

Electrostatic Races

GRADE LEVEL: 6-12

Objective:

Use static electricity to make objects move to the finish line as quickly as possible without allowing anything to touch them — including air and breathing. The only thing it can touch is the floor.

Background Information:

Using static electricity, show how a balloon rubbed on your hair will stick to a wall. Ask: What did you observe? Why do you think this happened? Next, rub the balloon on your head once again to charge it. Then, pick up specks of paper by holding the balloon over them.

Math Extension Activity:

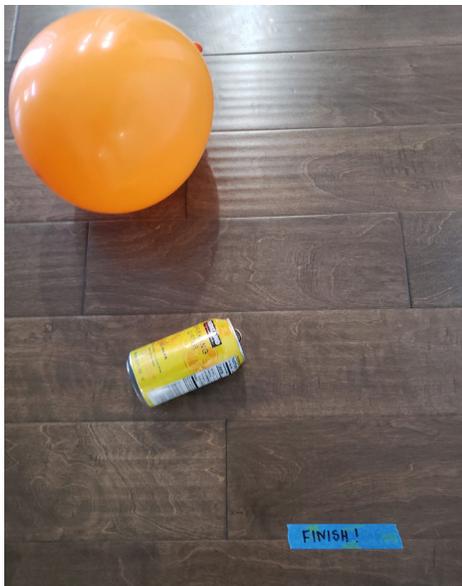
Measure the distance between the start and finish line. Use a stopwatch to see how fast they can cover the distance. Then they (or you) can calculate their object's speed by dividing their distance by their fastest time.

Materials:

- Balloons (assorted sizes and shapes, however, bigger ones work best). If you don't have a balloon, a plastic bag or plastic bottle works too.
- Find objects to test them. Cylindrical objects that roll easily when you gently push them are best. For example, soda cans, potato chip cans, toilet paper rolls or plastic bottles). Metal objects like soda cans work best because the electrons in the metal move through the aluminum. This leaves the side nearest the balloon with a positive charge — just what's needed to show an electrostatic force between the can and balloon.
- Tissues paper squares, hole punches or small pieces of torn paper
- Stop-watches (for math extension)
- Masking tape

Procedure:

1. Tape off the start and finish lines, about five feet apart, on a flat smooth surface.
2. Rub a balloon on your hair to strip electrons from your hair.



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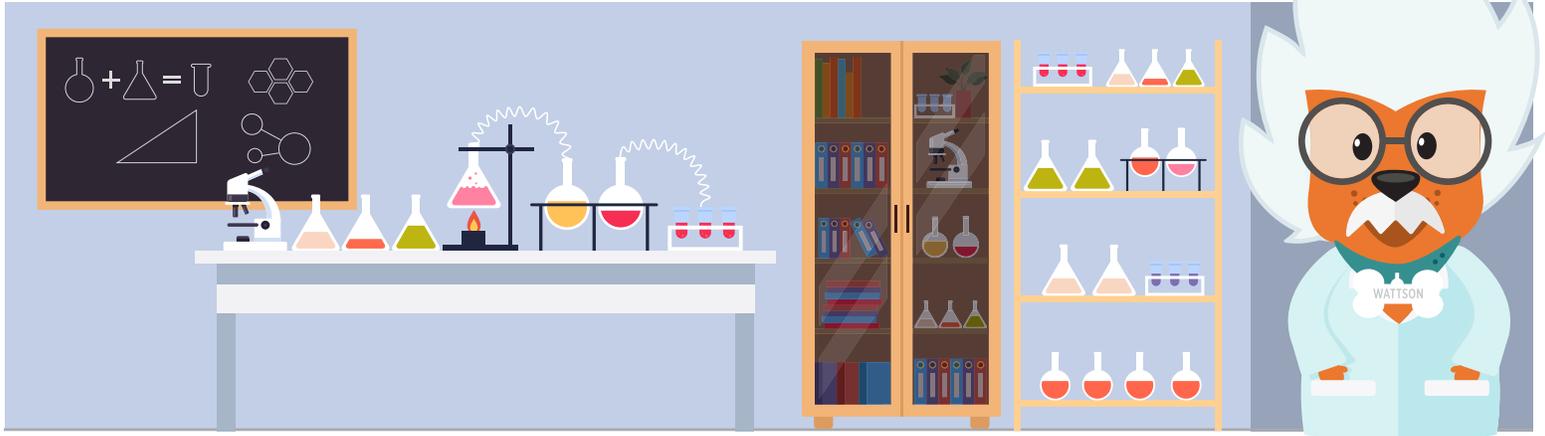
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3. Hold it close to (but not touching) the object and pull the balloon back, moving the balloon along the path. This should pull the object along the floor.

4. The first to move their object to the finish line without touching it wins! If a person touches their object, they must go back to the start line.



The Science Behind It:

In our experiment, after we rub the balloon on our hair, the balloon has extra electrons (negative charge) on the side we rubbed on our hair. Those electrons push on other nearby electrons while pulling on nearby protons.

When we put the balloon close to a soda can, a scrap of paper, or a toilet paper tube, the electrons in that object are pushed away from the balloon, and some will move farther away from the balloon. This leaves the positively charged protons in the object's atom closer to the balloon and the electrostatic pull between the electrons and protons work to pull the object toward the balloon. The electrostatic forces are invisible, but in this experiment, we

can use these invisible forces between charged objects to move something without touching it through an electrical interaction at-a-distance pushing and pulling electrons from atom to atom.

When some electrons are pulled away from their atoms, they leave behind a positively charged ion. We push and pull electrons through our powerlines primarily with our hydroelectric facilities (or dams) where kinetic energy from falling water is used to spin magnets in coils of wire. These magnetic forces push and pull the electrons. The electrostatic forces between electrons and protons pull electrons and protons toward each other.