Materials science engineers rely on chemistry when designing new materials. They use what they know about the properties of materials to decide where and how new manufactured materials would best be used. In this activity, you will create a new mystery substance and perform tests on it to learn about its properties.

**MATERIALS**
- Cup or glass
- Measuring spoons
- Measuring cup
- Baking soda
- Bowl
- Non-toxic craft glue
- Stirring utensil
- Food coloring (optional)
- Saline solution or contact lens solution (must contain boric acid or sodium borate in the ingredients)
- Several nickels or quarters (same denomination)
- Ruler or tape measure (for older students)
- Plastic bag or container with lid

*Experiment continued on next page...*
PROCEDURE

MAKE MYSTERY SUBSTANCE:

- In cup or glass, measure ¼ cup warm water. Stir in ½ teaspoon baking soda and stir until baking soda is completely dissolved. Set water-baking soda solution aside.
- Pour ½ cup glue in bowl. Add food coloring (optional) and water-baking soda solution. Stir thoroughly until combined.
- Add one tablespoon contact solution and stir to combine. Once glue mixture begins to pull away from the bowl, continue to knead by hand.
- Explore your mystery substance for two minutes. What are some words that could describe it? Make a list of the properties, or characteristics, of the mystery substance. When materials scientists make a new substance, they also make observations about the properties of the substance, and perform tests to find out more about the way the substance works.

TEST MYSTERY SUBSTANCE:

- Test to see how the mystery substance performs under certain conditions. How bouncy is it? Is it easy to compress or squish down? Is it sticky enough to pick up a paper clip or metal coin? What happens when you stretch it out? Discuss your observations with a friend or family member, and/or record your observations in your science notebook.
- Store the mystery substance in a plastic bag or airtight container. Be sure to wash hands after handling.

Experiment continued on next page...
TRY THIS

• What other tests could you perform on your substance to learn more about its properties? If you could re-design your substance, what would you do with it?

• Look around your home. What are some good materials you could use to build a chair? What are some good materials could use to build a trampoline? What is a test you could do to show that a material is sturdy? What is a test you could do to see if a material would be good for bouncing?

• Consider the following settings: farm, space shuttle (or cockpit), playground, construction site. Brainstorm a list of ways the substance you created could be used in each setting. How would you know if your substance would work for that particular use? What kind of tests could you perform?

DID YOU KNOW

How does slime work? It’s all thanks to chemistry! The glue is a polymer and is made up of long, repeating, and identical strands or molecules. These molecules flow past one another keeping the glue in a liquid state.

The borate ions in the saline solution serve as an activator. When the activator is added to the glue mixture, it starts to connect strands of glue molecules together. This process is called cross-linking. As these long strands tangle together, the substance becomes thicker and more rubbery.

Substances like slime are called non-Newtonian fluids. A non-Newtonian fluid is neither a liquid or a solid. It can be picked up like a solid, but it also will ooze like a liquid. Non-Newtonian fluids are used in paint, cosmetics, asphalt, glue and other industrial products.
6–8 GRADE EXPLORATION

Materials science engineers and chemists often test different formulas, or recipes, to see how the quantity of ingredients can affect a material’s overall properties. Test what happens when you add more activator (i.e. saline solution) to your slime.

- Create a batch of slime using the instructions above.
- Divide the slime into two equal size portions.
- Add ½ tablespoon extra saline solution to one portion and knead in to fully incorporate. This will be your “Test Formula.”
- Leave one portion as is. This will be your “Control Formula.”

Test the physical properties of the slime you made. Use a ruler or tape measure to test your results. Perform each test three times (trials) to check for consistency. Record the results of each test in the table on the next page, or in your science notebook.

**Test #1 Bounciness:** Roll the slime into a ball. Position ruler vertically (one inch mark towards the bottom). Drop the ball from the top of the ruler and measure how high it bounces.

**Test #2 Strength (needs a partner):** Stretch the slime across the top of the cup and have one person hold the edges. Place one nickel/quarter at a time on the slime until it breaks. How many coins could it hold?

**Test #3 Squishiness:** Using a round pencil or wooden dowel, roll the slime into a pancake shape. Use a ruler to measure how thin it can become.

**Test #4 Stretchability:** Roll the slime into a cylinder that is 3 inches long. Using a ruler, measure how long it can be stretched before it breaks. What if you stretch it quickly? What if you stretch it slowly?

**Test #5 Elasticity:** Roll the slime into a cylinder that is 3 inches long. Using a ruler to measure, stretch it to five inches, lay it on a flat surface and measure how much it shrinks in 30 seconds.

**Test #6 Stickiness:** Test how many nickels/quarters you can pick up with the slime.

**Test #7:** What other tests can you perform?

*Experiment continued on next page...*
### 6–8 GRADE EXPLORATION

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<thead>
<tr>
<th>Test</th>
<th>Trial #1 Results</th>
<th>Trial #2 Results</th>
<th>Trial #3 Results</th>
<th>Additional Observations</th>
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<tbody>
<tr>
<td>Test #1 Bounciness</td>
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<td>Test #2 Strength</td>
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- What are some key differences that you noticed between the two formulas? What could be some different applications, or uses, for each formula?
- What other variables could you change? How do you think it will affect the slime’s properties? Make a new batch of slime, changing a new variable and compare your results.