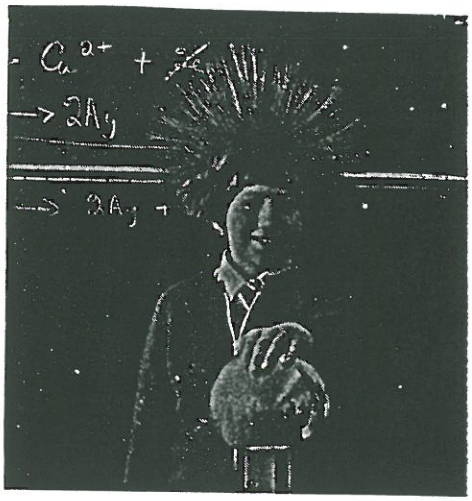
11.1 Electric charge

YEAR 9 Electricity Homework NAME: _____

It passes through the wires when you switch on the light and it causes lightning flashes. It makes polythene film stick to your hands and dust stick to your records. It can even make your hair stand on end!

It's called electric charge—no one knows what it is but a great deal is known about where it comes from and the way it behaves.



The electric atom

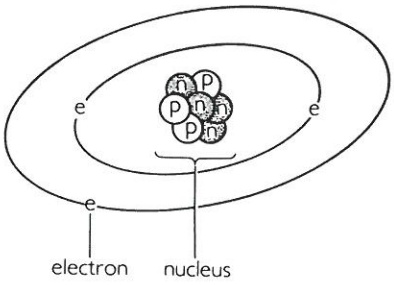
In the centre of an atom there is a *nucleus* made up of particles called *protons* and *neutrons*. Around this nucleus orbit very much lighter particles called *electrons*.

Electric charge is carried by the electrons and protons in every atom. There are different types of charge:

the charge on an electron is called a *negative* (−) charge;
the charge on a proton is called a *positive* (+) charge.
There is no charge on a neutron.

Normally, atoms have equal numbers of electrons and protons—they have equal amounts of − and + charge within them.

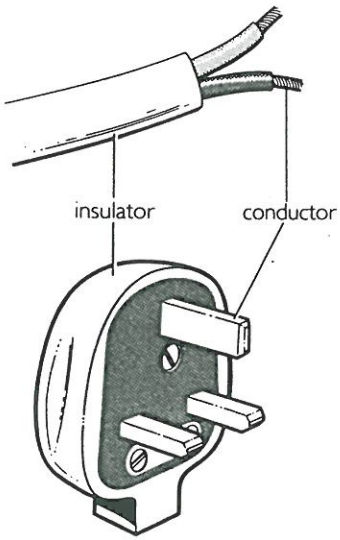
Electrons do not always stay attached to atoms. When you switch on a light, the 'electricity' that travels through the wires is actually a flow of electrons.



Conductors and insulators

Materials that allow electrons to pass through them are called *conductors*. All metals are good conductors of electricity, so is carbon. In a conductor, some of the electrons are not very tightly held to the atoms and are free to travel through the material.

Most non-metals conduct poorly or not at all. Materials that do not normally allow electrons to pass through them are called *insulators*: their electrons are all tightly held to atoms and are not free to move.



Conductors		Insulators	
Good	*Bad*	rubber	glass
metals	water	plastics	dry air
especially	the human body	e.g.	
silver	earth	PVC	
copper		polythene	
aluminium		cellulose acetate	
carbon			

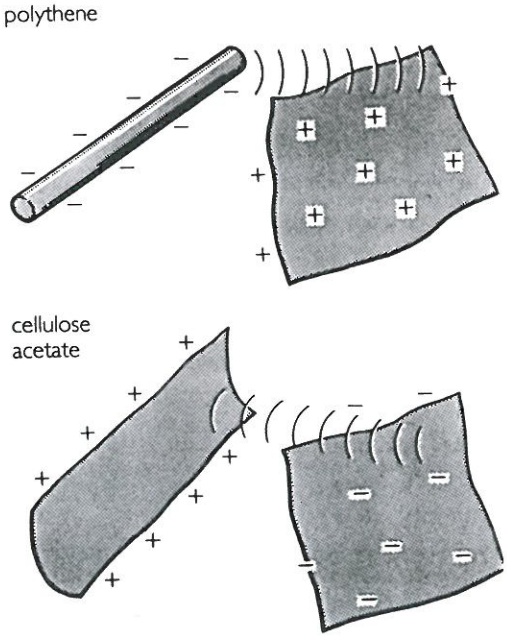
Static electricity

If a material gains or loses electrons, there is no longer an exact balance between the − and + charges within it—the material is said to be *charged*. Charged materials are sometimes said to have 'static electricity' on them.

Charging by rubbing Insulators become charged when they are rubbed:

A piece of polythene gains − charge when rubbed with a cloth. The polythene pulls electrons away from atoms in the cloth, leaving itself with more electrons than normal and the cloth with less. The charge stays on the polythene because polythene is an insulator—the extra electrons are unable to flow away through the material, though in time they leak into the air.

A sheet of cellulose acetate is left with a + charge when rubbed with a cloth. The cloth pulls electrons away from some of the atoms in the sheet, leaving the atoms with more protons than electrons.



Forces between charges An electric charge will push or pull on any other charge nearby.

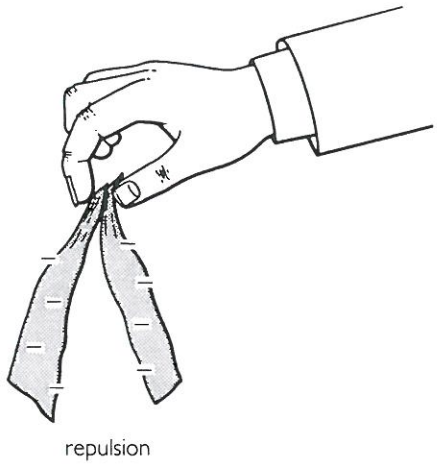
If two charged strips of polythene are held together at one end, the strips are pushed apart:

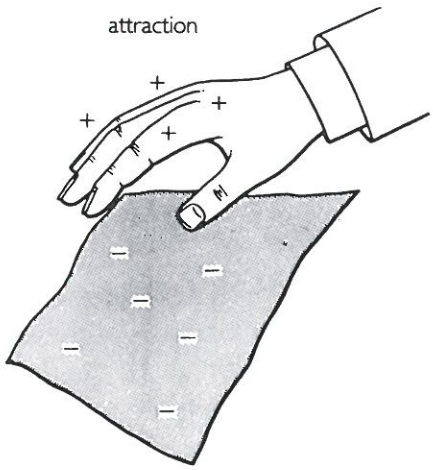
Like charges repel each other.

If you pull a polythene bag quickly through your hand, the polythene gains a − charge and your hand is left with a + charge. The bag clings to your hand because the − and + charges pull on each other:

Unlike charges attract each other.

The attraction between unlike charges makes dust cling to records and can even cause sparks when you take off nylon or Terylene clothing—the sparks occur when electrons are pulled strongly enough to make them jump through air.





Questions

1. What type of charge is on a) an electron; b) a proton?
2. A sodium atom has 11 protons. How many electrons does it have?
3. What actually travels through the wires when you switch on a light?
4. What is the difference between a conductor and an insulator? Name two good conductors.
5. What insulator would you rub with a cloth to produce a) a negative charge; b) a positive charge?
6. How could you show that like charges repel each other?
7. How could you show that unlike charges attract each other?

8 Summarise the information into a Mind Map - using an A4 sheet.