Electrophorus Activity

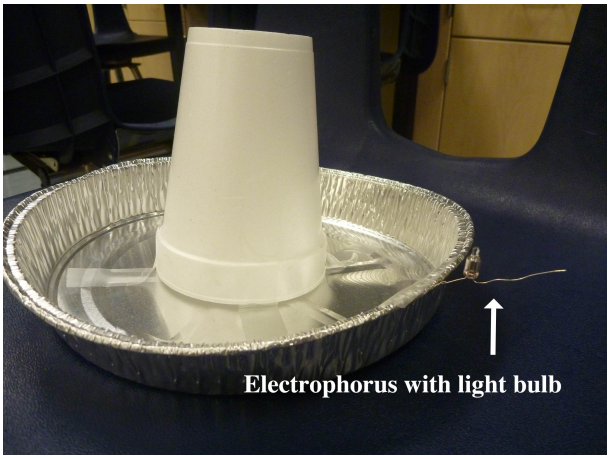
Name_____
Period_____
Date_____

Introduction

The 18th century American scientist and political activist Benjamin Franklin invented the electrophorus. He constructed his device with wood, sulfur, wax and lead alloy. Our electrophorus is constructed from an aluminum pie pan, our plastic chair and cup, some tape and a small neon bulb.

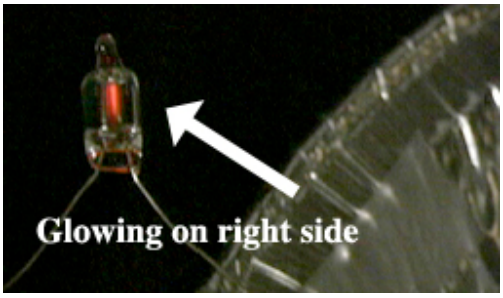
Materials

1. Electrophorus with a neon bulb
2. Electrophorus without a neon bulb
3. Surface of desk seat
4. Brown synthetic fur
5. Scotch tape
6. Meter stick (for positive tape on one end, negative tape on the other end).



Procedure

1. Use the electrophorus that has a neon bulb attached.
2. Charge your seat by vigorously rubbing it with the brown synthetic fur.
3. One partner should hold the electrophorus by the Styrofoam cup handle. Be careful not to touch the metal part of the pie tin with your hand. Bring the pie tin close to the seat but keep the electrophorus about an inch above the seat (do not touch the seat with the pie tin).
4. While the electrophorus is hovering about the seat, another partner should slowly bring a finger close to the outer wire of the neon bulb. Look closely at what happens. You should see or hear a **spark** and the bulb should **light**.
5. Now raise the electrophorus away from the seat, and again touch your finger to the outer wire of the neon bulb. The light should **flash again** and you should see or hear a **spark**.
6. Repeat steps #3->#5 a number of times (down-touch, up-touch cycle). Recharge the seat if you need to. Observe very closely. Only **one side** of the neon bulb should glow at a time, and this should depend on whether the aluminum plate is up or down. The side of the bulb that glows is the side that **negative charge** jumps from.

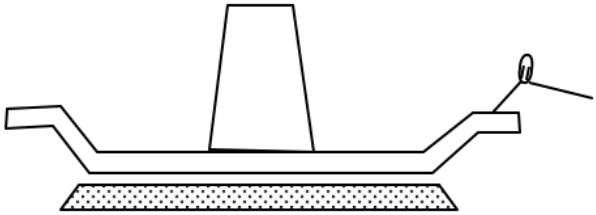


Discussion & Further Exploration

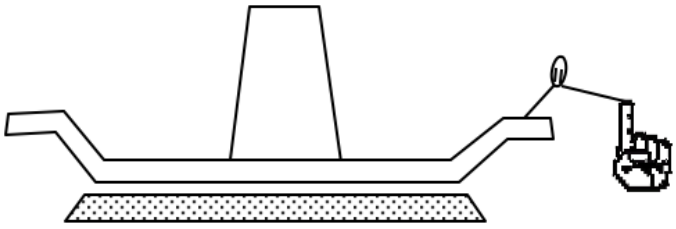
1. The original source of charge for the electrophorus is the charged seat. What kind of electric charge is on the charged seat? Use your charged tapes to determine the kind of charge on the seat. Explain how are you sure about this charge.

2. Do steps #2 and #4 in the procedure (charge the electrophorus). What kind of electric charge is on the charged electrophorus after step #4? Use your charged tapes to determine the kind of charge on the electrophorus. Explain how are you sure about this charge.

3. Based on what you have just determined. Describe the flow of electrons to or from the aluminum plate when it is above the seat 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.



before contact



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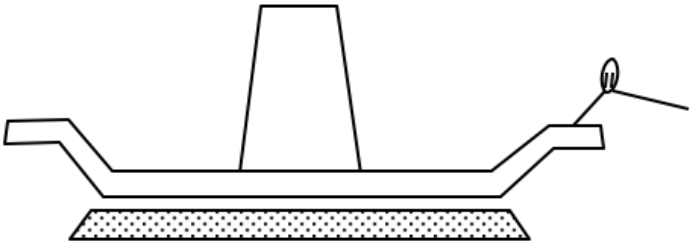
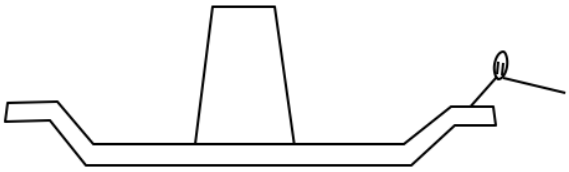


after contact

4. Do steps #2 -> #5 in the procedure . What kind of electric charge is on the charged electrophorus after step #5? Use your charged tapes to determine the kind of charge on the electrophorus. Explain how are you sure about this charge.

5. Describe what happens to electrons when the aluminum plate is raised in the air and touched touched. 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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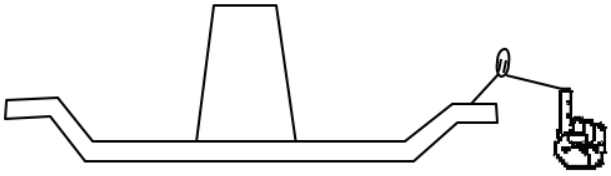

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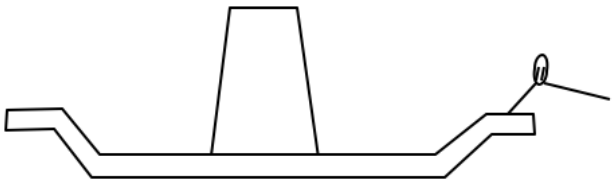

after contact

6. Now use the electrophorous without the bulb. Do steps #2-#5 but this time place the aluminum pan directly on the seat. **Do not** bring your finger near the edge of the aluminum pan. Now lift the pan into the air by the styrofoam 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?

7. Now do the same charge/discharge cycle by bringing your finger close to the rim while the Al plate is on the seat and then while it is held in the air (steps #2-#5). What do you notice?

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