Electrified Flying Objects

Van de Graaff Generator Demonstration

Introduction

The basic principle of electric charges is that like charges (positive to positive, or negative to negative) repel and unlike charges (negative to positive) attract. Visibly illustrate repelling of like charges.

Concepts

- Static electricity
- Van de Graaff generators
- Like charges

Background

A Van de Graaff generator builds up positive electric charge on its dome by separating negative static electric charge from positive static electric charge using a quickly moving belt. The positive charge collects on the large metal dome of the generator. When the charge buildup is large enough, a lightning-like spark can shoot from the dome to a grounded discharge rod.

Electrified Flying Objects is a fun demonstration to show the repulsive nature of like electric charges. Like electric charges repel, whereas opposite electric charges attract. When aluminum pans are charged by the Van de Graaff generator, they each attain the same positive charge polarity as the dome. Therefore, a positive charge accumulates over the entire surface of each aluminum pie pan. Each pan repels the others. The repulsive forces between the pans are strong enough to overcome the force of gravity and the top pan is pushed away from the dome of the Van de Graaff generator.

Materials

Van de Graaff generator

Discharge electrode

Aluminum evaporating dishes, small

Safety Precautions

Van de Graaff generators produce a very small current (microamps) and therefore an accidental shock from a Van de Graaff generator may cause pain and be startling, but the shock should not cause serious harm to most individuals, even at a high voltage. When working with a Van de Graaff generator it is important to have a metal discharge electrode connected to the Van de Graaff generator terminal. This acts as a ground and allows an operator to discharge the generator safely before getting near it. Do not use Van de Graaff generators near flammable gases or vapors. Do not touch a Van de Graaff generator with wet hands or damp clothing. Wear safety glasses when working with a Van de Graaff generator.

Procedure

1. Obtain 10 to 15 small aluminum evaporation dishes.
2. If the dishes have a small "handle" on the lip, fold this handle into the dish (see Figure 1).
3. Stack the aluminum evaporating dishes together and place them on top of a Van de Graaff generator.

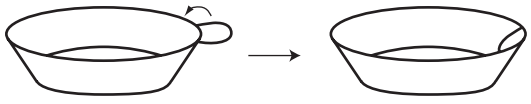

Figure 1.

4. Refer to the *Safety Precautions* section before turning on the Van de Graaff generator, and make sure a discharge wand or similar item is available to safely discharge the Van de Graaff generator after use.
5. Turn on the Van de Graaff generator and watch the aluminum evaporating dishes fly away one by one.
6. Discuss the results with the class.

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Tips

- This demonstration also works well with rice cereal or foam packaging peanuts, although using these materials may create more of a mess. Place these materials in a cardboard tube standing vertically or on a heavy plate, and place on top of the Van de Graaff generator.
- The evaporating dishes can be stacked on the Van de Graaff generator upside-down or right-side-up. Experiment to determine which orientation is better.
- Static electricity experiments and demonstrations always work best on a dry day. Lower humidity days are better than high humidity days. Air-conditioned air, or heated winter air tends to be drier, and more conducive to electrostatic dem onstrations.
- Request Flinn Safety Fax #10552, *Van de Graaff Generator Safety* for more information about the principles and hazards of a Van de Graaff Generator.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter, understanding of motions and forces
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure of atoms, structure and properties of matter, motions and forces

Materials for *Electrified Flying Objects—Van de Graaff Generator Demonstration* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP4699	Van de Graaff Generator
AP6476	Van de Graaff Generator, 400-kV
AP5634	Discharge Electrode
AP6389	Evaporating Dish, Disposable, Aluminum, 20-mL
AP6390	Evaporating Dish, Disposable, Aluminum, 50-mL

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.