

As a new employee at the tape manufacturing company Tape-R-Us, you hear of a challenge the company is facing. In the tape manufacturing process, it seems that some new rolls of tape are accidentally sticking and bunching together, resulting in costly loss of product. Your boss tasks you with investigating the issue, to try to understand why the new tape is unexpectedly sticking together, and what to do about it. You suspect static electricity may be behind the problem, and set out to investigate....

**Materials:**

- Scotch Tape
- Teflon Rod
- Silk Cloth

**Part I: Static Electric Tape**

- Cut 4 pieces of Scotch tape, each 10cm long.
- Stick the pieces to the edge of a table so each one hangs down over the edge.
- Fold a 1cm tab on the free end of each piece of tape - this will be the tape handle
- Label each piece: A, B, C, D
- Stick the sticky side of A to the unsticky side of B, then pull them apart.

1. When you move them close to one another, what do you notice about the force between them?

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- Put A and B back in place, using the remaining sticky parts to stick them back on the table.
  - Pick up C and D, stick the sticky side of C to the unsticky side of D, then pull them apart.

2. When you move them close to one another, what do you notice about the force between them?

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- Put C and D back on the table beside A and B.
  - Pull A and C off the table and move them close to each other.

3. When you move them close to one another, what do you notice about the force between them?

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- Put C back down and pick up D.
  - Move A and D close together.

4. When you move them close to one another, what do you notice about the force between them?

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l. Put A back down and pick up B.

m. Before you move B and D close to one another, what do you predict the force between them will be?  
 Now try it and see...what is the actual result?

Predicted Result	Actual Result

n. Use the silk cloth to charge the Teflon rod

5. What charge accumulates on the rod, positive or negative?

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o. Use the rod to check the polarity of charge on each tape segment. Record your readings in the table below:

Tape Segment:	A	B	C	D
Attract/Repel Rod:				
Charge Polarity:				

**Part II: Measuring Static Electric Force**

In this activity we'll see how different materials create more or less static charge on an inflated balloon.

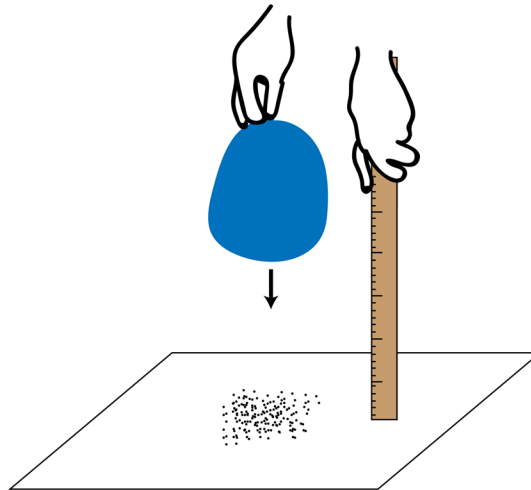
**Materials:**

- Silk cloth
- Wool cloth
- Fake fur cloth
- Cotton cloth
- Balloon
- Ruler with millimeter markings
- Pepper
- Sheet of white paper

Rubbing two materials together makes them exchange electric charge. Depending on the materials involved, typically one gains positive charge and one gains negative charge after friction contact. We will rub an inflated balloon with 4 materials - silk, wool, fur, and cotton - and see which one charges the balloon the most.

**Procedure:**

- a. Blow up a balloon about halfway and tie it shut.
- b. Set a sheet of paper flat on a tabletop and shake ½ teaspoon of pepper onto it in one spot.
- c. Pick one of the four cloth materials and rub the balloon with it for 30 seconds.
- d. Hold the balloon upside down by the tie, next to the millimeter ruler held vertically.
- e. Slowly let the balloon descend toward the pile of pepper until you see (or hear!) the pepper being attracted to the balloon



- f. Measure the position of the balloon and record the value in the table below.

Rubbing Material	Distance from Table (mm)
Silk	
Wool	
Fur	
Cotton	

- a. Pick one of the three remaining materials and repeat the rubbing and measuring process. Finish with the last two materials, going through the same process. Record measured distances in the table.

**Questions to consider:**

1. Based on the completed table, which material leaves the most charge on the balloon? Can you tell what the polarity of the charge is (positive or negative)? When you rub the balloon with one of the materials, what happens that makes the balloon charge differently from one material to another?

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2. Write a short report to your boss at Tape-R-Us about your findings. In your report, include a) evidence that static electricity can cause tape to move by both attraction and repulsion, and b) identify leading materials that, through friction in the manufacturing process, may be charging the rubber tape made in Tape-R-Us's factory.

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