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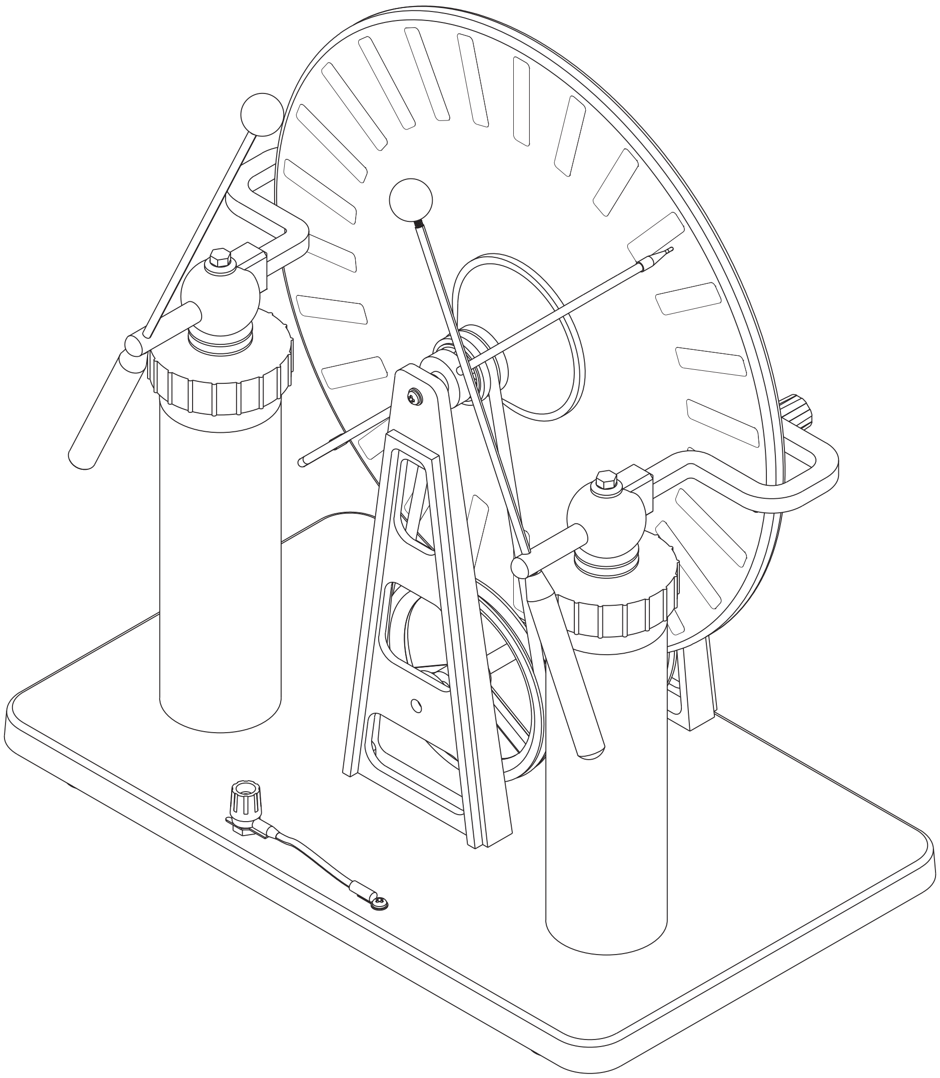


615-3190 WIMSHURST MACHINE

Demonstration Guide

SAFETY

Adult supervision required. This product is safe when used properly.

Warning:

People with cardiac pacemakers or other electronic medical implants or devices should never operate or come in contact with this product. Discharge of static electricity could cause the medical device to be damaged or malfunction.

Caution:

This device is designed to emit high-voltage electrical energy. Do not operate outdoors or in wet or damp locations. Do not operate this unit near any electrical devices, including but not limited to cell phones, stereos, tablets, and computers. Science First is not responsible for damage due to improper use.

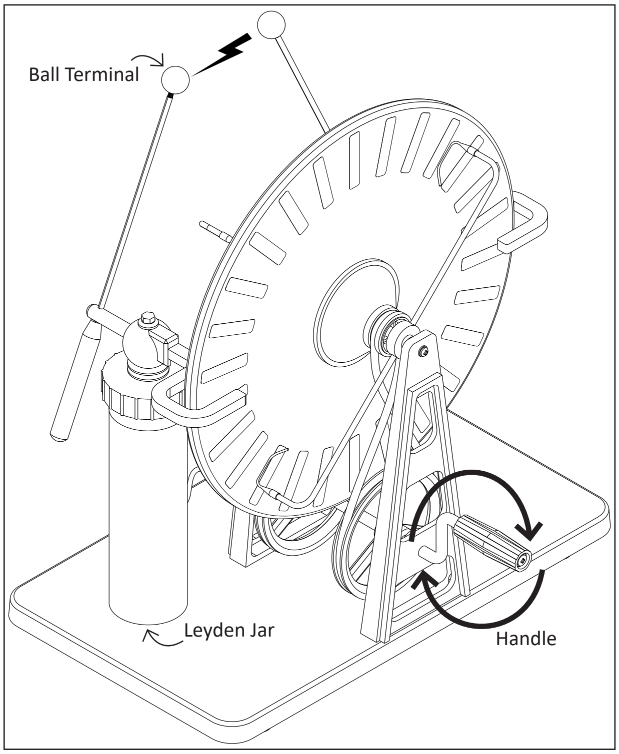
FIND DEMONSTRATION GUIDES, ACCESSORIES, AND MORE FOR THIS PRODUCT AT

SCIENCEFIRST.COM/DOCS

LIGHTNING

Objective

To demonstrate electrostatic discharge



Required Materials

- Wimshurst machine

Notes

- This experiment is best done in a darkened room.

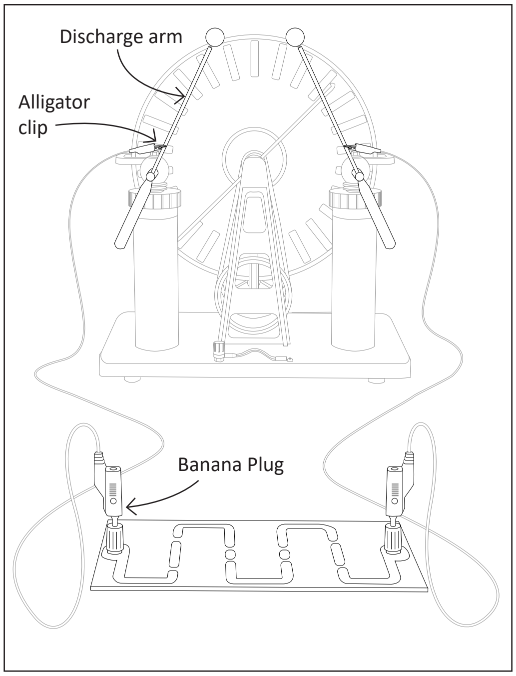
Procedure

1. Position the discharge arms so the ball terminals are 1–2 inches apart.
2. Turn the handle.
3. Observe the discharge between the ball terminals.
4. Adjust the space between the terminals to see how distance affects the brightness and frequency of discharges.

How it works

The Wimshurst machine builds positive charge in one Leyden jar and negative charge in the other. Those charges flow into their respective discharge arms and ball terminals. Therefore, he two terminals carry opposing charges. Because he terminals are close to each other, excess electrons on the negative terminal can “jump” towards the strong charge of the positive terminal. This results in a visible and audible discharge that mimics the phenomenon of lightning. Discharges will continue as long as the machine is running.

LIGHTNING LEAPER



Objective

To demonstrate electrostatic discharge and the path of least resistance

Notes

- This experiment is best done in a darkened room.

Required Materials

- Wimshurst machine
- Lightning Leaper accessory
- 2 Banana-plug/alligator-clip wires

Procedure

1. Using banana plug/alligator clip wires, connect the Wimshurst machine to the discharge arms on the Lightning Leaper, as shown.

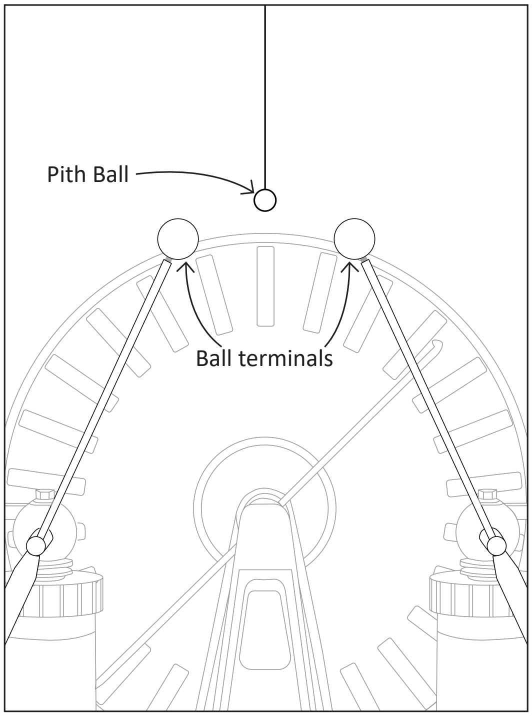
2. Crank the Wimshurst machine. You will see high-voltage electricity jumping across the gaps in the plate.

How it works

On the surface of the Lightning Leaper, a metallic path with eight small gaps is drawn in a zig-zag pattern. When connected to the Wimshurst machine, electrons flow from one banana socket to the other through the metallic path. At the gaps, electrons build up on one end then “leap” across to the other side of the path, resulting in visible discharge.

This demonstration is significant because electrons always travel via the path of least resistance, which is typically a straight line between electrodes. Therefore, one might expect the discharge on the Lightning Leaper to leap through the air directly from one banana socket to the other. However, the metal on the Lightning Leaper offers significantly less resistance than the air, so the electrons travel along that path, even though it is longer and has several turns and gaps.

PITH BALL



Objective

To demonstrate the principle of electrostatic repulsion

Required Materials

- Wimshurst machine
- Pith ball

Notes

- This demonstration is easiest to perform with two people.

Procedure

1. With the discharge arms positioned approximately 2 inches apart, have one person turn the handle on the Wimshurst machine.

2. Have the other person hold the pith ball by the string and dangle it between the ball terminals, as shown.

3. Observe the behavior of the ball.

How it works

When the Wimshurst machine is running, the pith ball gains charge from one of discharge arms. The type of charge depends on which ball terminal the pith ball is nearest, but for this explanation we will say it gains a negative charge.

Due to electrostatic repulsion, the pith ball is repelled from the negatively-charged arm and it moves away. Most often, the pith ball will move towards the other arm (which, in this example, carries a positive charge).

Upon nearing the positive arm, electrons will leave the pith ball for the positively-charged ball terminal; this leaves the pith ball with a positive charge. Therefore, the ball is repelled from the positive terminal and will most often move back towards the negative terminal. This cycle will repeat as long as the machine is running.

Sometimes, the pith ball may be repelled away from a ball terminal in a random direction (not towards the other terminal). This is still a result of electrostatic repulsion and is affected by many factors, including where the ball is hung in relation to the terminals. In these cases, the ball will maintain its charge from the first terminal and continue to be repelled (very likely moving on a circular path around it) until it loses its charge either to the atmosphere or as a result of nearing the oppositely charged terminal.

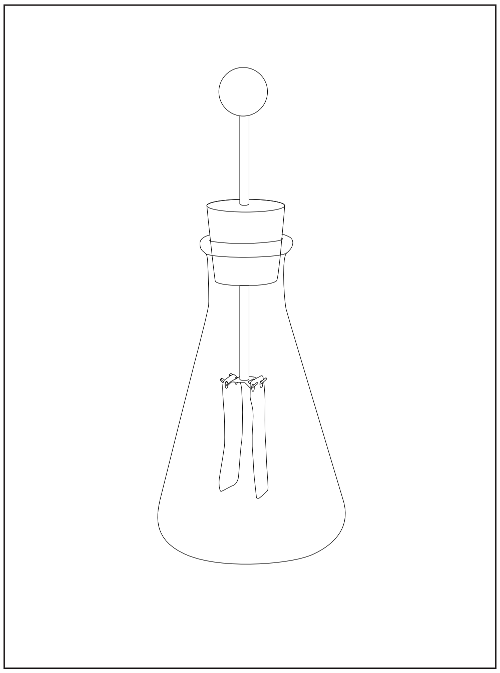
ELECTROSCOPE KIT

Objective

To demonstrate the principle of electrostatic repulsion

Required Materials

- Wimshurst machine
- Electroscope kit
- A flask that accepts a #6 rubber stopper (not included)



Procedure

1. Hang the two aluminum foil leaves (included) on the hooks of the brass hanger (see diagram).
2. Insert the assembly into the flask (see diagram).
3. Set the assembly near theWimshurst machine.
4. Charge the Wimshurst machine by turning the handle.
5. Holding the electroscope by the glass flask, bring it near near a ball terminal on the machine.
6. Observe the behavior of the foil leaves in relation to the distance between the ball terminal and the electroscope.

How it works

The aluminum leaves are connected to each other and to the ball terminal by means of the metal hanger, so they and the terminal will always have the same charge. In a neutral electroscope, both leaves hang straight down. When the electroscope nears a ball terminal on the Wimshurst, charge is transferred onto the electroscope, down the rod and hanger, then to the aluminum leaves. The charged leaves are repelled from each other due to electrostatic repulsion. The stronger the electric charge, the more forcefully the leaves will repel. Discharging the electroscope causes the leaves to return to neutral and hang straight down once more.