



**Mission:** How does changing the recipe affect how a material behaves?

**Age:** 8+

**Materials cost:** \$15

**Time:** 1 hour (Set-up: 10 min Activity: 35 min Clean-up: 15 min)

### What you need:

#### Materials:

- Popsicle sticks
- Cornstarch
- Elmer's all-purpose glue or Elmer's glitter glue (if you want color)
- Borax (work with a grownup!)
- Warm water
- Paper
- Marker
- Tape
- Cereal box (or other tall box for the backdrop)
- Disposable gloves (optional)
- Newspaper/trash bags

#### Equipment:

- Small Cups (4 or 6 ounces)
- A larger cup or bowl (for the borax solution)
- Measuring cup
- Measuring spoons
- Ruler
- Smartphone or other video recording device
- A friend!

### What to do:

In this **messy** mission, you will find the best recipe for making a high-bouncing bouncy ball by experimenting with different ingredient combinations, testing the property of bounciness, and recording your results like a true materials scientist!

#### Initial set up:

##### 1. Prepare the borax solution

- Mix 1/2 cup of warm water with 1 tablespoon of borax. (It may look cloudy.)
- Set the borax solution aside.

##### 2. Create a backdrop to help measure how high the balls bounce.

- Mark a piece of paper with horizontal lines at 1/2-inch increments.
- Tape it to the side of a tall box for easy viewing.
- Set up the backdrop on a hard surface.

##### 3. Lay out some newspaper or a trash bag to protect your work surface.

## Part 1: Create the bouncy balls

1. You'll try three different recipes to make three different balls.
2. Label three cups A, B, and C. For each, follow the recipes on the Data Sheet:
  - **Cup A:** Mix 1 tablespoon of cornstarch and 1 tablespoon of glue, then add 1/2 teaspoon of borax solution.
  - **Cup B:** No cornstarch in this one. Mix 1 tablespoon of glue and 1/2 teaspoon of borax solution.
  - **Cup C:** Mix 1/2 tablespoon of cornstarch and 1 tablespoon of glue, then add 1/2 teaspoon of borax solution.
3. Let each mixture sit for ~15 seconds, then stir with a popsicle stick until it clumps. Roll the clump into a ball with your hands, applying pressure. If it's too sticky, add a few drops of borax solution to smooth it out. Bouncy balls can be tricky to make, so don't worry if it takes a few tries!
4. Play with all three balls, but be sure to keep track of which is A, B, and C. Which ball would you recommend to your friends? Why?

## Part 2: Grab a friend and measure the bounce

1. One person will drop the ball for each test. Make each ball as round as possible so they bounce straight up. Hold each ball at the top of the paper backdrop-record this height on your data sheet! Then let it drop from your fingers. Be sure to drop the balls from the same height each time. Why do you think this is important?
2. The second person will record a video of each test with your phone's camera. Hold each ball at the top of the paper backdrop and let it bounce off a hard surface to measure the height of its first bounce. View the video on your phone's camera. Replay the video, pause at the first bounce, and record the height measurement on your Data Sheet.
3. Think about your results. Which recipe made the highest-bouncing ball: A, B, or C? Would you recommend either of the other balls for a different reason besides bounciness?

## Go Further: Beyond the bounce

**Different tests:** Scientists design different ways of testing a property. Try testing bounciness by comparing a variety of different starting heights. Or, count how many times each ball bounces before coming to rest. Test the durability of a ball by dropping it multiple times and seeing whether the first bounce height stays the same.

**Different methods:** Materials scientists also try making materials in different ways, or with different ingredients, to see how those changes affect a property. Try making different balls by changing the type of glue, adding other ingredients, or using different amounts. You could also try freezing (or heating) the balls before testing them.

**Different properties:** Instead of bounciness, try designing a totally different property, such as hardness or stretchiness. Based on your observations, what mixtures and methods would you try?

## Clean-up:

To save your bouncy balls, place them in a sealed plastic bag so they don't dry out. They may flatten out, but can be reshaped by rolling.

Gather all materials and discard any leftover borax solution, glue, or cornstarch in the trash. Dispose of the newspaper or trash bag. Wipe down surfaces with a damp cloth to remove any residue. Wash your hands well after handling the materials.

# BALL RECIPES

## CUP A

- 1 Tbsp Cornstarch
- 1 Tbsp Glue
- 0.5 tsp of Borax Solution  
(water & borax mixture)

## CUP B

- No Cornstarch
- 1 Tbsp Glue
- 0.5 tsp of Borax Solution  
(water & borax mixture)

## CUP C

- 0.5 Tbsp Cornstarch
- 1 Tbsp Glue
- 0.5 tsp of Borax Solution  
(water & borax mixture)

Tbsp = Tablespoon  
tsp = teaspoon

# BOUNCY BEHAVIORS DATA SHEET



**Predict:**

1. Which ball do you predict will bounce the highest? (circle one)

Ball A

Ball B

Ball C

	Ball A	Ball B	Ball C
Drop Height			
First Bounce Height			
Bounciness Ranking (Best = 1, Worst = 3)			

2. Based on your results, do you think cornstarch or glue is more important for bounciness?

Glue

Cornstarch