - Slime ingredients to have available for youth include white glue, water, liquid starch;
  - Mixing bowls, measuring cups, measuring spoons, spoons
  - Index Cards to use as recipe cards
  - Markers, pencils, paper
  - Ziploc bags, quart
- Optional, but super fun! Food coloring, glitter, confetti
  - Yardsticks, rulers
  - Miscellaneous ingredients for youth to test that could include flour, corn starch, sugar, milk, apple juice, vinegar, soda pop, honey, toothpaste, pudding, etc. (*If you can add a second slime activity the following day, you could ask youth what other types of ingredients they would like to try and have those available to them.)*

Note: Liquid starch, can be purchased at a grocery store (near the laundry detergent).

Slime Recipe:

- ✓ ½ cup of white glue
- ✓ ¼ to ½ cup of liquid starch
- ✓ ½ cup of water

Directions

Step #1: In a bowl add ½ cup of water and ½ cup of glue and mix well.
Step #2: Add food coloring, glitter, etc. and mix really well.
Step #3: Pour in ¼ cup of liquid starch and stir. You'll begin to see the slime immediately start to form and pull away from the sides of the bowl. Keep stirring until you have a great gooey blob of slime. The liquid should be totally gone!
Step #4: Start kneading your slime. It will appear stringy at first but just keep working it with your hands and you'll see a change in its consistency.

Tip: The trick with liquid starch slime is to put a few drops of the liquid starch on your hands before picking up the slime. Be aware that adding more liquid starch reduces the stickiness and will eventually create a stiffer slime.

Room: This activity is best facilitated in an informal setting of tables where small groups of youth can work together on their challenges. It's definitely important to use a space that is easy to clean up spills and sticky messes. A sink in your space is great so that youth can wash their hands as they experiment with their slime recipes.

Content:
Is slime a solid or a liquid? Actually, it's neither! Slime flows like a liquid, but unlike familiar liquids (e.g., oil, water), its ability to flow, or viscosity, is not constant. So it's a fluid, but not a regular liquid. Scientists call a material that changes viscosity a non-Newtonian fluid. When you pour slime or let it ooze through your fingers, it has a low viscosity and flows like a thick liquid. When you squeeze a non-Newtonian slime, like oobleck, or pound it with your fist, it feels hard, like a wet solid. This is because applying stress squeezes the particles in the slime together, making it hard for them to slide against each other. Most types of slime are also examples of polymers. Polymers are molecules made by linking together chains of subunits.

Want to learn more about the science of slime? Check out this website:
https://blog.giftedstudy.org/the-science-behind-slime/

Inquiry: It's important to encourage students to ask their own questions about slime and its properties. Though it can certainly get messy, allowing youth to create their own slime recipes testing out ingredients of their choosing is a powerful experience in the scientific process. Rather than following a step-by-step slime recipe, your role as facilitator of this experience will be to ask questions that prompt youth to predict, observe, hypothesis, test, revise, and refine.

For example, throughout the activity you might ask the following questions.

- ✓ What happens if….?
- ✓ When you added…… how did that change your slime?
- ✓ Tell me about your recipe? Why did you choose those ingredients?
- ✓ What amounts did you use?
- ✓ What could you add to make your slime stretchier?
- ✓ What could you do to help make your slime bounce?

Facilitator Checklist for Preparation:

- ✓ Organization: I practiced the activity/technology, prepared materials/extras/place to record youth ideas, completed an activity (including timings).
- ✓ Materials: Materials are appropriate for teaching the learning goals; youth will be able to use them and will think they are appealing.
- ✓ Space Utilization: The space is set up appropriately for the activity and there will be no safety issues or distractions.
- ✓ Relevance: I have researched why the content matters to youth's everyday lives.
- ✓ Content Learning: I have become familiar with the content.
- ✓ Inquiry: I have become familiar with how authentic, age-appropriate inquiry practices look in this activity.

INTRODUCTION TO ACTIVITY (10 MINUTES)

With your class divided into small teams of 2-3 youth at each table, give each team a Ziploc bag of the Slime you've prepared before class. Tell your class that this sample is slime that you made prior to class. Allow youth to examine the slime and talk about its properties. After listing some of the properties, ask the class to predict whether or not the slime will stretch or bounce. Then test it!

Share the recipe you used to make the slime with the class. Pass around the ingredients you used (*water, liquid starch, and glue*) and ask if they are familiar with these ingredients. Most likely they'll have never heard of liquid starch so you'll need to demonstrate to them with a can of spray starch and an iron how and why people use starch. Be sure to lists out the individual properties of each ingredient.

Also show the student teams the Slime Ingredient Table you have set up for them to use that contains not only original recipe ingredients of water, liquid starch, and white glue; but the additional unique ingredients that you have available for their experimentation with the recipe.

Now is a good time to introduce the following vocabulary words.

Properties
Definition: Things that can be observed about an object (such as color, shape, size, texture, etc.)

Molecule
Definition: Any time two atoms join together they make a molecule. All the stuff around you is made up of molecules.

Polymer
Definition: A polymer is unique because it has qualities of both a solid and a liquid. It can take the shape of its container like a liquid does, yet you can hold it in your hand and pick it up like a solid. Jell-O, rubber bands, plastic soda bottles, sneaker soles, even gum are all forms of polymers.

More…

Solid molecules are tight together, liquid molecules spread out and break apart. Polymer molecules chain themselves together (they can stretch and bend like chains) and that makes them special.

Facilitator Checklist for Introduction to Activity:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Purposeful Activities: This intro section gets youth on track for the learning goal.

- ✓ Content Learning: If age appropriate, I will accurately present content.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Relationships: I will make each youth feel welcome.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

ACTIVITY ENGAGEMENT (40 MINUTES)

Invite your youth teams to create their own recipe for slime that will meet the following challenges:

- Challenge #1: Create SLIME that will stretch the furthest
- Challenge #2: Create SLIME that will bounce the highest

Ask student teams to remember to record their measurements for the ingredients in their slime recipe and record their final recipe on the Slime Recipe Card (index card).

Ask student teams to create **three different recipes** and write their recipe with a marker on the Ziploc bag into which they'll store the slime made from that recipe. Also, ask them to record how far their slime will stretch on the Ziploc bag and whether or not the slime can bounce.

Encourage teams to test and revise their slime recipes as they learn about the properties of the ingredients they use.

Facilitator Checklist for Activity Engagement:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Participation: All youth will have access to the activity.
- ✓ Purposeful Activities: This core section helps youth to move toward the learning goal.
- ✓ Engagement: This activity has youth physically engaged with their hands while engaged with their minds.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection: If appropriate, I will ask youth questions during the core activity that will help them make sense of what they are learning.
- ✓ Relationships: I will take steps to share my enthusiasm and create a nurturing, safe learning environment.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

FINAL REFLECTION AND RELEVANCE (10 MINUTES)

Today we had a fun time experimenting with SLIME! Not only is slime a fun thing to experiment with but did you know that today we used chemistry? Chemistry is all about the states of matter, liquid how states of matter (liquids, solids and gases) AND how these materials act under different conditions.

Lead a final reflection with youth asking them if they can think of any potential uses for slime in their lives. Review the properties of slime and think about potential ways scientists and engineers could create/invent a substance that could be of use to people.

This is also an opportune time to talk about how snails use their slime to move!

Facilitator Checklist for Activity Reflection & Relevance:

- ✓ Space Utilization: Again, I will use the space informally.
- ✓ Participation: I will prompt youth who do not have access to the activity to participate.
- ✓ Purposeful Activities: The closing section helps youth to reach the learning goal.
- ✓ Content Learning: I will help youth make connections between different ideas. I will create opportunities for youth to ask questions/provide ideas that show a deeper level of understanding.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection. I will provide youth with a sustained opportunity to make sense of their learning.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

NGSS STANDARDS RELEVANT TO THIS ACTIVITY

PS1.B: Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed.