Name_____

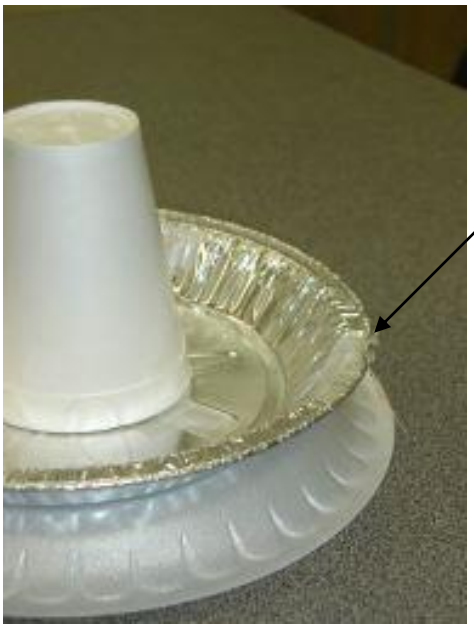
Date_____Pd____

E & M 1 - Activity: The Electrophorus

Introduction

The electrophorus was invented by Johannes Wilcke and perfected by Alessandro Volta over 200 years ago. Volta's device was made of turpentine, resin and wax and a tin foil covered plate with an insulating handle. Our electrophorus is constructed from an aluminum pie pan, a styrofoam plate and cup, some tape and a small neon bulb.

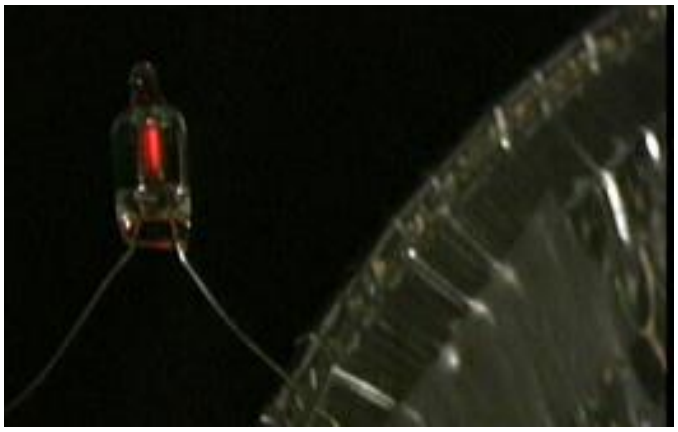
Procedure



Construct an electrophorus by taping the styrofoam cup to the center of a pie pan. Separate the leads of the Neon bulb and tape one end to the edge of the pie pan. The neon bulb will clearly glow at 65V - 90V, readily indicating typical static electric charges.

1. Charge the styrofoam plate by rubbing it against your hair or rub it with rabbit fur and then place it on the table. The original source of charge for the electrophorus is the charged styrofoam plate. What is the sign of this charge? How does this charge come about? Come up with a method of proving the charge on the styrofoam. (Think sticky tape lab!)

2. Using the styrofoam cup taped to the pie pan as a handle, hold the aluminum pan just above the styrofoam plate. Be careful not to touch the aluminum with your hand. Touch the outer wire of the neon bulb with your finger. You should draw a spark and light the bulb.

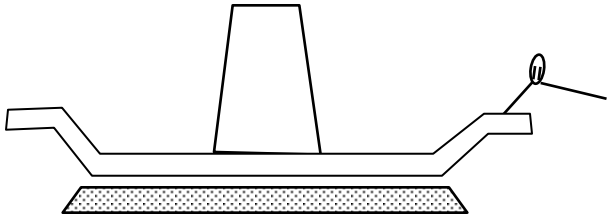


3. Now raise the aluminum pan by the insulating handle, and again touch your finger to the outer wire of the neon bulb. The light should again glow. Repeat the down-touch, up-touch cycle several times with your partners. Closely examine the Ne bulb during the down-touch, up-touch cycle. Only one side of the Ne bulb *should* glow at a time, and this should change depending on whether the Al plate is up or down. The side of the bulb that glows is the side that negative charge jumps from.

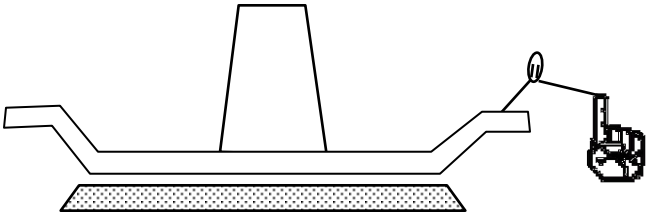
Discussion

1. Describe the flow of electrons to or from the Al plate when it is above the styrofoam plate and the bulb is touched. Draw a diagram indicating the charge distribution before the hand contacts the bulb, then the flow of the charge when the hand touches the bulb, and then after the hand is taken away. Only the areas of excess charge need to be shown.

   What is the net charge of the pie pan after the bulb lights?



before contact



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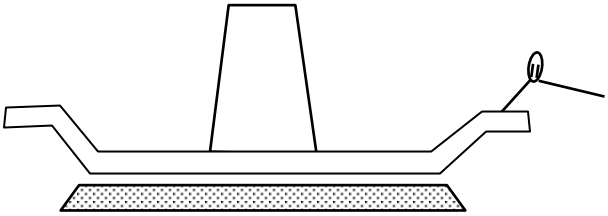
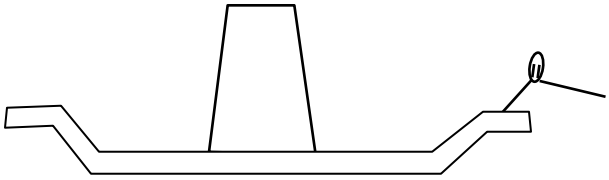


after contact

2. Again describe what happens to electrons when the Al plate is raised in the air and again touched. Again diagram the charge distribution before contact and the flow of charge during contact. How is the up-in-the-air situation different?



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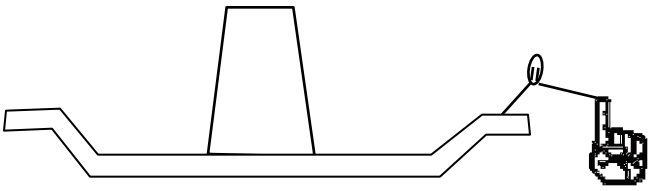

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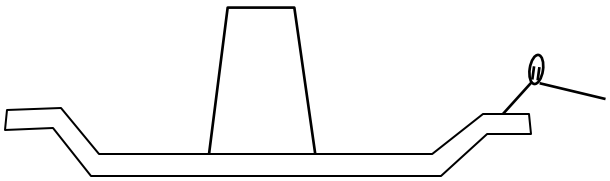

after contact What is the net charge of the pie pan after the bulb lights?

3. Now remove the bulb and place the Al pan directly on the base pan. Do not bring your finger near the edge. Lift the pan into the air by the insulating handle and touch the rim. What happens? What is the net charge on the pie pan before you touched it? Come up with a test to verify your answer?

4. Now do the same charge/discharge cycle by bringing your finger close to the rim while the Al plate is on the styrofoam and then while it is held in the air. What do you notice?

5. The down-touch, up-touch cycle can be repeated almost indefinitely or until the charge on the styrofoam leaks away. Since the charge on the styrofoam is not "used up," where does the energy to light the bulb repeatedly come from in this device?