Electrostatic Motor

Overview: Did you know that you can make a motor turn using static electricity? We're going to use the concept that like charges repel (think two electrons) and opposite charges attract.

What to Learn: How to make an electrostatic motor using the ideas of plus and minus charges to attract and repulse a charged object.

Materials

- Balloon (one per student)
- Soup spoon
- Flat table
- Yard stick

Lab Time

1. Set the spoon face-down on the table, near the edge.
2. Carefully balance the yardstick on the back of the spoon. You want the yardstick to be perfectly balanced and not touching the table or falling off the edge.
3. Blow up the balloon.
4. Charge the balloon by scrubbing it on your head.
5. Bring the balloon near the edge of the yardstick that's hanging off the table. The yardstick should begin to chase the balloon.
6. Can you position your lab team around the perimeter to see how fast you can make your yardstick go? Draw a diagram of your experiment and label each student participating.

7. What would happen if you use *both* a positively charged object *and* a negatively charged object to make the yardstick move?

Reading

The first electrostatic motors were designed and tested by Benjamin Franklin and Andrew Gordon in the 1750s. An electrostatic motor is based on electric charge, like we've been studying. It's dependent on the attraction of plus-minus and the repulsion of minus-minus and/or plus-plus in order to work. Electrostatic motors that you find on the shelf today usually require high voltage, so this experiment is a perfect demonstration of how it works without the kids getting shocked. These types of motors are found in tiny electronic systems that are way too small for ordinary magnetic motors to be used in.

Exercises

1. What happens if you rub the balloon on other things, like a wool sweater?
2. If you position other people with charged balloons around the table, how long can you keep the yardstick going?
3. Can we see electrons?
4. How do you get rid of extra electrons?
5. Why do you think the yardstick moved?
6. What would happen if you use *both* a positively charged object *and* a negatively charged object to make the yardstick move?

Answers to Exercises: Electrostatic Motor

1. What happens if you rub the balloon on other things, like a wool sweater? (You get a positive charge on the balloon, which doesn't affect the experiment. The balloon will still make the yardstick move whether it's positively or negatively charged.)
2. If you position other people with charged balloons around the table, can you keep the yardstick going? (Yes.)
3. Can we see electrons? (Nope. The radius of an electron is approximately 0.000000000000002 meters)
4. How do you get rid of extra electrons? (Ground yourself or the object by touching something like the floor or a water pipe that's buried into the earth.)
5. Why do you think the yardstick moved? (The negative charge in the balloon repels the electrons in the yardstick, exposing those positive protons, which are attracted to the balloon. Since the stick is free to rotate, it chases the balloon around in a circle.)
6. What would happen if you use *both* a positively charged object *and* a negatively charged object to make the yardstick move? (Nothing – the charges in the yardstick get confused and it stays put. Or, if you're really careful about where you place each one, you could possibly get it to move a bit.)