Ωhm CΩmfΩrts

Electricity Types

Static and Current Electricity

NOTE: If you attempt to do any electrical experiments – NEVER use the electricity from a socket unless your teacher has given you strict instructions. It is very powerful and very dangerous. Unless told to do so you should only use batteries for electrical experiments.

There are two types of electricity:

1.) Current Electricity – is caused by tiny invisible things called electrons that move through metal. This flow is called an electric current. Objects that need current electricity (moving electrons) are powered by batteries or by electrons carrying energy which travel along wires from a power station. The circuit is completed by a switch, which turns the appliance on. When the switch is turned off, the circuit is broken and the appliance is turned off. Many objects that we use every day are powered by electrical energy – from computers and hairdryers to lamps and washing machines.

2.) Static Electricity - this type of electricity stays in one place. Static electricity is produced when some materials are rubbed together. Static electricity is the result of one of the objects that are rubbed having additional negative charges and the other material excess positive charges. These charges can build up on the surface of an object until they find a way to be released or discharged. One way to discharge them is through a circuit.

How does static electricity work? Static electricity happens when there is an imbalance between negative and positive charges in objects. It causes crackles when you comb your hair and makes dust stick to television screens. Static electricity experiments work best on a dry day.

Lightning is caused by a natural build-up of static electricity in clouds. The lightning strike is just a giant spark of electrical energy.

Have you ever walked across the room to pet your dog, but got a shock instead?

The rubbing of certain materials against one another can transfer negative charges or electrons. For example, if you rub your shoe on the carpet, your body collects extra electrons. The electrons cling to your body until they can be released. As you reach and touch your furry friend, you get a shock. Don't worry; it is only the surplus electrons being released from you to your unsuspecting pet.

Have you ever taken your hat off on a dry winter's day and had a "hair raising" experience?

As you remove your hat from your head, electrons are transferred from the hat to your hair, creating and re-arranging your interesting hairdo. Remember, objects with the same charge repel each other. Because they have the same charge, your hair will stand on

end. Your hairs are simply trying to get as far away from each other as possible. Combs attract bits of paper. Clothing "clings" to your body because of static electricity.

Have you ever made a balloon cling on to a wall after rubbing it against your clothes?

When you rub a balloon against your clothes and it sticks to the wall, you are adding a surplus of electrons (negative charges) to the surface of the balloon. The wall is now more positively charged than the balloon. As the two come in contact, the balloon will stick because of the rule that opposites attract (positive to negative).

All physical objects are made up of atoms. Inside an atom are protons, electrons and neutrons. The protons are positively charged, the electrons are negatively charged, and the neutrons are neutral. Therefore, all things are made up of charges. Opposite charges attract each other (negative to positive). Like charges repel each other (positive to positive or negative to negative). Most of the time positive and negative charges are balanced in an object, which makes that object neutral.

FOR EACH OF THE FOLLOWING EXPERIMENTS THAT YOU TRY DRAW A DIAGRAM OR DIAGRAMS TO SHOW WHAT YOU DID AND WRITE A CONCLUSION EXPLAINING YOUR OBSERVATIONS

Static electricity experiments

1. Stuck on You A sticky experiment!

Materials you will need:
- A Balloon
- Strong Lungs
- A Woollen or Nylon Sweater (Jumper)

Steps:
1. Blow up the balloon and tie the end so that the air does not escape.
2. Take the balloon and rub it vigorously against your jumper/sweater or your head of hairs about ten times.
3. Now hold the balloon against your jumper/sweater or hairs for a minute.
4. Let go of the balloon. What happens? Does it stick?

When a balloon and a jumper/sweater or hairs are rubbed together; each will gain a different type of electrical charge. The balloon becomes a negative charge and the jumper/sweater or hairs becomes a positive charge. Opposite charges attract each other.

2. Bending Water Experiment

Materials you will need:

- ✓ A Plastic Comb or rod
- ✓ Woollen Jumper or cloths
- ✓ Running Tap (Water)

This is a cool experiment!
Steps:

1. Rub the plastic comb against your jumper or comb through your hair around ten times.
2. Turn the tap on so that it has a slow, steady stream of water.
3. Place the comb close to the water (don't let the comb touch the water).

3. Resisting Balloons

Materials you will need:

- ✓ Tape
- ✓ Scissors
- ✓ Door Frame
- ✓ Two Balloons
- ✓ String/Thread
- ✓ A Woollen Sweater/Jumper

Steps:

1. Cut two equal lengths of thread/string and tape them to the top of a door frame in the middle about 1 inch or 2.5 cm apart.
2. Blow up the balloons and tie each end so that the air does not escape.
3. Tie each of the blown up balloons to the end of each thread/string so that they are hanging at the same height and are resting next to each other.
4. Rub each of the balloons with the woolly jumper/sweater to charge them (one at a time).
5. What happens when you let them go? How do they react to each other?

Both of the balloons have become negatively charged once they have been rubbed with the woollen jumper/sweater and will push each other away. Items that are made up of the same material will always take on the same charge. If you have a matching charge of static electricity in like items, they will repel each other just like the same poles of magnets will repel each other.
Try to bring the two balloons together after they have been rubbed with the woollen sweater/jumper. What happens when you try to bring the balloons together?
Place your hands in between the two balloons, does something different happen?

4a. Rising Tissue Paper

This is a fun experiment to watch as the tissue paper is pulled up by the charged comb/pen.

Materials you will need:

- Scissors
- Tissue Paper
- Woollen Jumper/Sweater
- A Plastic Comb/Pen

Steps:

1. Cut up some small pieces of tissue paper.
2. Charge up the comb/pen by rubbing it against a jumper/sweater or combing through your hair about ten times.
3. Hold the comb/pen over the small pieces of tissue paper.

4b. Rising Tissue Paper

Materials you will need:

- Ruler
- Tiny pieces of colourful tissue paper
- Several objects available that you can rub the ruler with that will prevent it from picking up the tissue paper (paper, metal, water)
- Several objects that will enable you to pick up the tissue paper (fake fur, silk)

Steps:

1. Ask the students if they think you can pick-up the tissue paper with the ruler.
2. Try to pick up the pieces of paper with a ruler that has not been charged.
3. Next, ask the students if they can think of what you could do to the ruler to enable it to pick up the pieces of paper.
4. Use the materials listed above to try to demonstrate to the students what materials will charge the ruler and which ones won't.

Note: You must neutralize the ruler each time before you rub the ruler with a new object. You can neutralize it by rubbing on your shirt or wetting it with water.

5. Charged or Not Charged - Balloons

Materials you will need:

- ✓ ·Tape
- ✓ ·Scissors
- ✓ ·Two Balloons
- ✓ ·String/Thread
- ✓ ·A Woollen or Nylon Sweater (Jumper)

Steps:

1. Inflate both balloons so they are the same size. Tie a knot in the neck of each balloon so that the air does not escape.
2. Tie one end of the string to one of the balloons.
3. Using tape, secure the free end of the string to the edge of a table.
4. Charge the second balloon by rubbing it with the wool scarf.
5. Hold the charged balloon near, but not touching the hanging balloon.
6. Observe the motion of the hanging balloon.

Before rubbing, like all materials, the balloons and the wool scarf have are neutral. This is because they each have an equal number of positively charged subatomic particles (protons) and negatively charged subatomic particles (electrons).
When you rub the second balloon with the wool scarf, electrons are transferred from the wool to the rubber because of differences in the attraction of the two materials for electrons. The balloon becomes negatively charged because it gains electrons from the wool, and the wool becomes negatively charged because it gains electrons from the wool, and the wool becomes positively charged because it loses electrons.
When the negatively charged balloon is brought near the neutrally charged hanging balloon, the electrons on the surface of the hanging balloon move away because like charges repel. This leaves the surface facing the charged balloon more positive. Since opposite charges attract, the positive charge on the surface of the hanging balloon is attracted to the negative charge on the hand-held balloon. This attraction is strong enough to move the hanging balloon.

6. Charging up a Lamp

Materials you will need:

- ✓ A Dark Room
- ✓ Fluorescent Light Bulb
- ✓ A Comb/Woollen Scarf

Steps:

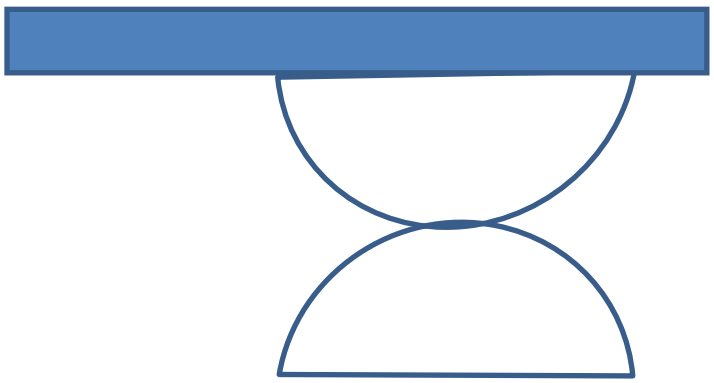
1. Go into a dark room with the light bulb and the comb (woollen scarf).
2. Run the comb through your hair around 20 times. You could rub the comb over a woollen scarf for the same effects.

3. Place the comb on the metal end of the light bulb and watch as the filament in the bulb lights up.

The friction between your hair and the comb causes electrons to travel from your hair to the comb. This causes your body to become positively charged and the comb becomes negatively charged. With the comb being charged, it discharges into the light bulb causing the bulb to emit the small pulses of light.

7. Two Charges

Place one watch glass upside down on top of another one. The top one should be free to rotate. It can be achieved with one, but it is not usually as effective
Charge a rod with a cloth and carefully place it onto the watchglass leaving one side overhanging. DO NOT touch the rod as it is placed on the watchglass as it will discharge.
Charge another rod and bring it close to the charged rod (do not touch it)
Depending on the charge of the rod the other rod should rotate towards or away from the rod. Try similar and opposite rods. Always use the same cloth to rub each of the roads. This shows that there are two types of charge original with the names – positive and negative.



8. Separating Salt and Pepper

Materials you will need:

- One teaspoon of Pepper
- One teaspoon of Salt
- A piece of Wool or Fake Fur
- Plastic petri dish or Sheet of Paper and a Clear plastic ruler

Steps

Using a Sheet of Paper

1. Have the students measure out one teaspoon full of salt and one teaspoon full of pepper onto the sheet of paper.
2. Use a pencil's eraser top or pen top to mix the salt and pepper together.
3. Have the students take the plastic ruler/rod and rub it with the wool/fake fur.
4. Approach the pepper with the ruler/rod from above slowly. The pepper will begin to jump onto the ruler. As you get closer to the mixture, the salt will eventually begin to jump to the ruler. The pepper will jump to the ruler/rod and stick.

Using a Petri Dish

1. Have the students measure out one teaspoon full of salt and one teaspoon full of pepper into the petri dish.
2. Place the cover on the petri dish and mix well by gently swirling.
3. Have the students rub the top of the petri dish with the fur. Turn the petri dish over for a few seconds and then turn it back to the original position. The pepper should stick to the top of the petri dish.

The uncharged pepper particles were attracted to the petri dish or ruler as opposite charges were induced in the pepper. Since pepper is lighter than salt, it takes less effort for pepper to overcome the force of gravity.
Rubbing the plastic surface with the fur/wool caused the plastic surface to become charged with static electricity. (There was an excess of electrons left on the plastic from the fur/wool).
Since pepper is lighter than salt, it takes less effort for pepper to overcome the force of gravity.
You can place both the salt and pepper into water. The pepper will float and the salt will sink. You can skim the top of the water and remove the pepper.
Using the stencil allowed rubbing the petri dish lid at certain confined areas. Only those areas that were touched with the fur/wool were charged.

8b. Stencilling in Salt and Pepper

Extensions

If using a petri dish, you can expand on this lab.
Steps:

1. Place the salt and pepper back in the bag and clean the petri dish.
2. Start with a clean, dry petri dish.
3. Next, let add a pinch of pepper to the petri dish.

4. Place the lid back on the petri dish.
5. Take a piece of paper and cut it the same size as the lid to the petri dish.
6. Once this is done, have them cut out a stencil from this paper.
7. Next, hold the stencil on the lid and rub the open area (the cut-out area) with the fur.
8. Remove the stencil and turn the petri dish over for a few seconds and turn it back over again to the original position.
9. You should see their stencil of pepper sticking to the cover.

Don't even try to try all these experiments. If you feel brave this is best done as a circus.

9.Charging cornflakes , charging balloons

- ✓ Cornflakes, suspended on thread
- ✓ Balloon
- ✓ Clamp stand, bosshead and clamp

Rub the balloon on your hair or a cloth, bring it towards a hanging cornflake and see what happens.
Then suspend two balloons on thin threads and hang from clamps, be sure the metal clamps are as far from the balloons as possible (maybe clamp two metres sticks etc)
Rub the balloons on your hair and gently release then without touching the part that you rubbed. The balloons should repel.

Alternative Teacher Led demonstrations

1. **Try to stick a rubber balloon on the ceiling or wall after you have put electric charges (remember that charges are positive or negative parts of an atom) on it.**
2. **Now answer the questions in your jotter.**
   a. *What do you think affects the length of time the balloon sticks to the wall?*
   b. *Explain how you put electric charge onto the balloon.*

3. **Use a plastic comb, ruler or rod to pick up some small pieces of paper.**

4. **Now answer the questions in your jotter.**
   a. *Can you make the comb pick up more paper?*
   b. *If you could pick up more paper explain how you did it.*

5. **Describe what happens when an electrically charged plastic pen is held near a thin stream of water.**

6. **Rub a balloon on your jersey and try to make your hair stand on end.**

7. **Now answer the questions in your jotter.**
   a. *Can you give a reason for why this happens?*
   b. *Does your hair standing up depend on whether you have rubbed the balloon?*
   c. *Is your hair being pulled towards the balloon or away from it?*

8. **If you have time or are waiting for apparatus complete the following task in your jotter. Read and answer the questions on page 84 of Starting Science Book 1.**

9. **The following task must be completed with your teacher. Read the following paragraph and then copy and complete the summary to check that you have understood the work.**

10. When you rubbed the rod against a _____ or your _____ some of the outer _____ from the materials were 'stolen' by the rod. This means that the rod has _____ electrons and so is negatively charged. The material has lost some electrons and so is _____ The material and the rod are likely to remain like this for some time. This is because the materials from which they are made do not allow charges to move or escape.