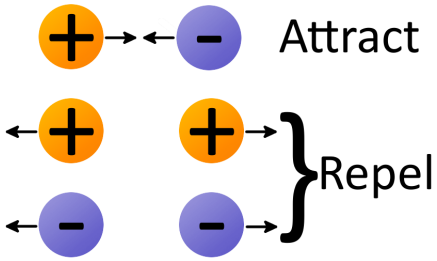
Static Electricity: Opposites Attract

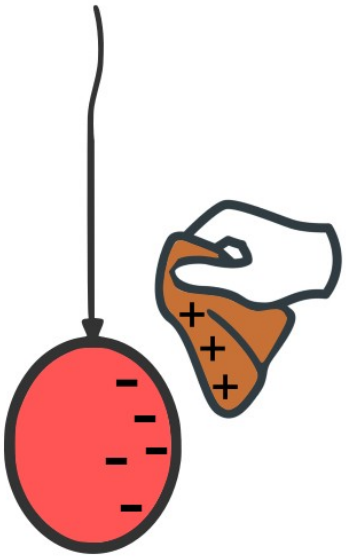


- There are two kinds of **electric charge**: + and -
- Opposite charges attract, like charges repel
- All objects contain + and – charges. **Static cling** occurs when an object builds up charge, resulting in attraction
- When a charged object is brought near a **neutral** object (no excess charge), the electrons in the neutral object can rearrange to move towards one direction. This is called **induced charge** and can make the two objects attract.

Part 1: Building up Static Charge

1. Blow up a balloon, knot it shut, and tie a string around its neck. Use the string and tape to hang the balloon upside down so that it is not touching anything. (eg: off the side of a table).

2. Rub the hanging balloon with a piece of wool (or rub it on your hair – human wool!)



What happens if you hold the wool near the balloon? Is the balloon… (circle one)

attracted towards it repelled away does not respond

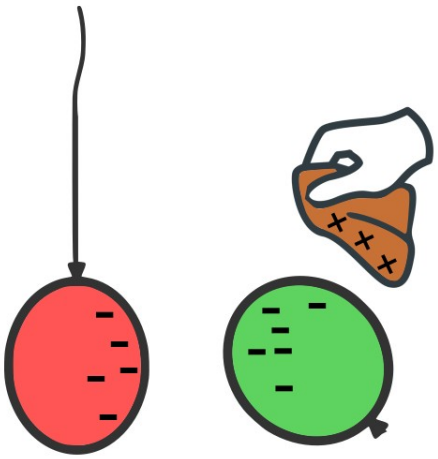
Discuss: can you explain what is happening to the balloon?

Rubbing with the wool transfers many negative charges onto the balloon. The wool is left positively charged.

Fill in the general rule:

Negative charges and positive charges _____ each other.

2. Now blow up the 2nd balloon. Make a **hypothesis** (prediction) of what will happen if you rub both balloons with the wool and bring them near each other.



Hypothesis: The two balloons will attract / repel / do nothing

Now try it. Rub both balloons with the wool, then bring the free balloon near the hanging one. What happens?

Observation: The hanging balloon is attracted / repelled / does not move

Fill in the blanks. In this experiment,
The hanging balloon is _____ charged.
The second balloon is _____ charged.

Two _____ charges must _____ each other.

Part 2: Induced Charge

Now let's see if a charged object can attract a **neutral** object (no excess charge).

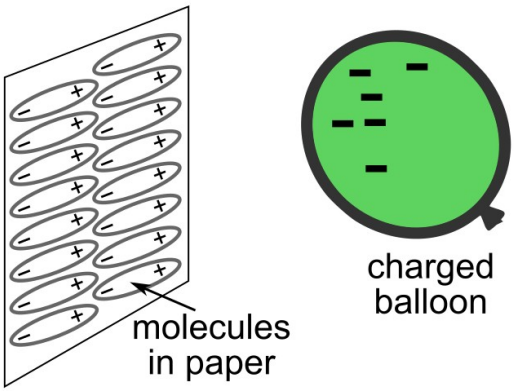
1. Tear a few small pieces of tissue paper (less than 1cm in size) and scatter them on the table.

2. Rub a balloon with wool, then hover it over the pieces of paper (without touching them).

How do the pieces of paper respond?
Attracted repelled do not move

Discuss: Why are the (overall neutral) pieces of paper attracted to the negatively charged balloon?

Paper is a **dielectric material**. This means that its molecules have separate positive and negative charges. The molecules can reorient slightly to line up their positive charges to point towards the balloon and their negative charges to point away. Because the positive charge is closer, the paper is attracted to the balloon.

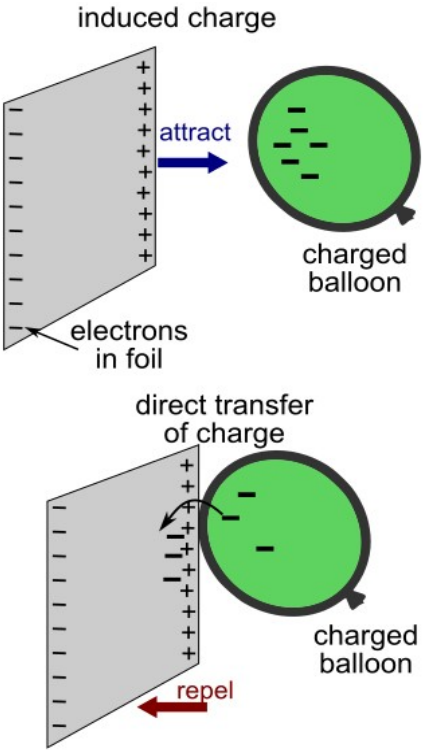


3. Make a prediction: if you rub the balloon with wool, and then hover the wool over the paper, what will happen?
The paper will be: attracted / repelled / do nothing

Test your prediction, and explain what you see!

4. Rip up many small pieces of foil, pea-sized but flat, and scatter them over the table.

5. Rub the balloon with wool again and hover the balloon over the foil pieces.



What do the foil pieces do? attract / repel / jump up and down

When the balloon is nearby, the charges in the foil will also rearrange to put positive charge closer to the balloon; the foil becomes attracted. When the foil touches the balloon, some of the negative charges from the balloon flow directly into the foil. The negatively charged piece is then repelled and falls back down.

6. What do you think will happen if you place the following materials between a charged balloon and the little pieces of tissue?
Write your hypothesis (will jump or won't jump) in the table.

Material	Hypothesis will jump / won't jump?	Observation jumps / doesn't jump
aluminum		
paper		
plastic		

7. Have one student hold a large piece of foil as a roof, a short distance above the tissue paper (close but not touching). Rub the balloon with wool and place it over the foil. Write your observation in the table.

8. Repeat the experiment with a piece of paper or a plastic ziploc bag between the balloon and the scraps of tissue.

Part 3: Build an Electroscope

Let's build a simple device to detect whether an object is charged.

1. Cut 2 strips of foil, 15cm long and 1 cm wide.

2. Use a clothespin to hold the two pieces together near the ends.

3. Insert the foil strips into a bottle, and rest the clothespin on top. The foil strips should be hanging down without touching the sides of the bottle.

Make a prediction: If you touch a charged balloon to the strips, what will they do?

Spread apart stick together do nothing

4. Now try the experiment. Charge up a balloon by rubbing it. Touch it to the top of the foil strips.

What do the strips do? Spread apart stick together do nothing

Discuss: Why do the strips of foil behave as they do? Think about what happens to the negative charges from the balloon once it touches the foil.

The electric charges from the balloon enter the foil strips, making both strips negatively charged. Because like charges repel each other, the foil strips should split apart.