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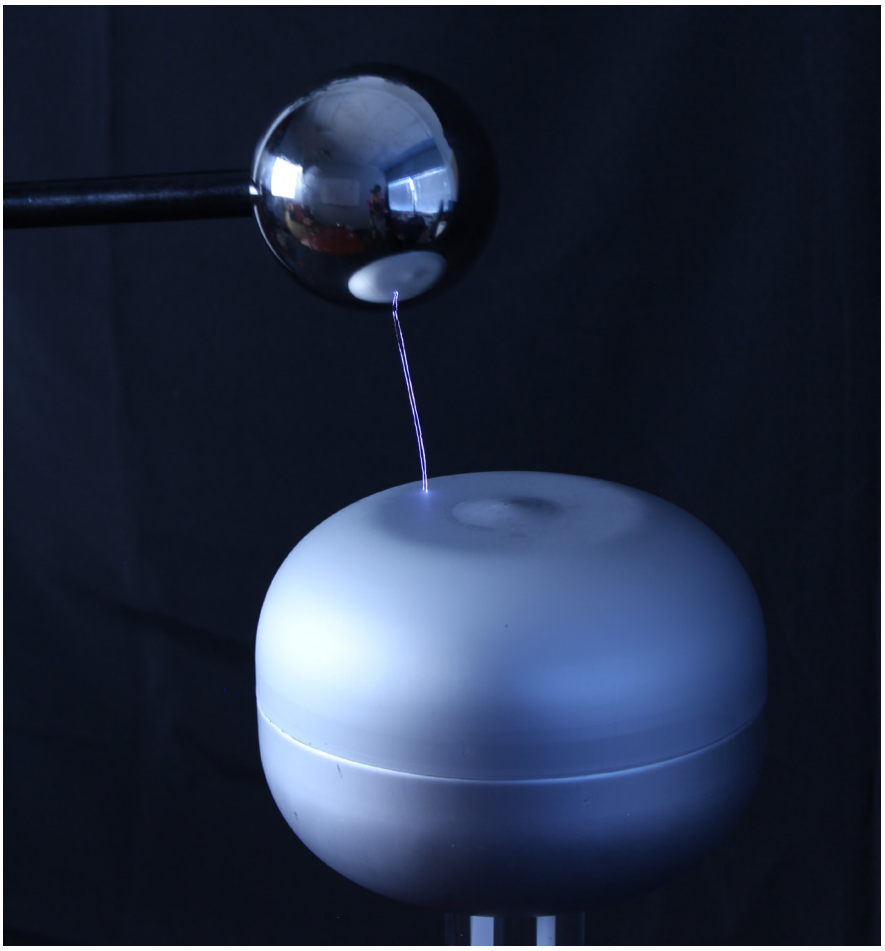


VAN DE GRAAFF GENERATOR

Neon Wand Accessory Package Demonstration Guide

SAFETY

Warning:

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

Caution:

This device is designed to emit high-voltage electrical energy. 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.

- Adult supervision is required. This generator is safe when used properly.
- Only plug the generator into a grounded (3-prong) 110 volt 60 Hz outlet (motor-operated models).
- Do not operate outdoors or in wet locations.

ABOUT THIS GUIDE

This guide is intended to be an expansion of the standard Van de Graaff demonstration guide, which can be found at ScienceFirst.com/docs.

ELECTRIC FIELD APPARATUS

Objective

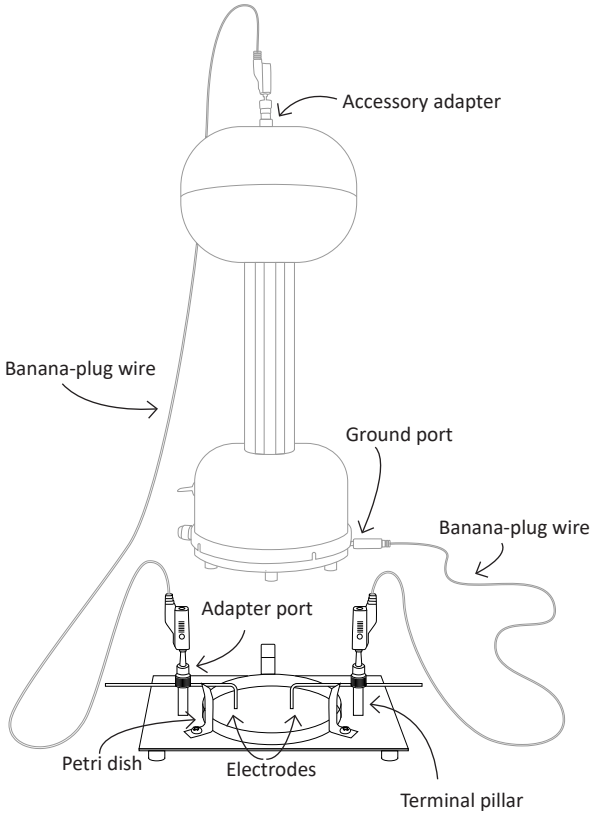
To show the lines and shape of electric fields

Notes

- Different combinations of electrodes will yield different results; see the diagrams on page 4 for suggestions.

Required Materials

- Van de Graaff generator and discharge wand
- Electric Field Apparatus
- 2 banana plug wires
- Accessory adapter



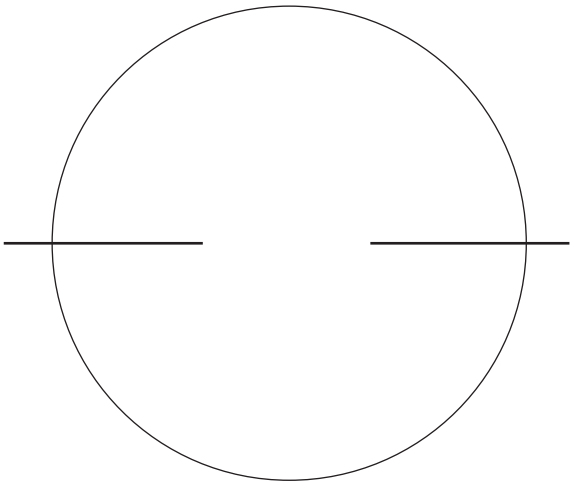
Procedure

1. Place the apparatus on a flat surface or on an overhead projector (for class viewing).
2. Pour about 5mm of mineral oil into the Petri dish.
3. Sprinkle a pinch or two of iron shavings onto the mineral oil.
4. Unscrew the adapter ports from the top of the terminal pillars and mount the desired electrodes (see diagram).
5. Screw the nuts back onto the terminal pillars to secure the electrodes. The ends of the electrodes should be immersed just under the surface of the mineral oil.
6. Using the banana plug wires, connect the apparatus to the dome and ground port of the generator (see diagram). Ground port may vary for hand-crank model (615-3140).
7. Start the generator and observe the behavior of the iron shavings.
8. Turn off and discharge the generator.

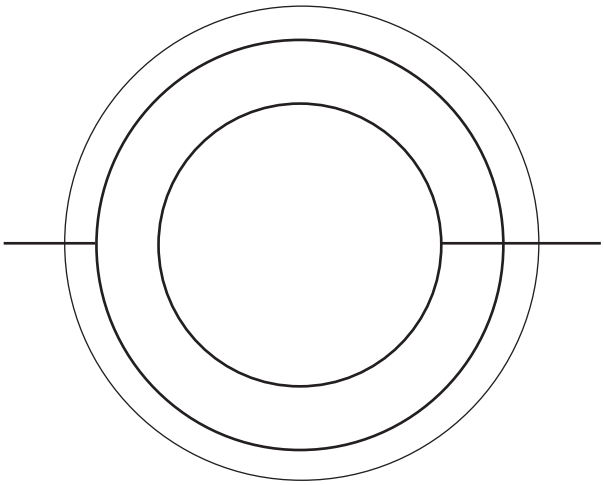
How it Works

By connecting the dome and ground of the generator (which have opposing charges) to the lightning leaper, the two electrodes in mineral oil also gain opposing charges. The separation of the oppositely-charged electrodes creates an electric field. The iron particles suspended in oil will move toward or away from the electrodes as they gain or lose electrons, depending on which electrode they are near. After a short time, you should be able see a pattern in their movement.

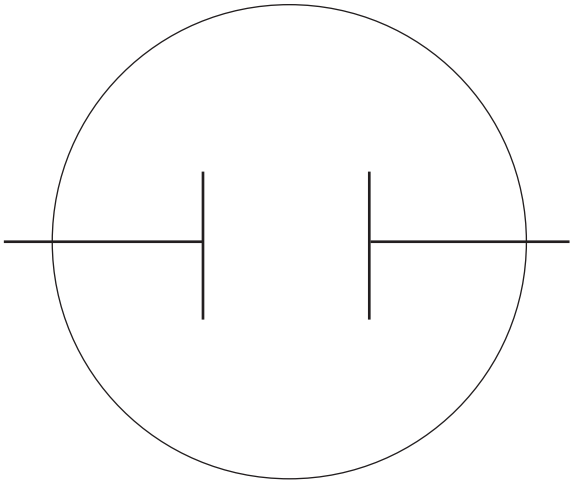
Electric Field Apparatus: Electrode Combinations



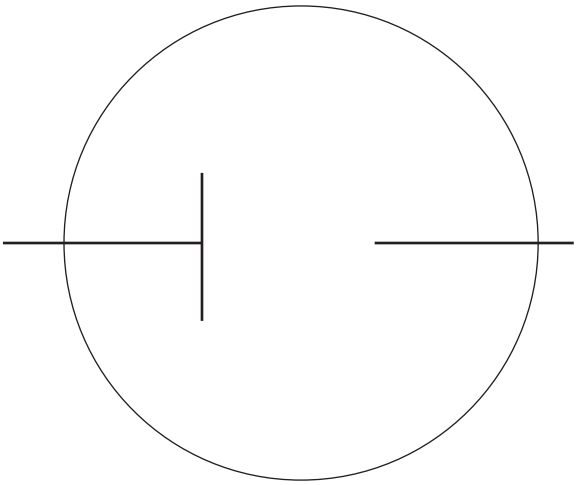
Two single-point electrodes



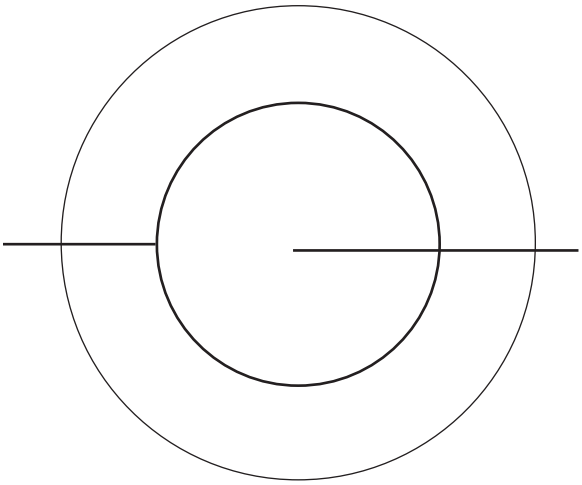
Two circular electrodes



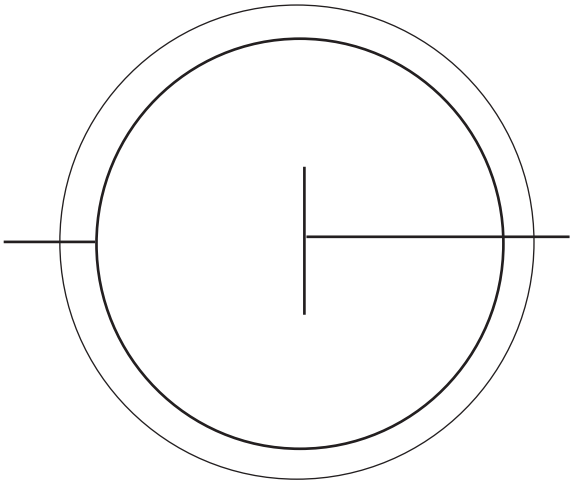
Two bent electrodes



One bent and one single-point electrode



One circular and one single-point electrode



One circular and one bent electrode

NEON WAND

Objective

To demonstrate the excitation and relaxation of light-emitting particles

Notes

- The neon wand is designed to be used with high-voltage and high-frequency power supplies. Even when following proper techniques, it is possible to be shocked by electricity. The neon wand is made of glass and will break if dropped on a hard surface. Do not drop the neon wand.
- This demonstration is best done in a darkened room.

Required Materials

- Van de Graaff generator and discharge wand
- Neon wand
- Rubber tongs

Procedure

1. Plug the discharge wand into the ground port at the base of your generator.
2. Start the Van de Graaff generator.
3. Holding it in the rubber tongs, bring the neon wand toward the dome of the generator.
4. Adjust the distance between the wand and dome, observing how it affects both the interval between discharges and the brightness of their glow.
5. Turn off and discharge the generator.

How it works

As you bring the wand near the generator, the electric field is strong enough to flow through the tube, exciting the neon atoms. As the atoms relax, they give off light, causing the wand to glow with neon's characteristic red-orange color. Wands filled with other gases would glow with their own characteristic colors.

BALL AND SNAKE DEMO

Objective

To demonstrate the principles of induction and charged and uncharged objects

Required Materials

- Van de Graaff generator and discharge wand
- Ball and Snake accessory

Procedure

1. Plug the discharge wand into the ground port on the generator.
2. Start the generator.
3. Hold handle of either the ball accessory or the snake accessory and dangle the object near the dome. Observe its behavior.
4. Turn off and discharge the generator.

How it works: Ball

When the neutral ball enters the charged air around Van de Graaff generator, it is attracted towards the dome as a result of **induction**. Induction is the process by which charges move within an object as they are attracted to or repelled from nearby charges. In this case, the negative charges in the ball are attracted to the positive electric field near the dome, so they move towards the dome. This attraction pulls the ball towards the generator.

As it gets closer, electrons will transfer out of the ball and into the generator, leaving the ball positively charged. As soon as this happens, electrostatic repulsion pushes the ball away from the dome. Because it is a sphere, the ball retains its charge fairly well. As long as it remains charged, the ball will float or fly around the dome at a distance of several inches because it will continually be repelled. Once the charge has dissipated, the ball will again be attracted to the Van de Graaff.

How it works: Snake

Just like the ball, the ribbon (or snake) is attracted to the dome by induction. As soon as the ribbon touches the dome, it gains the same electrical charge and then is pushed away through electrostatic repulsion.

In contrast to the ball demo above, the snake is a poor geometric shape for retaining charge. The two edges allow excess charge to easily transfer into the atmosphere, returning the ribbon to a neutral charge quickly. Once neutrally charged, the ribbon repeats the process of attraction to and repulsion from the dome, resulting in a whip-like action.