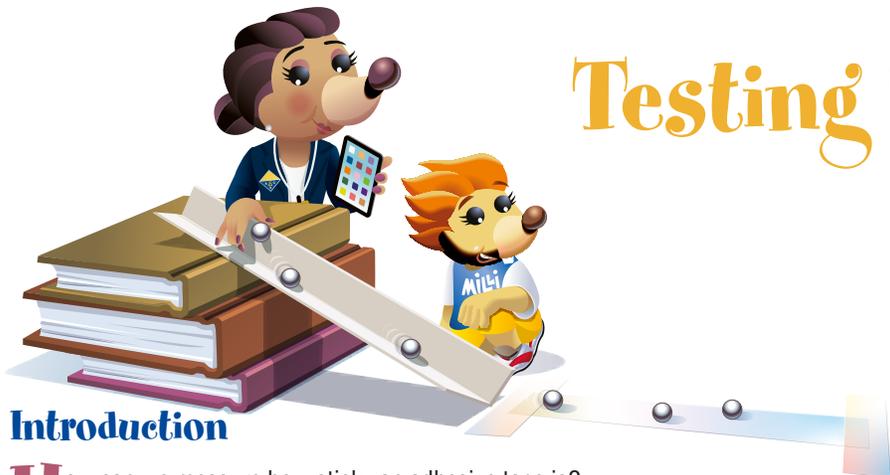


Testing Tape Stickiness

By David Heroux and An-Phong Le



Introduction

How can we measure how sticky an adhesive tape is? This question is more complicated than it seems!

We can describe stickiness in different ways. As you have already learned, adhesion describes how strongly the tape and the surface bond to each other. Cohesion describes how strongly the adhesive molecules on the tape attract and hold on to each other. **Tack** describes how quickly a bond forms between the tape and the surface.

Scientists customize tapes for specific uses by balancing adhesion, cohesion, and tack. For example, high-tack tape sticks quickly to a surface, but it may be difficult to move later. In this activity, you will be a scientist testing the tackiness of different tapes.

Adhesive scientists around the world use tests like this!

Materials

- Ruler
- Scissors for cutting tape
- Several ball bearings or large marbles (you'll need separate ones for each test). You can try using balls of different sizes, masses, or materials.
- Book
- Several different kinds/brands of tape, such as duct tape, masking tape, cellophane tape, or packing tape.
- Protractor to measure angle of ramp (optional)
- Wipes to clean the test marbles or balls



Procedures

1. Build the *rolling ball tack tester* following the design illustrated above.
2. The ball bearing or marble needs to roll easily down the incline. Make an incline out of cardboard strips folded into a 'V' shape or a cardboard tube from a roll of paper towels. You could also use the middle of an open thin book or magazine.
3. Use books or blocks to support one end of the incline until the slope is about 30 degrees. You can use a protractor or your smartphone to measure the angle. There should be little to no drop between the incline and the test tape surface.
4. Mark the ball's starting point at the top of the incline with a pencil or Post-it note. It is very important to release the ball at the same point for each test.
5. The tape will be sticky-side-up when the ball rolls onto it. Place about 10 inches of tape, sticky-side-up, on your work surface. The sticky surface should begin at the lower end of the incline.
6. Use masking tape to fasten each end of the tape to the flat surface. You will repeat this for each tape to be tested.
7. Hold the ball at the starting point and then carefully release it. Allow it to roll down the incline onto the tape, where it will stick. You may need to adjust the angle of your ramp or starting point until you get good results.
8. Measure the distance from the base of the ramp to the point where the ball or marble stops, and enter this distance into your data table.
9. Do three trials for each type/brand of tape. This is what scientists always do: repeat their measurements to make sure their results are correct.

Notes: The ball bearings or marbles used in this activity need to be washed and dried before they are used again. You also need to use a new piece of tape each time you do the activity.

SAFETY SUGGESTIONS

- Do not eat or drink any of the materials used in this activity
- Thoroughly wash hands after this activity

Note: Follow Milli's Safety Tips found in this issue of *Celebrating Chemistry*.

What did you observe?

Kind of Tape	Distance Traveled		
	Trial 1	Trial 2	Trial 3

How does it work? / Where's the chemistry?

Pressure-sensitive adhesive tapes are coated with an adhesive made of large molecules called *polymers*. Pressing the tape on a surface causes these large polymers to spread out. The spread-out adhesive now interacts and bonds with the surface, causing the tape to stick. The tack of a tape depends on how easily the adhesive can spread out and interact with the surface.

Does a high-tack tape let the ball roll a short distance or a long distance? Based on your measurements, which tape had the highest tack? Did the same tape have the highest tack for all of the different balls you rolled?

Here are some more questions that you might want to explore:

- Try rolling balls with different masses. If you roll a heavy ball and a light ball down the tape, which one do you think exerts more pressure? How did the mass of the ball affect how far it rolled on the tape?
- How does the roughness of the ball affect how quickly a tape will stick?
- What happens to the tack of the tape if you reuse it for several tests? Can you see any differences on the tape surface?

What other questions can you investigate about tapes? Experiment to find the answers!

Dr. David Heroux is an Associate Professor at Saint Michael's College in Colchester, VT.

Dr. An-Phong Le is an Associate Professor at Florida Southern College in Lakeland, FL.