

Topics: Electricity,
Electrostatics

Materials List

Per static tubes:

- ✓ Plastic tubes with caps
- ✓ Styrofoam balls, tiny, many

(NOTE: Oils and moisture can affect the retention of static charges.

Washing the tube and completely drying it may be necessary before first use as well as after a number of uses.)

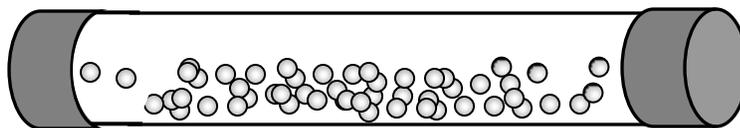
This activity can be used to teach:

Next Generation Science Standards:

- Energy can be transferred and converted (Grade 4, Physical Science 3-2 & 3-4; High School, Physical Science 3-3)
- Electric or magnetic interactions between objects not in contact with each other (Middle School, Physical Science 2-5, High School, Physical Science 3-2, 3-5)

All Charged Up

Tubes for Investigating Static Electricity



Charge up this plastic tube with a quick rub and watch the little balls dance!

To Do and Notice

Note - results will vary with temperature and, especially, humidity!

1. Vigorously rub the tube with a dry hand, paper towel or piece of fabric (wool or silk work well). Experiment with different fabrics or similar material.
2. Notice how some of the Styrofoam® balls cling to the inner surface of the tube. Tip the tube to have the beads flow over the area that was rubbed.
3. Bring a finger towards the area where the balls seem to be clinging to the inside of the tube. Touch the tube and run your finger along it and notice what happens.

The Science Behind the Activity

Rubbing the tube causes electrons to be transferred between the plastic and the item being rubbed, leaving one of the objects positively charged (the one that lost electrons) and the other object negatively charged (the one that gained electrons). This experiment demonstrates the transfer of electrons between objects; but, by itself, does not indicate which object gained the electrons.

Like charges repel each other while opposite charges attract. These forces are stronger if the distance between the charges is less. Plastic is an insulating material, which means that charges on its surface cannot easily move. Metals and even your body are examples of conductors through which charges can move easily.

The charges on the outside surface of the plastic tube exert forces on the balls of Styrofoam® which are electrically neutral (equal numbers of negative (electrons) and positive (protons) charges). At first thought it may be surprising to think of a neutral object being attracted to a charged object, but an interesting thing occurs within the Styrofoam® balls or any other neutral object. The charges on the outside of the plastic tube cause the charges within the Styrofoam® balls to rearrange themselves. This results in the opposite charges being a little closer to each other than the like charges. This means that the attraction between the opposite charges is slightly stronger than the repulsion between the like charges. This slightly greater attraction is what causes the Styrofoam® balls cling to the tube.

Running your finger on the tube allows the charges on the surface of the tube to “escape” by moving through you. You have so many atoms that you can take on extra electrons or give them up as needed to neutralize the excess charges on the tube.

Web Resources (Visit www.raft.net/raft-idea?isid=275 for more resources!)

You can find additional experiments with static electricity at these Web sites:

<http://www.sciencemadesimple.com/static.html>

http://www.exploratorium.edu/snacks/charge_carry/index.html