Fun Fly Stick

11-0058

INSTRUCTIONAL GUIDE

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- Fun Fly Stick
- 10 Fun Stick Flyers

Required but not Included:

- 2 AA Batteries (P8-5600)

Background

The Fun Fly Stick is a toy that appears to magically levitate and repel objects after the teacher presses the button on the handle. The Fun Fly Stick accumulates a large static electric charge using a miniature mechanism similar in design to the high voltage atom smasher devised Robert Van de Graaff at Princeton University in 1929. Van de Graaff's invention was used to accelerate particles to energies high enough to create new elements, finding widespread use in medicine and high-energy physics research.

A Van de Graaff Generator consists of a hollow aluminum sphere seated on top of an insulated column that houses a rubber belt, moving at high speeds. The belt draws negative charge (electrons) from the felt roller in the base of the device and deposits those electrons ultimately on the outside of the aluminum sphere where the sphere would become negatively-charged. The Fun Fly Stick has a design which parallels a "mini Van de Graaff Generator" and works in a similar way. Using this toy, it will make it possible for your students to understand how static charges form, interact with other charged and uncharged objects, and grasp the concept of static electricity in a fun and exciting way.

Introduction

The Fun Fly Stick can clarify several important concepts about Static Electricity:

1. Objects may be electrically neutral, possess an overall positive charge or possess an overall negative charge.
2. Charging objects can be accomplished by two methods; Charging by Conduction ("contact" with a charged object) or; Charging by Induction ("non-contact" proximity to a charged object)
3. Like charges repel one another, unlike charges attract one another and a charged object will attract a neutral object.
4. Students will understand that conductors (metals) and insulators (wood, rubber) can be charged by both charging methods.
5. Students will grasp the extended concept of how static generators such as a Van de Graaff generator function.

When the teacher pushes the button on the handle of the battery-powered wand, a belt moves inside the Fun Fly Stick and a static charge is formed which builds on the wand. When one of the included five Mylar (thin aluminum foil) shapes is brought in contact with the wand, the Mylar becomes charged. Since Conduction or "Charging by Contact" results in the same charge as the wand, the Mylar shapes will gain the same charge as the Fun Fly Stick. Since like charges repel, the Mylar shapes will immediately expand to their pre-set shape and can be levitated. With a little practice, you and your students can move them about the room simply by bringing the charged Fun Fly Stick in close proximity to the Mylar shape.

After some simple testing by your students, you will find the charge on the Fun Fly Stick to be positive. You may want to hide that fact from your students initially and have them experiment to find out what the charge is on the device or even make it an additional laboratory station for your Static Electricity lessons! This may also be confirmed with the **E-Field Detector (96-3580)**.

Charging objects with your fun fly sticks:

Using the **Triboelectric Series Chart**, your students can determine what the overall charge is on two different objects after rubbing them together. Some matter tends to "hold on to" electrons more tightly than others do. If a material tends to "give up" electrons when in contact with another material, it will be more positive in the Triboelectric Series. If a material tends to capture or gain electrons when in contact with another material, it will become more negative in the Triboelectric Series. Using a **pith ball (P6-1650)** a student can determine the charge on the Fun Fly Stick. (A piece of aluminum foil rolled into a tight ball attached to a thread will also work well.)

Charge a neutral pith ball by rubbing a balloon/plastic tube with **faux fur (P6-1608)**. Touch the pith ball with the balloon/plastic tube (Charging by Conduction) and the pith ball will become negative. Charge the Fun Fly Stick by pressing the button and bring it close to the negatively-charged pith ball. The wand will attract the pith ball. Ask your students if this is absolute proof that the Fun Fly Stick is positive. Most will say that the experiment does prove that, in fact, the wand is positive. However, **attraction does not prove nor determine if an unknown object is charged** because even a neutral wand would also attract a negative pith ball.

Have the students now rub a **glass rod (P6-1601)** with (plastic wrap) and touch a neutral pith ball. You have charged the glass rod positively according to the Triboelectric Series and charged the pith ball positive as well. Now bring the charged wand near the positively-charged pith ball and… repulsion! "Repulsion always proves the charge on an object" and now you are certain that the wand is positive. Ask students to explain why repulsion is the definitive test.

You can also prove the charge on your Fun Fly Stick with an **electroscope (P6-1170)** by charging it with a known charged object by conduction. This time you can charge the electroscope negative or positive and bring the

Triboelectric Series
(Positive items at the top and negative items are at the bottom)

- Human hands (**Very positive)**
- Rabbit Fur
- Glass
- Human hair
- Nylon
- Wool
- Fur
- Lead
- Silk
- Aluminum
- Paper
- Cotton
- Wood
- Amber
- Hard rubber
- Nickel, Copper
- Brass, Silver
- Gold, Platinum
- Polyester
- Styrene (Styrofoam)
- Saran Wrap
- Polyurethane
- Polyethylene (like Scotch Tape)
- Polypropylene
- Vinyl (PVC)
- Silicon
- Teflon (**Very negative)**

charged wand near the Electroscope and observe whether the needle moves. If the electroscope is charged positively, then the wand will cause the leaves to diverge further. If the Electroscope is charged negatively, then the wand will cause the leaves to fall.
It is always more difficult to create strong positively-charged objects for students to experiment with than it is to charge objects negatively, unless you have ideal weather conditions. With the Fun Fly Stick, you will finally have a constant source of known positive charge for your electrostatic demonstrations, whether in lab or for any electrostatic applications any time of the year.

Activities

Use your Fun Fly Stick to apply "invisible glue" to paper!

Place a plain piece of paper against your blackboard, and it falls immediately. Hold the paper against the blackboard and rub the Fun Fly Stick on the paper and it will stick to the board. Ask students why the paper is held in place by rubbing the wand over the paper. The positively-charged paper attracts electrons in the neutral board to the surface and maintains the attraction (unlike charges attract) until the paper loses its charge to the air (depending on humidity levels).

Use your Fun Fly Stick to attract a water stream!

Hold the charged wand near a thin stream of water and the water stream will bend toward the Fun Fly Stick. The positively-charge wand polarizes the water molecules causing the negative side of the hydrogen-oxygen dipole to rotate and attract to the stick, bending the water toward the wand.

Use your Fun Fly Stick to make the Mylar shapes come alive!

Charge the wand and allow a Mylar shape (preferably an elongated shape… it works better!) to be charged by touching the wand. The Mylar shape will immediately repel from the stick due to the repulsion of like charges. If your hand is held near the wand, the Mylar will be attracted to your hand because you are neutral. Once the Mylar touches your hand, it will instantly become grounded (The Mylar is a conductor), losing its positive charge and become neutral. With the positively-charged wand held in close proximity, the Mylar will again be attracted to the wand until it touches the wand becoming positively charged by contact and is repelled from the wand again. This process repeats causing the shapes to jump back and forth from your hand to the wand. Cool stuff!

Use your Fun Fly Stick to make "Snap, Crackle & Pop" dance!

Charge the wand and bring it toward some Rice Krispies on a lab table. The Rice Krispies will be attracted to the wand and then be repelled as soon as they gain a positive charge. Once grounded, they will instantly be attracted to the Fun Fly Stick again, creating dancing cereal! This is the poor man's version of a more expensive electrostatic demonstration called **Volta's Hailstorm (P6-3320)**. Students could watch this demonstration all day!

Attract soda cans and an 8-foot 2 X 4 piece of lumber!

Charge the Fun Fly Stick and bring it near an empty soda can lying on its side. The can will attract and roll toward the wand. Quickly bring the wand to the other side of the can and it will roll the opposite way. Since the can is a conductor, the electrons in the can nearest the charged wand migrate to that side of the can, causing attraction. The same process occurs when moving the wand to the other side of the can. With practice, you can roll the soda can back and forth with ease. Charge the Fun Fly Stick and bring in near an 8-foot piece of lumber (A 2 X 4 works well) that is balanced in the center by an upside-down watch glass or some other friction-free pivot point. The wood must pivot freely for the experiment to work. Hold the wand near either end of the wood board and the charged wand will attract the board.

The electrons in the wood nearest the positively charged wand migrate to that side of the wood causing attraction just like in the aluminum can demonstration. Students are impressed by the strength of the electrostatic force that causes the long wooden board to rotate!

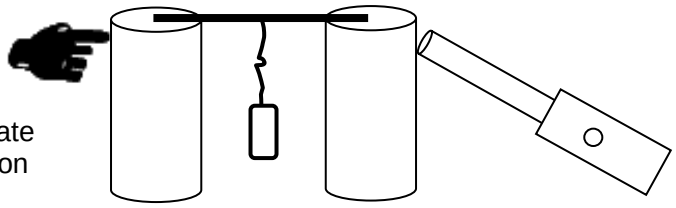
Flying saucers!

Stack pie tins (small tins that are used to make tarts) and use your charged wand to transfer charge to the stack of tins by touching them. One-by-one, the tins will fly off the stack due to the electrostatic forces of repulsion between the pie tins. Because of the tins' individual weight, they will repel one after the other from the stack. A demo that previously could only be done with a full-size **Van de Graaff Generator (P6-3300)**!

Franklin's Bells!

Everyone has heard the legend of Ben Franklin's famous kite experiment. While the actual flying of the kite in a thunderstorm by Franklin may still be up for debate, Franklin did experiment with electricity in many other ways. Using your Fun Fly Stick, you can create your own Franklin's Bells, a device which Franklin did invent to detect nearby charge. Using two soda cans (Place on an insulated surface such as Styrofoam) with one of the soda tabs hanging between the cans from an insulated support (wood stick) between the two cans (see diagram), a re-creation of Ben Franklin's device can be shown.

Touching one of the cans with your charged wand and touching the other with your finger, the soda tab will bounce back and forth at a very high speed, creating a bell-like sound. The wand causes one can to be positively-charged; the other can is grounded by your finger and will be neutral. The soda tab is attracted to the positive can, gains a positive charge and then is repelled to the opposite can. Touching the opposite can, the soda tab is grounded immediately and becomes neutral. Once neutral, the process repeats at a very fast rate and creates the ringing bell sound. A demonstration that your students won't forget!



Related Products

Electrostatic High-Voltage Genecon (P6-2640) This hands-on alternative to traditional "Van de Graaff" generators allows electrical discharge experiments to be performed in the classroom with far greater ease and less cost.

Proof Plane, Small (96-3585) This small Proof Plane has a solid brass disk attached to an insulating brass composite handle and is used to transfer charge from a charged object to another.

Friction Rod Kit (P6-1600) Explore charging by friction, positive and negative charge, and attraction and repulsion with the friction rod kit. Includes glass and hard rubber rod, silk and faux fur pads, bubble wrap, glass rod mounted on pivot needle, and complete instructions.

Acknowledgements

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