1.1 Charging up

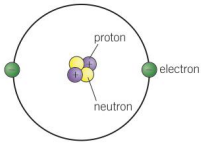
Learning objectives

After this topic you will be able to:

- explain how objects can become charged
- describe how charged objects interact
- describe what is meant by an electric field.

Because of static electricity you can stick a balloon to a wall or bend a stream of water. Static electricity produces lightning. What is static electricity, and where does it come from?

▲ You can bend a stream of water with static electricity.



▲ An atom contains three types of particle.

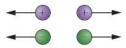
Link

You can learn more about atoms in C1 2.2 Atoms

Attracting and repelling

There are two types of **electric charge**: **positive** charge (+) and **negative** charge (–). Charges **attract** or **repel** each other, like magnets do.

- **Positive** charges *repel* **positive** charges.
- **Negative** charges *repel* **negative** charges.
- **Positive** charges *attract* **negative** charges.



▲ Repelling.

▲ Attracting.

Memory jogger

Remember it like this: 'Like charges repel, unlike charges attract.'

A State the two types of electric charge.

Where does the charge come from?

Everything is made of particles called **atoms**.

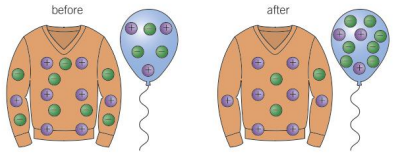
Atoms in turn are made of three types of smaller particle:

- **protons**, which have a positive charge
- **electrons**, which have a negative charge
- **neutrons**, which have no charge.

Charge is a property of a particle or object, just like mass.

Atoms contain equal numbers of protons and electrons. Overall an atom has no charge: it is **neutral**.

When you rub a balloon on your jumper some electrons are transferred from the jumper to the balloon. The balloon now has an overall negative charge. Your jumper has an overall positive charge. They will attract.



▲ Rubbing a balloon transfers electrons from your jumper to the balloon.

The balloon is made of rubber. The electrons stay on the balloon.

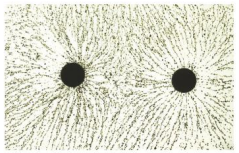
B State the charge on an electron, a proton, and a neutron.

Lightning

In a thundercloud air moves around, producing regions that have a positive or a negative charge. Electrons jump from one charged area to another and this produces a big **current**, which quickly heats the air. You see **lightning** and hear thunder.

What is an electric field?

There is an **electric field** around a charge, just as there is a gravitational field around a mass. If you put a charged object in an electric field, a force will act on it.



◀ Pepper grains line up in an electric field. This shows the electric field between two charges that are repelling.

Atomic puzzle

Unscramble the words below and pair them up. Explain why you have chosen to pair them that way.

notpro oneturn iviespot gianteve laterun centrelo

Key Words

electric charge, positive, negative, attract, repel, atom, proton, electron, neutron, neutral, current, lightning, electric field

▲ Lightning can strike a plane.

Fantastic Fact

Since you took your last breath lightning has struck the Earth 100 times. On average, airliners will get struck by lightning once a year.

Summary Questions

1 Copy and complete the sentences below.

There are two types of electric charge: _____ charge and _____ charge. When you rub a polythene rod with a cloth you transfer _____ from the cloth to the rod. Two polythene rods would _____ if you brought them close together. A polythene rod would _____ a rod that had a positive charge.

(5 marks)

2 A student rubs a balloon on his jumper and sticks it to the wall. Explain in terms of electrons why the balloon sticks to the wall.

(3 marks)

3 Compare a gravitational field and an electric field.

(6 marks)