Physics 221 – Lab 10
Static Electricity

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.

Procedure
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 small piece of paper

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

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

Visualization

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.

Other Charges

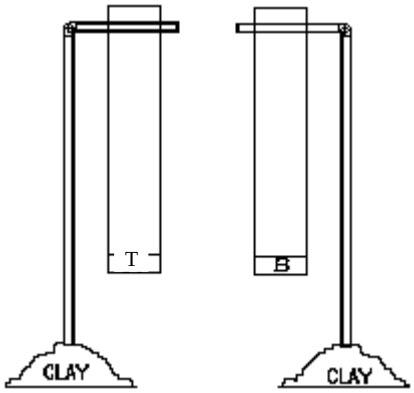
A person brings to a you a material that she claims is charged, but is a different kind of charge than both the T tape and the B tape.
Explain how you can determine if the unknown material is in fact charged.

Explain how you can determine if the unknown material is charged differently than both the T tape and the B tape.

Is it possible that there are 3 different types of charge? 4 different types? Explain.

Identifying charge

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



Obtain a variety of objects including those listed in the table below. Try rubbing each of the objects with a cloth or 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.

	Bits of paper	T tape	B tape
plastic plumbing pipe:			
Plexiglas:			
plastic silverware:			
wood:			
glass test tube:			
overhead transparency:			
rubber balloon:			
Styrofoam:			
metal nail:			

magnet:			
aluminum foil:			
paper clip:			

Which of the above items did NOT give a definite indication that it had been electrically charged after it was rubbed with cloth? Explain

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.

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. Be ready to defend your choices.

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

Charging Objects

Use diagrams and words to describe how a positive object becomes charged when it's rubbed with a paper towel. Be sure to specifically describe if electrons and/or protons move to create the net charge.

Repeat the above for an object that becomes negatively charged.

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?

When you shock a friend, what do you think happens? Draw a diagram before and after the shock.

Based on your model above, will your friend now be able to shock you? Can the shock simply go back and forth forever? Why?

Summary and applications:

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

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