



# ZOOM Glue



## What You Need

- ½ cup skim milk
- 2 tablespoons vinegar
- 2 large paper cups
- 5 paper towels
- rubber band
- plastic spoon
- 1 teaspoon baking soda
- 3 tablespoons water



## Engineering Scoop

When you mix milk and vinegar together, the vinegar makes the **protein** in the milk stick together to form small white lumps. These are called **curds**. When you add **baking soda**, it **reacts** with the small amount of vinegar left in the curds. Add a little **water** and, voilà—you've got sticky **glue**! When you **add** glue between two pieces of paper, the glue **seeps** into tiny **cracks** in the paper. When the glue **hardens**, it holds the paper together. Engineers have designed glues to **hold together** things like envelopes, sneakers, and even airplanes! What can you **stick** together with your glue?

**1 Put** the vinegar into the cup holding the skim milk. **Stir** for about 30 seconds. The lumps that form are called **curds**, and the liquid is called **whey**.

**2 Make a strainer** to separate the curds from the whey. **Put** a folded paper towel over one of the large paper cups. **Push** down in the center so it forms a **bowl** shape. Put a rubber band around the top of the cup to **hold** the paper towel.

**3 Pour** the curds and whey into the cup with the paper towel.

**4 Wait** about 5 minutes for all the whey to drip through the paper towel.

**5 Use** a spoon to carefully **scoop** out the curds and **put** them on a clean paper towel.

**6 Put** another paper towel on top of the curds and **gently press** down. **Soak up** the remaining liquid until the curds feel **firm**, not squishy.

**7 Put** the curds in a clean paper cup. **Add** about 2 teaspoons of water to the curds and **stir**.

**8 Add** the baking soda and stir. Do you see any **bubbles**? This is the carbon dioxide **gas** that's made when baking soda and vinegar **react**.

**9 Add** small amounts of water until your mixture looks like glue.



## Redesign It!

**Change** your glue recipe. What happens if you **use whole milk** instead of skim milk? What happens if you **leave out the baking soda**? You can also **invent your own glue** out of different ingredients. Choose **one thing** to test and **send** your results to ZOOM.

Sent in by Ashley V. of Norwood, MA



© 2003 WGBH Educational Foundation. All rights reserved. ZOOM and the ZOOM words and related indicia are trademarks of the WGBH Educational Foundation. Used with permission. ZOOM is produced by WGBH Boston. Funding for ZOOM is provided by the National Science Foundation, the Corporation for Public Broadcasting, and public television viewers. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. All submissions become the property of ZOOM and will be eligible for inclusion in all ZOOMmedia. This means that we can share your ideas with other ZOOMers on TV, the Web, in print materials, and in other media. So, send it to ZOOM. Thanks! Illustrations by Stephen Schudlich.

[pbskids.org/zoom](http://pbskids.org/zoom)



# ZOOM Glue

Engineer's Notebook

## Test Glue with the Stick-o-meter!

- 1 Put** a small amount of ZOOM glue in the **center** of a test strip.
- 2 Stick** the test strip to the **bottom** of a paper plate and let the glue **dry**.
- 3 Punch** holes through both ends of the test strip and through opposite sides of a paper cup.
- 4 Tie** the string to the holes in the cup. Use a paperclip to **attach** your test strip to the string.
- 5 Ask** a friend to hold your paper plate as shown in the picture.
- 6 How many** pennies do you think you can add to the cup before the test strip pulls away from the plate? **Record** your prediction in the chart below.
- 7 Test it out! Drop** pennies **one at a time** in the cup until the strip pulls away.
- 8 Count** the number of pennies in the cup. **Record** your results in the chart.
- 9 Repeat** the test with other sticky things, like white glue, a glue stick, and peanut butter. How does ZOOM glue **compare** to the other sticky things?



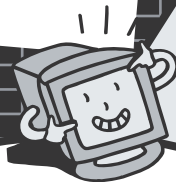
## What You Need

- test strip (1" x 8" piece of paper)
- paper plate
- paper cup
- hole punch
- string
- large paperclip
- pennies

## Stick-o-meter Results

(Number of pennies needed to break the glue bond)

	ZOOM Glue	White Glue	Glue Stick	Peanut Butter
Prediction				
Actual number of pennies				



**Send It to ZOOM™!**

Tell us about your results at  
[pbskids.org/zoom](http://pbskids.org/zoom)