CENTRAL SCIENTIFIC COMPANY

OPERATING INSTRUCTIONS

Volta's Hailstorm
No. 30823-01

1. Introduction

With Volta's Hailstorm chamber (30823-01), used in conjunction with a Van de Graff generator, you can demonstrate Coulomb's Law qualitatively and illustrate the method of smoke control based on the electrostatic removal of solid particles from the smoke stream.

2. Description

The Volta's Hailstorm consists of a chamber on an insulated base in which charged particles react. Also supplied is a small amount of Vermiculite to use in the chamber.

3. Operation

To demonstrate the method of smoke control based on the electrostatic removal of solid particles from the smoke stream, fill the empty chamber with smoke and replace the lid. With the Van de Graff generator off, electrically connect the top metal ball of the chamber to the generator dome by way of alligator clip leads. Start the generator. The smoke will immediately clear.

> ***Caution: Always take great care when performing experiments using an electrostatic generator. Shocks from an electrostatic generator can be quite painful.***

To demonstrate Volta's Hailstorm, pour some Vermiculite into the chamber and close the lid. The amount of Vermiculite used can be determined by experimentation. We prefer to coat the bottom of the chamber with a light layer of Vermiculite. Connect one end of the cage to ground and the other end of the cage to the sphere of an electrostatic generator. When the generator is operating, Volta's hailstorm comes alive! Two pith balls can be used in place of the Vermiculite. The pith balls can be seen jumping around, and in dim light sparks are easily noticed.

4. Theory

For smoke precipitation, the smoke particles can be considered to behave in two ways: Either they have charge or they do not have charge. The electric field set up by the generator acts upon the particles with charge with a force along or against the direction of the lines of force. They then move until they arrive at a wall or baffle, where they lose their charge and accumulate. Those particles which do not have a net charge also move when they are in a region of non-uniform field. One way of thinking about this is to picture a single smoke particle as a small sphere with its charges evenly distributed. In a non-uniform field the electric field on one side of the smoke particle will be stronger than on the other side. You can picture more lines of force on one side of the smole particles than the other. Since we are assuming the charges on each side of the smoke particle are roughly the same, but the electric field is different on each side of the particle, it follows that the force will be different for each side of the smoke particle. The force is the product of the electric field strength and the charge. Force stated mathematically is:

$$F = EQ$$

The greater force will move the smoke particle. Another explanation would arise from energy density considerations. Any particle without net charge which is motionless in a region of uniform field (i.e., $E_{left} = E_{right}$) is moved away from the field by collisions with particles in motion.

In Volta's Hailstorm, attraction and repulsion effects are demonstrated. The effects occur upon induced charges when the bodies used are conductors and have a path to ground to get rid of the repelled charge. They occur upon dipoles or poles of higher order when there is no path to ground or the bodies are nonconductors. Sometimes the dampness of the atmosphere renders dielectrics (non-conductors) slightly conducting and the effects are due to a combination of causes. The particles in the Vermiculite are repelled from the metallic base because they pick their charge from it. Upon losing it on the upper plate they fall due to gravity. They are also repelled from the upper plate if they stick long enough to pick up a new charge.

5. Maintenance

Volta's Hailstorm needs no special maintenance. If you should experience any difficulty with this piece of equipment, please contact Central Scientific Company, giving details of the problem. To ensure better service, please do not return any apparatus to Central Scientific Company until we have sent you authorization.

6. Copyright Notice

Revised 2/92