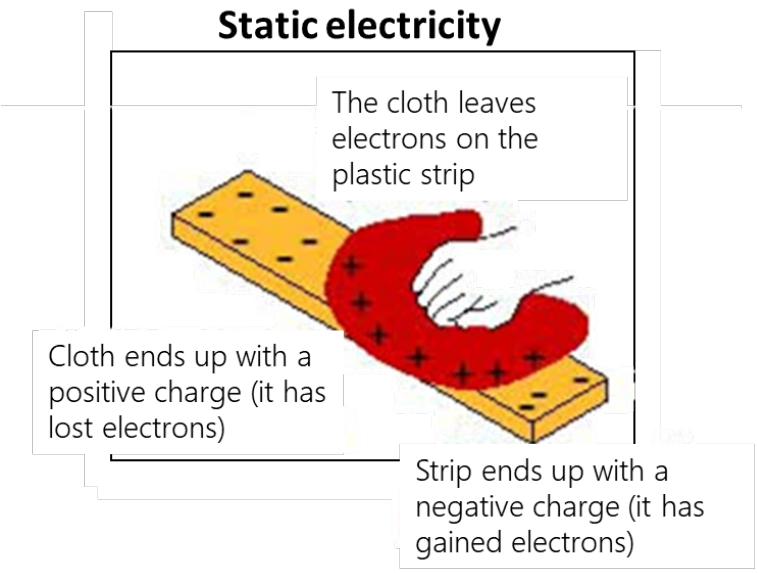
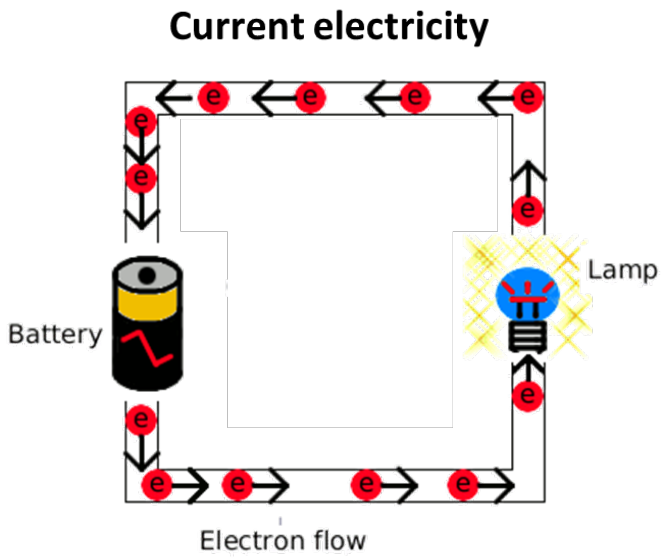
Types of electricity





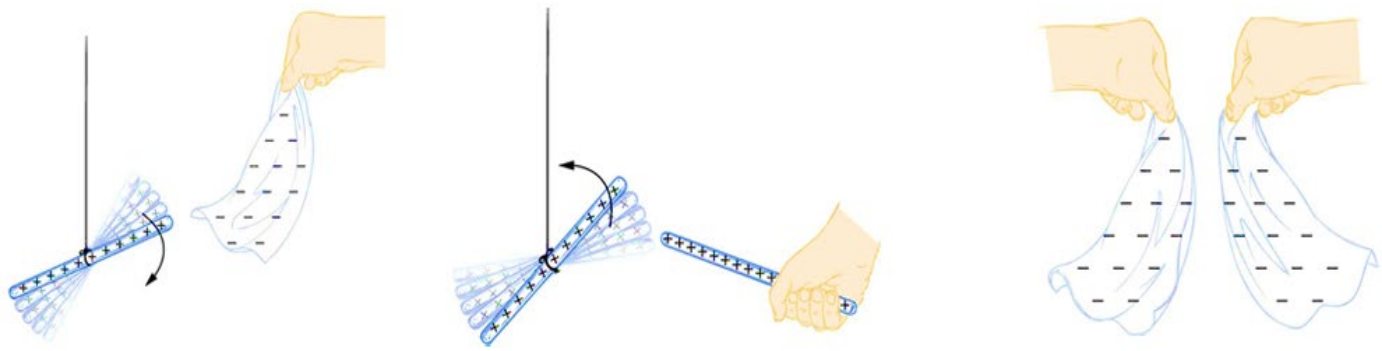
There are two types of electricity. **Static electricity** involves charge that is built up on insulators, usually by friction, and when there is a large force acting on the charge, the charge will suddenly move. **Current electricity** involves the movement of charge through a conductor and it flows continuously if a pathway is formed. Electric charge produced by friction is the same charge which, moving around a circuit, produces an electric current

Static Electricity

Static electricity is the build-up of electrical charges on the surface of a material, usually an insulator (non-conductor of electricity). It is called "**static**" because there is no current flowing, as there is in alternating current (AC) or direct current (DC) electricity.

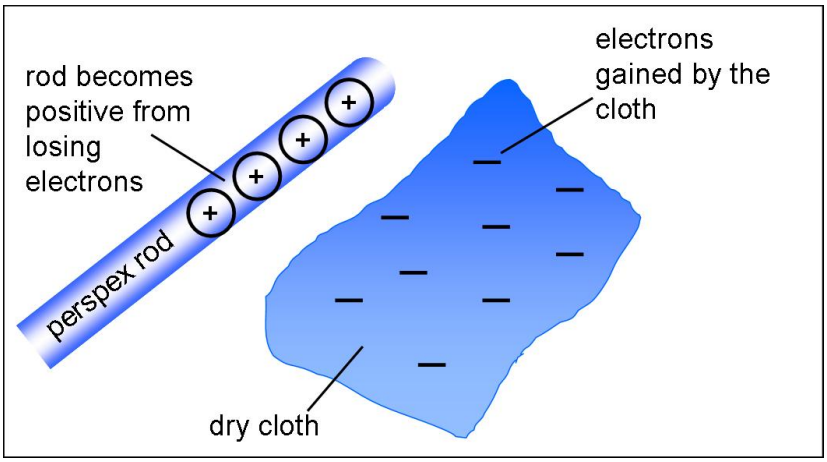
Usually, two materials are involved in static electricity, with one having an excess of electrons or negative (−) charges on its surface and the other material having an excess of positive (+) electrical charges. An object with no charge is neutral.

Attraction or repulsion



There are only two types of charge, which we call positive and negative. **Like charges repel**, **unlike charges attract**, and there are electric forces between charges. Both positive and negative charges exist in neutral objects, but they can be separated by rubbing one object with another. For objects (large enough to be visible), negatively charged means an excess of electrons and positively charged means a depletion of electrons (that have been removed). Charge is measured in coulombs (C)

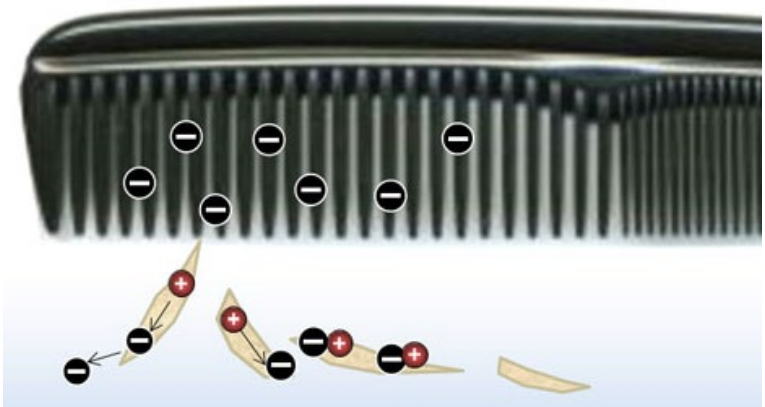
Law of Conservation of charge



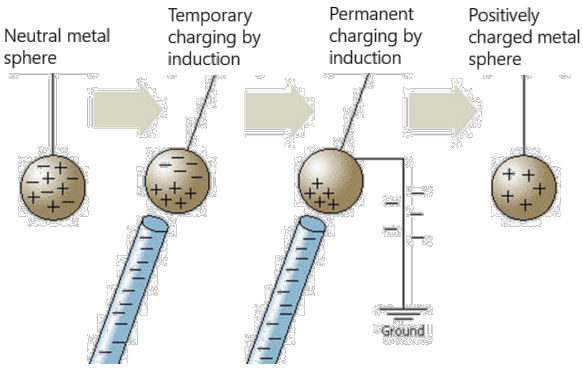
No charge is actually created or destroyed when charges are separated. Instead, existing charges are moved about. In all situations the total amount of charge is always constant. This universally obeyed law of nature is called the **law of conservation of charge.**

Charging by contact

Static electricity involves a build-up of charge when two different objects are rubbed together and electrons from one jump across to another. This is called **charging by contact**. Some materials, such as plastic, hold onto electrons better than others do and they will become negatively charged. The other object, due to electrons being lost, will become positively charged. The two objects are attracted to each other due to their positive and negative charges.



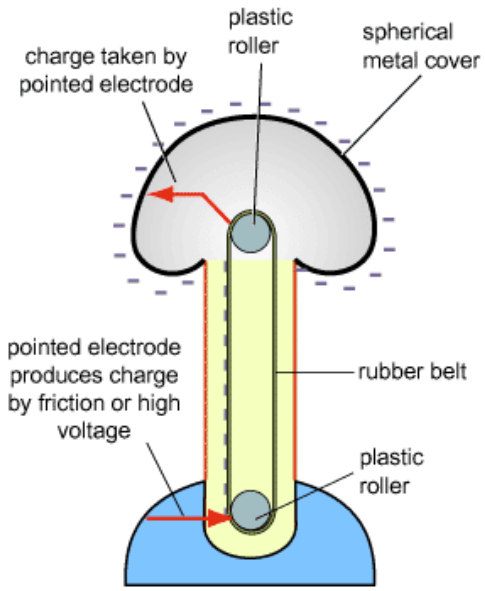
Charging by induction - EXTENSION



Objects can also be **charged by induction**. When a negatively charged object is held close to another object but not touching then the negative electrons are repelled and move away (if a path is created which "earths" the object) and the non-moving protons cause the object to be positively charged.

If the object being charged is not earthed, then as soon as the negatively charged object is moved away then then electrons will just shift back again and neutralise it once more.

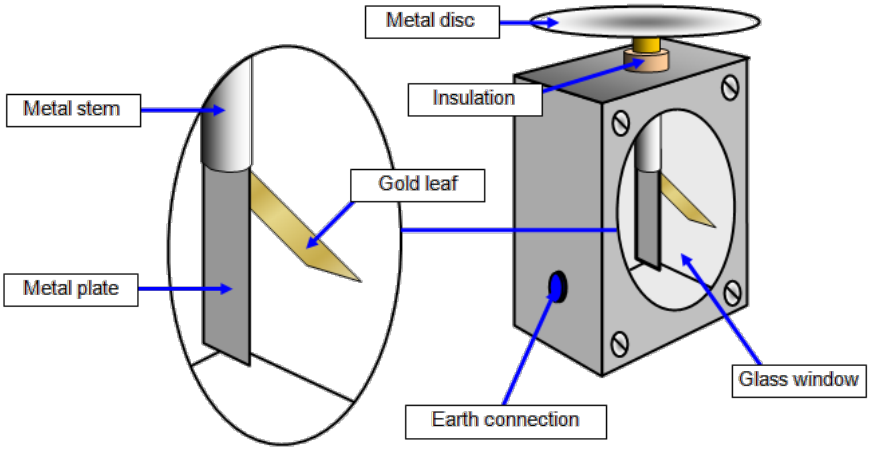
.Charge can be transferred using a van der Graaf generator



The van der Graaf generator produces and stores charge to create static electricity. A big rubber band moves over a piece of felt, which is insulated and creates friction and the negative electrons are "stripped away'. The electrons move up the rubber band to the metal ball and into a person whose hand is placed on the generator. By standing on an insulating surface, the charge cannot go through the body and get to the ground. The repelling electrons, trying to get as far away from each other as possible, cause the person's statically charged hair strands to repel each other and stick up.

Charge can be detected using an electroscope

An electroscope can detect charge by induction or contact. A charged object is placed on or near the metal disc. A negatively charged object will repel negative charge in the insulated electroscope. The negative charge will travel down to the gold leaf and metal plate (some electroscopes have two gold leaves).



The negatively charged leaf/plate will then repel each other and move apart. The more they more apart, the more the charge held in the original object

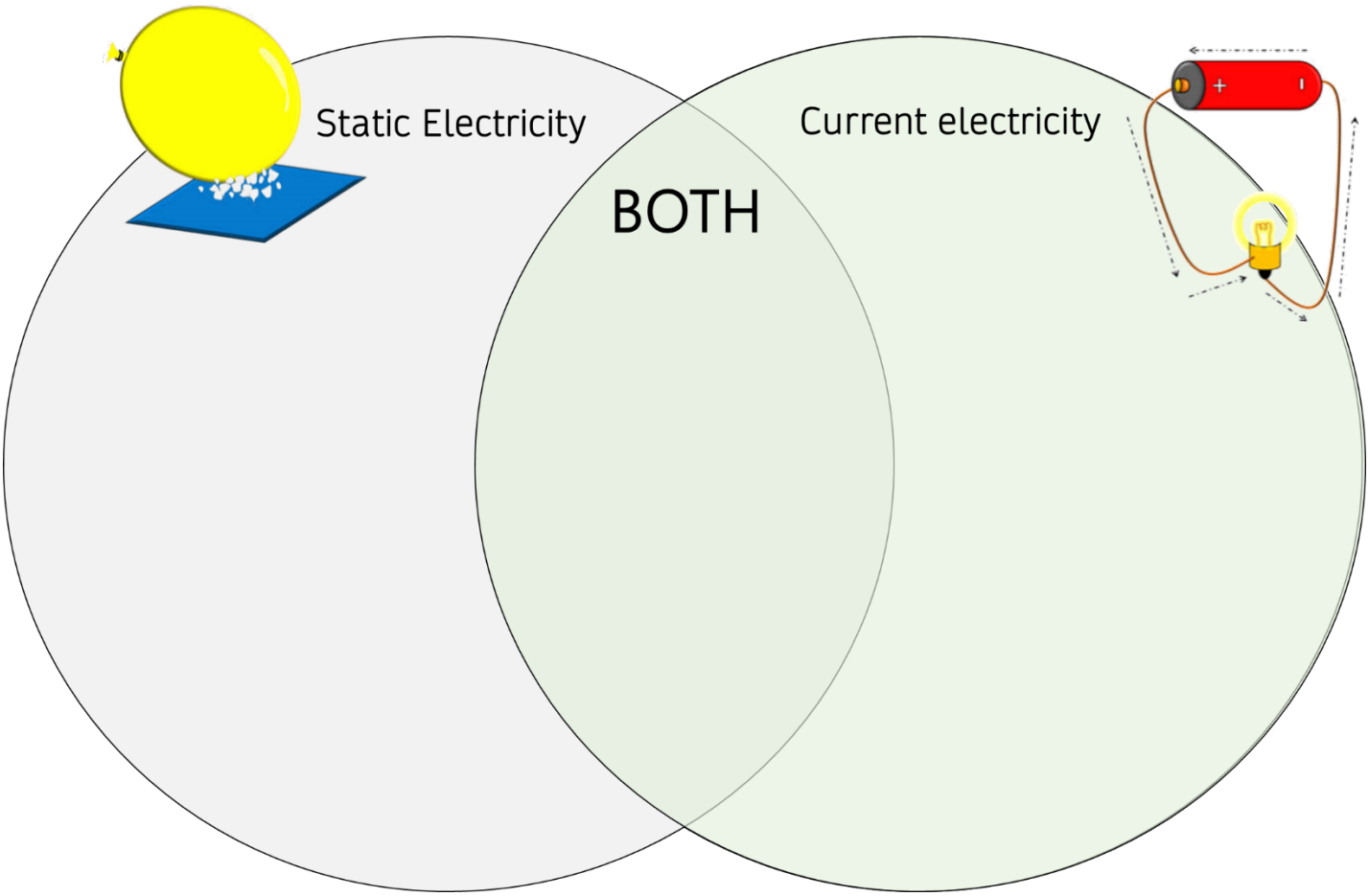
Electrical discharge in air

Electric discharge describes any **flow of electric charge** through a gas, liquid or solid. If there are enough positive (+) electrical charges on one object or material and enough negative (−) charges on the surface of the other object, the attraction between the charges may be great enough to cause electrons to jump the air gap between the objects. When charges move, we call it a **current**.

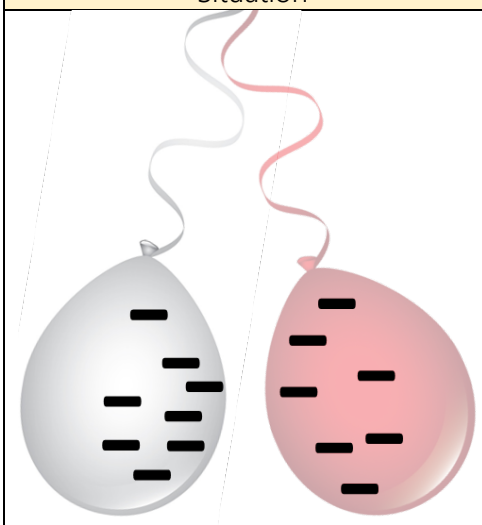
Once a few electrons start to move across the gap, they heat up the air, encouraging more electrons to jump across the gap. This heats the air even more. It happens rapidly, and the air gets so hot that it glows for a short time. That is a **spark**.

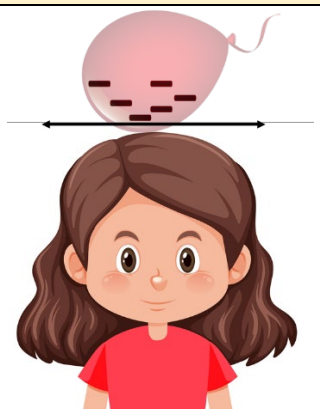
The same thing happens with lightning, except on a much larger scale, with higher voltages and current.

1. Use the Venn diagram below to show the similarities and differences between static and current electricity

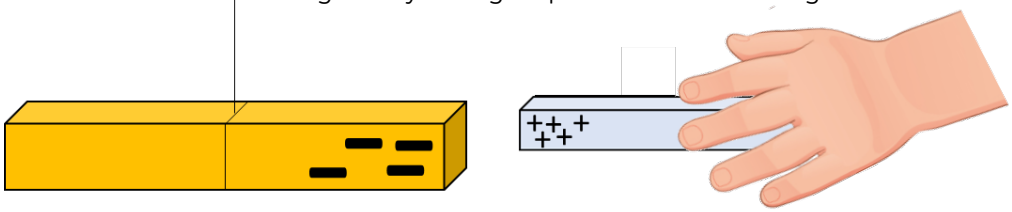


2. Describe your observations for each of these situations with charged non-conducting objects. Then explain that observation. You could also investigate each of these situations in your Science class.

Situation	Observation	Explanation
 Two negatively charged balloons on strings placed together		

Situation	Observation	Explanation
 A balloon is rubbed many times on hair then held close to head		
 A comb that is rubbed many times with a soft cloth is held next to pieces of tissue paper		

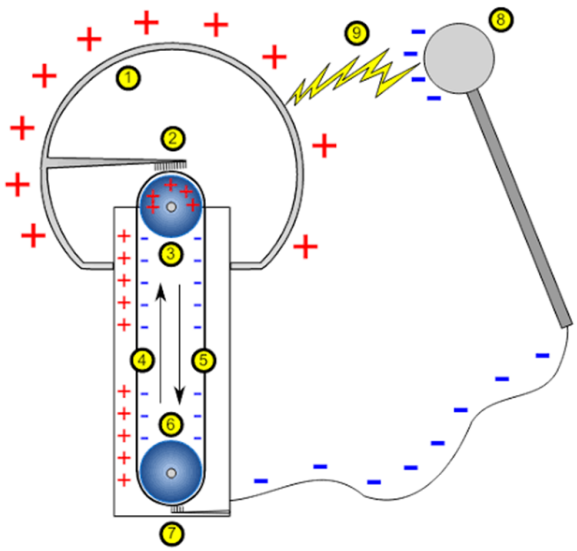
Positively charged Perspex rod is moved around close to a negatively charged plastic rod on string



Observation

Explanation

3a. Match the correct numbered parts of the van der Graaf generator to the description



https://commons.wikimedia.org/wiki/File:Van_de_graaf_generator.svg

Number	Description
	side of the belt with positive charges
	upper roller (Plexiglass)
	spark produced by the difference of potentials
	electrode connected to the sphere, a brush ensures contact between the electrode and the belt
	lower roller (metal)
	hollow metallic sphere (with positive charges)
	spherical device with negative charges, used to discharge the main sphere
	lower electrode (ground)
	opposite side of the belt with negative charges

3b. Why does a spark occur when the spherical device is held close to the van der Graaf generator? In your explanation use the terms: *imbalance, charge, discharge, positive, negative.*

4. Use the diagram of the electroscope to explain why the gold leaves push apart when a statically charged object is placed near the top plate.