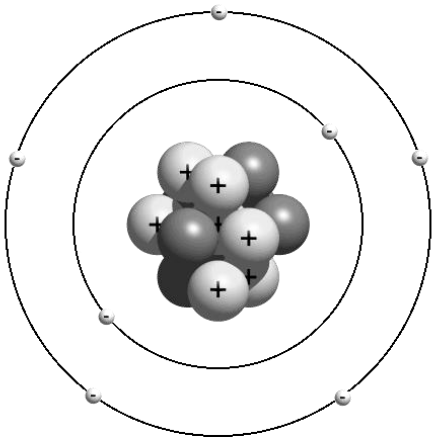
Lesson 1. Electric charge

Read the following two pages:

Electric charge

The atom

An atom is composed of three types of particles: protons, neutrons and electrons. The protons and neutrons form a tiny nucleus at the centre which is orbited by the electrons (compare with the planets orbiting the Sun – on a much bigger scale!). These particles have a property called electric charge.



Particle	Charge
proton	positively charged
neutron	no charge – electrically neutral
electron	negatively charged

An atom usually has the same number of protons and electrons, and because the amount of positive charge on a proton is the same as the amount of negative charge on an electron, an atom is therefore overall electrically neutral. However, for some atoms it is relatively easy to remove or add one or more electrons (it is much more difficult to affect the neutrons and protons 'hidden' away in the nucleus at the centre of the atom).

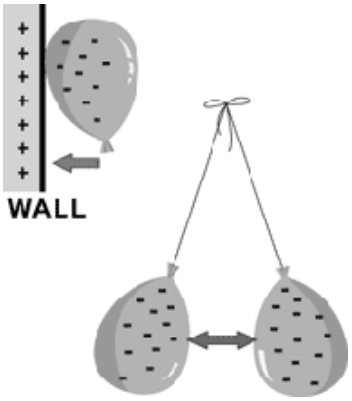
- If an atom gains electrons it will become overall negatively charged.
- If an atom loses electrons it will be left overall positively charged.

All the electrical effects which we will look at involve the movement of electrons.

(Origin of word electricity: William Gilbert in the 16th century did experiments involving charging materials by rubbing them. One of the materials he used was amber (fossilised tree resin) which in Greek is called *'elektron'*. He named the force which he observed between these charged materials 'electric'. The particle which we call the electron was first discovered in 1897 by J J Thomson who received the Nobel prize for his work.)

Charging objects and the electric force

You will probably have experienced the effects of **static electricity.** How many of the following have happened to you?

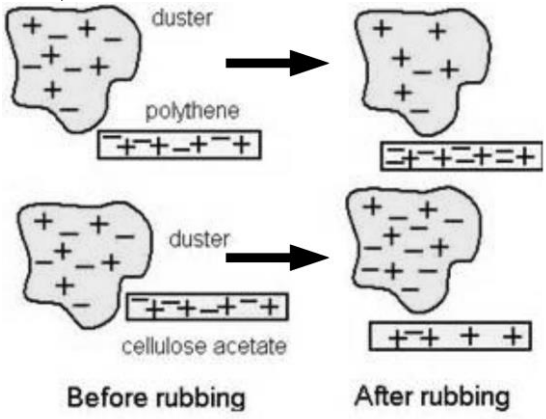


Your hair stands on end when you comb it.
You rub a balloon on your jumper and you can 'stick' it to a wall or it attracts your hair.
You walk across a synthetic carpet and you get an electric shock when you touch a metal door handle.
You get out of a car and get a shock when you touch the car door.
You get an electric shock when jumping on a trampoline.

You see and hear sparks when you remove a jumper.
You hear a crackling when removing clothes from the tumble dryer and they appear to stick together.

These are all examples of charging objects by rubbing them together. This can be demonstrated using polythene and acetate (which are different types of plastic) rods rubbed on a cloth:

- When a **polythene** rod is rubbed on a cloth, some ***electrons move*** from the atoms of the cloth on to the polythene – the polythene becomes **negatively** charged (and the cloth is left positively charged).
- When an **acetate** rod is rubbed on a cloth, some ***electrons move*** from the atoms of the acetate on to the cloth – the acetate is left **positively** charged (and the cloth becomes negatively charged).

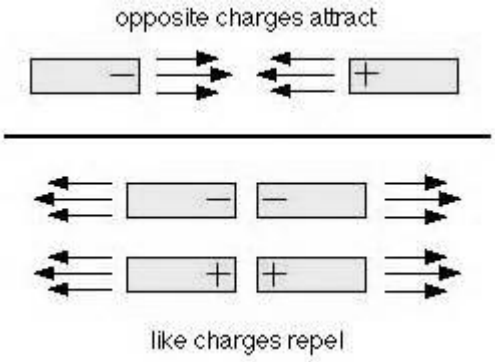


(Note that in both cases it is only electrons moving from one object to the other.)

This effect is called static electricity because the electrons remain stationary once they have been transferred onto an object. (In electric circuits which we will see later the electrons are always moving around the circuit.)

The electric force acts between charged objects:

- Two objects of the opposite charge will attract each other.
- Two objects of the same charge ('like charges') will repel each other.



Inside an atom the electrons orbit the nucleus. They are held in orbit by the attraction of the electric force between the positive charge on the protons in the nucleus and the negative charge on the electrons. (In the Solar System the planets are held in orbit around the Sun by the Gravitational force.)

Now view the first 26:30 minutes of the youtube video 'Zap, Crackle and Pop: The Story of Electricity'.

In your jotter or on a sheet of paper (if you have neither then make a Word file on your ipad) write the heading ‘Electricity. Lesson 1. Electric Charge’ then copy the following note and fill in the blanks:

An atom has a nucleus made up of _____ and _____ at the centre orbited by _____. The protons are _____ charged, the neutrons have no charge and the electrons have _____ charge.

When objects are rubbed together _____ can be transferred from the atoms of one object to the atoms of the other object. If an object gains electrons it will become overall negatively charged, if it loses electrons it will be left overall _____ charged.

An electric force acts between charged objects. Two objects of the _____ charge repel and objects of _____ charge attract.