Science 265
Fun with Tape!

Challenge

At the end of this lab you are to answer the question that follows. Please keep it in mind as you explore static electricity today.

The question: Is a thin stream of water charged? If so, what is its charge? Plan a procedure you could perform to find out. Now perform the necessary investigation to answer the question. Write up your procedure, data and conclusion in a way that a fellow classmate who missed lab could understand.

Investigate

Press a piece of tape (about 15 – 20 cm) firmly on a smooth unpainted surface. Peel the tape off quickly. Describe the behavior of the tape as you bring objects toward it (e.g. a hand, a pen).

Make another piece of tape as described above. Bring the second piece of tape toward the first. Describe your observations.

How does the distance between the tapes affect the interaction between them?

Each member of your group should press tape onto the surface and write a "B" (for bottom) on it. Then press another tape on top of each B tape and write "T" (for top) on it. Slowly pull each pair of tapes off the table as a unit. After they are off the table, separate the T and B tapes quickly.

Describe the interactions between the following when they are brought near one another.

- two T tapes

- two B tapes

- a T and a B tape

- a T tape and a little bit of paper (5 mm on a side or smaller)

- a B tape and a little bit of paper

- two small bits a of paper

Things that are *electrically charged* attract the little bits of paper. The T tape and the B tape are both charged and the bits of paper are considered *neutral*.

Describe a procedure that you could use to determine if an unknown object is charged or neutral.

Is neutral a type of charge? Explain?

Rub a PVC pipe with a paper towel and then hold the pipe near *newly made* T and B tapes. Determine whether the pipe is charged or neutral. If it is charged, determine if it is charged T or charged B. Explain specifically how you know.

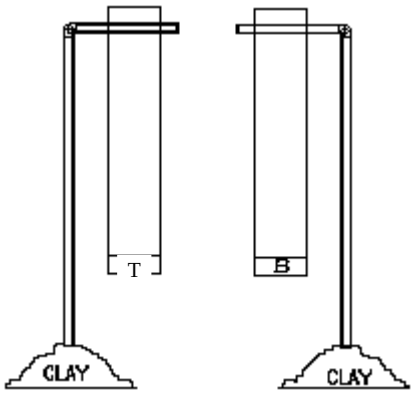
Visual Model

Open the PhET simulation, *Balloons and Static Electricity.* Play with the sim and then describe which features of the sim (sweater, balloons or wall) that the T tape, B tape and bits of paper behave most like. If it's not possible to match the items up exactly, explain why.

Draw a diagram of the "net" charge on a piece of T tape, B tape and bit of paper.

Identifying charge

Obtain two flexible straws and stick each into its own small piece of Play-Doh to form inverted "L"s. These will serve as holders for a *freshly made* test strip of T tape and B tape.



This lab requires "finesse and care"
If you are careful and make sure your T and B tape always have a good charge, the lab will go smoothly.

Obtain a variety of objects including those listed in the table below. Try rubbing each of the objects with a paper towel. First bring the object near hanging strip T then near hanging strip B and finally near a small stack of torn up paper. There are spaces provided for you to try some objects of your own. Record your observations in the table below. Write *attracted, repelled* or *neither*.

	Bits of paper	T tape	B tape
plastic plumbing pipe:			
Plexiglas:			
plastic silverware:			
Wood tongue depressor:			
glass test tube:			
metal nail:			
magnet:			
Aluminum tube:			
paper clip:			

Which of the items did NOT give a definite indication that it had been electrically charged as either T or B after it was rubbed with cloth? Explain

★Check with your instructor

Magnetism

The magnets that you are working with are very strong. Test them with each item to see which are attracted by the magnetic force. If there is a very weak attraction, it's probably not a magnetic force that you are seeing since these are very strong magnets.

Which items are strongly attracted by the magnet?

Did any of the items that are not strongly attracted surprise you?

Based on your observations, are magnets attracted to electrical charge?

★Check with your instructor

Positive and Negative Charges

The phenomenon you have just observed was first recorded by Thales of Miletus nearly 2500 years ago in ancient Greece. He observed that pieces of amber when rubbed with fur would attract feathers and dried leaves. During the middle ages, it was noted that a glass rubbed with silk or cotton would behave similarly. It remained just an interesting phenomenon until about 1600 when Sir William Gilbert made the first systematic study of the phenomenon. He called the phenomenon 'electricity' after 'electron', the Greek word for amber. In 1747, Benjamin Franklin became America's first internationally known scientist after publishing his studies on electricity. Besides flying his kite in a thunderstorm, and inventing the lighting rod, Franklin was the first to name the two types of electricity plus and minus. After it had been rubbed with cloth, Franklin named the kind of electricity found on glass 'plus' or 'positive' electricity. Even though some of Franklin's original ideas of electricity have now been replaced, people have continued calling the two types of electrical charge 'plus' and 'minus' (positive and negative).

Use this information to determine the charge of your T tape and B tape. Explain why.

Now that you've identified the charge of your T tape and B tape, draw new diagrams indicating the net charge on each.

★Check with your instructor

Consider the fact that conductors have some “free electrons” that are able to move easily throughout the metal. Draw a diagram of a metal nail with a piece of T tape held near. Indicate the net charge on each demonstrating why they attract.

Now determine the type of electrical charge found on the objects in the table above.

	Charge (positive, negative or neutral)
plastic plumbing pipe:	
Plexiglas:	
plastic silverware:	
wood:	
glass test tube:	
metal nail:	
magnet:	
aluminum tube:	
Paper clip:	

★Check with your instructor

Charging Objects

Open the PhET sim *John Travoltage.* Explain what happens when John rubs his foot on the carpet.

What do the blue spheres represent?

What happens when John touches the door knob after his foot has been rubbed on the carpet multiple times?

Summary and applications:

Does an object have to have an electrical charge to be attracted to an electrical charge? Give an example.

The question: Is a thin stream of water charged? If so, what is its charge? Plan a procedure you could perform to find out. Now perform the necessary investigation to answer the question. Write up your procedure, data and conclusion in a way that a fellow classmate who missed lab could understand.