

ELECTRICITY

Grades 4-5

Overview

The students will be involved with three experiments that will help them understand that rubbing certain objects results in the removal of electrons and a build up of positive or negative charges.

1. The students will have to figure out how the teacher got balloons to stick to the blackboard. Once they figure this out, the students attempt to stick balloons onto the blackboard.
2. The students use a “magic comb” to make a thread stand upright.
3. the students will use a comb to separate salt from pepper.

Objectives

- The students will demonstrate an understanding that rubbing certain objects will result in the removal of electrons and a build up of positive or negative charges.
- The students will demonstrate an understanding that certain uncharged objects are attracted by charged objects.
- The students will demonstrate an understanding that there are two kinds of static charges: negative and positive.

Vocabulary

Static: stationary or not moving

Positive: a positive electrical charge that is designated by the symbol “+”

Negative: a negative electrical charge designated by the symbol “-”

Materials

Activity 1: Balloon Garden

For the presenter:

- wear a **wool** shirt or blouse.
- three or four balloons
- a clean blackboard
- silk material
- wool material
- cotton material
- an overhead projector

For each student:

- 1 balloon (have a few extras)

Activity 2: The Magic Comb

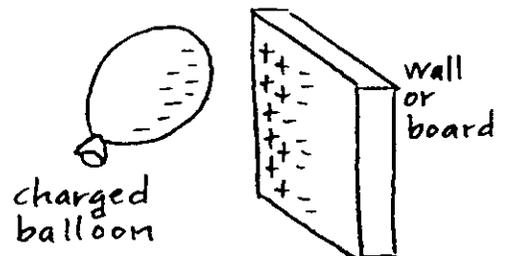
For each group of students:

- 1 comb
- a piece of thread
- Optional, but super - 1 comb & thread for each student

Activity 3: Please Pass the Pepper

For each group of students:

- a mixture of table salt and pepper
- a comb (same one used for activity 2)
- a sheet of wax paper



Getting Ready

1. Blow up four balloons.
2. Draw a picture of the - negative charged balloon and the + positive charged wall on the overhead or blackboard. (See picture below.)
3. Have all the materials set up by activity on a table.

Procedures

1. Tell the students that you are planting balloons in a row on the blackboard.
2. As if cleaning the dust off the balloon, rub your **wool** sleeve carefully against the balloons, then stick them to the blackboard in a horizontal row.

3. Hand out a balloon to each student.
4. Have the students blow their balloons up and ask them if they can start another row of balloons in your “balloon garden.”
5. Ask volunteers to come up and start another row in your balloon garden.
6. When they figure out that you are rubbing the balloons to get them to stick, have them rub their balloons against their hair or shirt and then try to make another balloon row.

Questions

“How did the balloons stick to the blackboard?”

“What did the rubbing do to the balloon?”

“Try rubbing the balloon against cotton, silk, wool, and hair. Did you find any difference in the static charge built up?”

“Do you think the balloons will stick better to the blackboard on a very cold winter day or on a rainy day? Please give reasons for your answer.”

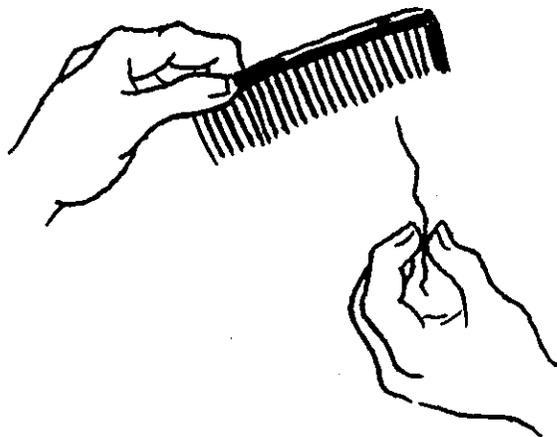
“Will the balloons stick to the walls indefinitely?”

Explanation

When rubbing the balloons, the material that is being rubbed against it loses some electrons; consequently, the balloon obtains an excess of electrons, which gives it a ***negative charge***. Initially, the wall in the balloon had the same type of charge but when the material was rubbed against the balloon, making it negative, the wall has a positive charge in comparison to the negative charge of the balloons. Since opposite charges attract, the negative balloon is attracted to the positive wall. **(See drawing above and show this drawing on the overhead to the students as you explain.)** The easier a material loses its electrons while rubbing against the balloon, the easier the balloon gets charged. The most common materials to charge the balloons are wool, cotton and hair. When the negatively charged balloon approaches the board, the negative charges are repelled and then a positive charge is induced at the spot where the balloon touches the blackboard. This is why the balloon initially sticks to the surface of the board, but eventually with time, the electrons will transfer from the balloon to the board, and the balloon gets neutralized and drops to the floor. Water is an excellent conductor of electricity, so on a humid or rainy day, the loss of an excess charge occurs easier and the balloons may not stick to the blackboard or will stick for a very short period of time.

Closure

Ask students to draw the “balloon garden” showing the electrons on the balloon and the electrons on the wall. An indication that they have understood the concepts would be their showing negative electrons on the balloons and both positive and negative electrons on the wall.



Activity 2: The Magic Comb

Procedures

1. Hand out the materials for Activity 2.
2. The students are to follow each step with you.
3. Holding a piece of thread in one hand ask the students to observe the thread's position in relation to your hand. (*It will hang down.*)
4. Run a comb briskly on your clothing. (Have the students do the same.)
5. Bring the comb near the free end of the thread. As you do this, you'll make the thread stand straight up
6. Move the comb in small circles above the thread; the thread will also move in small circles.

Questions

“How was the thread different after you placed the comb above it compared to before you placed the comb over it?”

“Why does the thread move in circles when you move the comb in circles?”

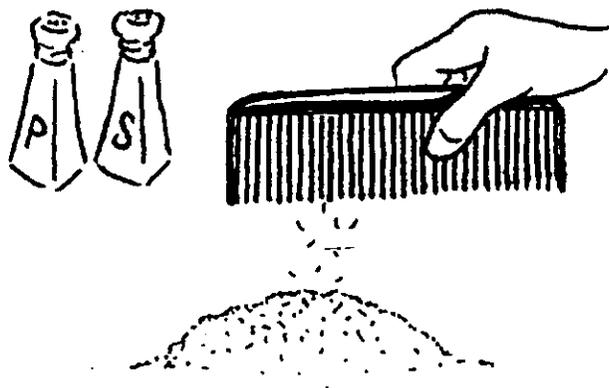
Explanation

Call upon the students to explain this in their groups if they are in groups. After the first activity, they should now understand the main concepts. Walk around listening to them. Choose one student to explain it to the class.

Static electricity makes the trick possible. When you rubbed the comb on your clothing, friction caused the free electrons to leave the clothing and attach themselves to the comb, giving it a negative electric charge. Free electrons are repelled from the thread, leaving it positively charged. Because opposite charges attract, the thread is drawn towards the negatively charged comb.

Closure

Using the terms negative and positive charges, have the students turn to someone near them and explain to each other why the thread stood upright and moved in small circles.



Activity 3: Please Pass the Pepper

Materials

For each student or group of students:

a mixture of table salt and ground pepper on a sheet of wax paper
a comb (same comb used in activity 2)

Procedures

1. Pass out the mixture of salt and pepper on the wax paper and combs to each student or each group of students.
2. Ask the students how can the pepper can be separated from the salt; in other words "please pass only the pepper."
3. If they don't come up with the answer, run your comb through your hair and hold it over the salt and pepper mixture. The pepper will jump to the comb because it is lighter than the salt.

Questions

“What did running the comb through your hair accomplish?”

“Why did only the pepper stick to the comb?”

“What is another way to separate the pepper from the salt?”

Explanation

Initially, the salt and pepper and the comb all had identical electrical charges. By rubbing the plastic comb through one’s hair, the comb is charged with static electricity from the excess electrons left on the plastic by one’s hair, making it negative. The salt and pepper have identical charges but one grain of salt is about 100 times heavier than one pepper flake. They both have positive charges compared to combs negative charges. The combs negative charge is strong enough to pick up the positive pepper flake but it is not strong enough to pick up the heavy positive grain of salt.

Closure

Have half the class stand and form themselves into the shape of a comb. Have the other half of the class count off by twos. The ones are salt and the twos are pepper. Tell the “comb students” that they were just rubbed through a giant’s hair. Ask them what is the consequence of this? Then have the “pepper students” jump to the comb if they first can explain why they will do this. Ask the “salt students” to explain why they are not jumping to the comb.

Clean Up

The classroom needs to be left just as it was. Give each group specific clean up tasks, and compliment the groups/students.