

Main Topic	Electrostatics
Subtopic	Static Charge
Learning Level	High
Technology Level	Low
Activity Type	Student

Description: Students investigate the effect of positive and negative charge on a pith ball and an electroscope.
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Required Equipment	Ring Stand, Clamp, Pith Ball on string, Rubber rod, Fur pad, Glass Rod, Silk cloth, Plastic Meter Stick, Paper Towel, Wool pad, Electroscope, Electrophorus.
Optional Equipment	<u>Optional</u> : Electron-o-Scope

Educational Objectives

- Explore charging by conduction and induction.
- Investigate the effect of positive and negative charge on a pith ball and an electroscope.

Concept Overview

Static charge (electrons, in this case) can be physically transferred from one object to another through friction. Students will use rubber, glass, fur and silk to create positive and negative charges, and investigate how these charges cause forces.

The idea that like charges repel and opposites attract will not be new to students. They will observe those concepts, as well as how small objects (like a pith ball) are attracted equally well to positive and negative.

Excess charge can be transferred to another object by touching (conduction). A metal object can also be inductively charged; that is, it can have its charges separated within by merely bringing a charged object nearby, but not touching. An electroscope will be used to demonstrate this.

Lab Tips

Note: Static electricity demonstrations work better in dry air. Dry air is a better electrical insulator than moist air. On humid days, the experiments described here may not work.

Acknowledgement

Thank you to Dwight “Buzz” Putnam for developing and contributing this lab.

Materials:

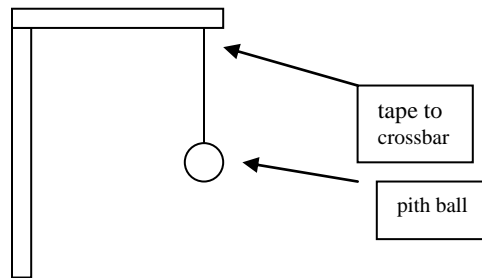
Ring Stand, Clamp, Pith Ball on string, Rubber rod, Fur pad, Glass Rod, Silk cloth, Plastic Meter Stick, Paper Towel, Wool pad, Electroscope, Electrophorus.

Optional: Electron-o-Scope

COMPLETE DIAGRAMS and/or EXPLANATIONS TO SHOW THE RESPONSES OF... THE PITH BALL AND THE ELECTROSCOPE.

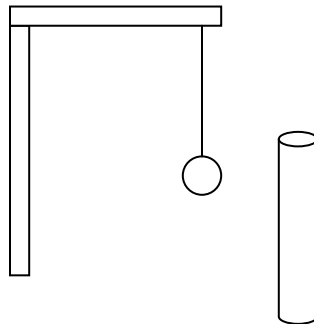
PROCEDURE

Use a **PITH BALL** and attach it to the set-up as shown. Be certain it starts out with a **NEUTRAL CHARGE!**



1. THE PITH BALL

a. Rub the **Rubber rod** with **fur**. The charge on the Rubber rod is now **NEGATIVE**. Bring the tube close to, but **NOT** touching the pith ball. Observe what happens and draw the sequence of events.

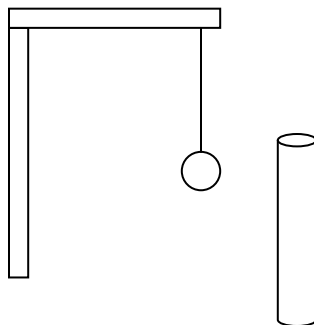


Static Electricity

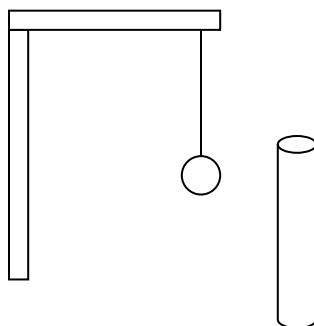
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- b. **Touch** the pith ball to remove any excess charge [GROUND THE PITH BALL]. Repeat the above with a **glass rod** rubbed with a piece of **Silk cloth**.



- c. Ground the pith ball again & now **touch the charged Rubber rod to the pith ball**. Bring the charged glass rod close to the pith ball & observe what happens. Draw the sequence of events.



- d. Find the charge of the following objects using a **- charged pith ball**. Place a **“- sign”** or a **“+ sign”** in the chart below.

* You may also use the “Electron-O-Scope” at the front Teacher's table. Plug in the “Electron-O-Scope” and bring the charged body CLOSE TO but not touching the knob. If it lights up when you move the object toward it, the object is negative. If it lights up when you move the object away from it, the object is positive.

Object to be charged	Rub with ...	Object is now charged... [+ or -]
wood meter stick	fur	
wood meter stick	Silk cloth	
Plastic meter stick	Paper towel	
rubber rod	wool	

2. CHARGING ELECTROSCOPES BY CONDUCTION

- a. Charge the Rubber rod with fur. **Touch** the rubber rod to the top of a neutral

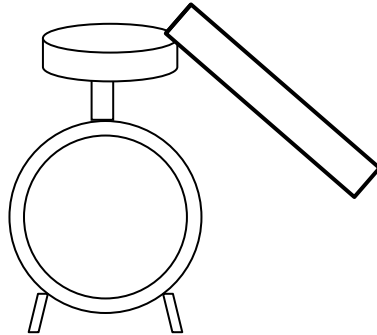
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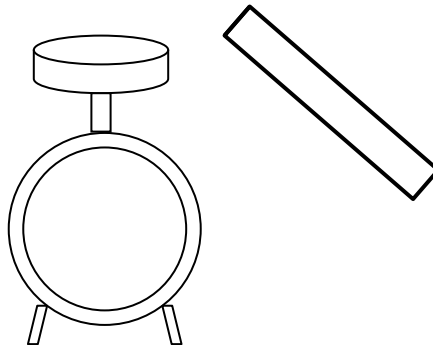
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electroscope. Draw the result. [You may have to draw the rod across the knob of the Electroscope several times to obtain a charge on it.]

- b. Repeat the above with a **glass rod** rubbed **with Silk cloth**. Be certain your electroscope is neutral before you repeat this part of the experiment! Draw the results.

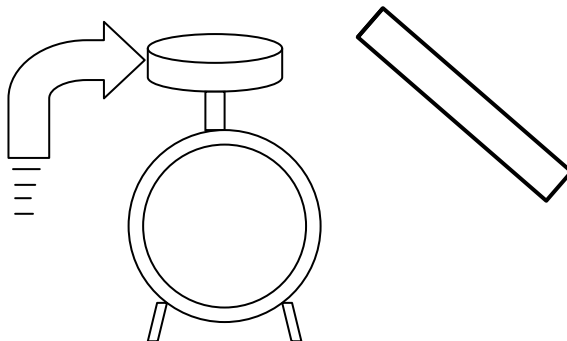


- c. **Charge the electroscope negative** and then bring a **charged Rubber rod near**, but **NOT touching** the top of the electroscope. Draw the results.



3. CHARGING BY INDUCTION

- a. Bring a charged rubber rod **near** the top of a neutral electroscope **but not touching it**. While the rod is near the top of the electroscope, touch the top of the electroscope **with your finger**. Remove your finger, then the charged rod. Test the charge on your electroscope. Draw what you observed and what occurred.



- b. With the Electroscope still charged by **Induction**, what happens to the

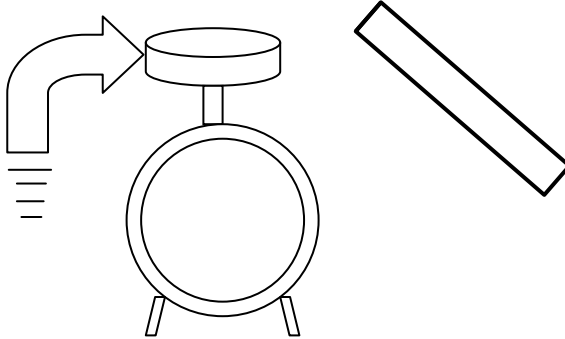
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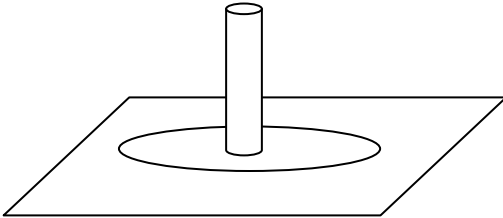
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Electroscope when you bring a **charged glass rod** near, but NOT touching the Electroscope?

c. Repeat STEP A with a **charged glass rod** rubbed w/ Silk cloth & draw your observations.



d. Obtain an Electrophorus from your teacher. Charge the **BASE** of the Electrophorus with **fur**. Bring the paddle close BUT NOT TOUCHING the base. At the same time, bring your finger close to the paddle of the Electrophorus until a spark jumps to your finger. Bring the PADDLE close to a **+charged pith ball**. Draw what happens.



CONCLUSIONS

1. What was the charge on the glass rod when it was rubbed with Silk cloth?
2. What was the charge on the Silk cloth when rubbed on glass?
3. What is the total charge on the glass rod & the Silk cloth **before** rubbing together?
4. What is the total charge on the glass rod & the Silk cloth **after** rubbing together?
5. Two like charges [repel, attract, no reaction] while two unlike charges [repel, attract, no reaction].
6. When a **positive object** is grounded, what happens to the object and electron flow?
7. What is the charge on an electroscope when charging with a glass rod by **conduction**?

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8. What is the charge on an electroscope when charging with a rubber rod by **induction**?

9. What would happen to a negatively-charged pith ball when a glass rod rubbed with Silk cloth is brought nearby?

10. Why don't we charge **metal rods with fur** for our lab experiments?