Name _____ N°___

Surname _____

NATURAL SCIENCE

ELECTRICITY & MAGNETISM

ELECTRICITY & MAGNETISM

In this unit we are going to learn about:

1. Magnetism
2. Magnets
   - Types of magnets
   - The poles of a magnet
   - Magnetic fields.
3. The Earth is a magnet
4. Magnetism and electricity
5. Electromagnetism
6. Magnets and electromagnets around us

MY VOCABULARY

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1. MAGNETISM

A magnet is an object that can attract certain types of metal, such as iron and mixtures of iron, such as steel. The ability to attract magnetic materials is called **magnetism**.

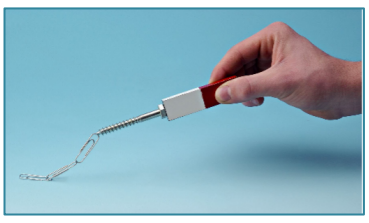
2. MAGNETS

Magnets can be **natural** or **artificial (man-made)**. The mineral **magnetite** is a natural magnet, but most of the magnets we use today are man-made, which are made of magnetic metals. Minerals such as **iron**, **nickel** and **cobalt** are **magnetic metals**. Magnetic materials are always metallic, but not all metals are attracted to magnets.

TYPES OF MAGNETS

- Permanent magnets never lose their magnetism. They cannot be switched on and off; they **always** have a magnetic field. Bar magnets are permanent magnets. This means they can't be switched on and off: they always have a magnetic field

- Temporary magnets (or **induced magnets**) have **temporary** magnetic force. For example, if you pick up a paper clip with a magnet, the paper clip will become temporarily magnetised. When you remove the magnet, the paper clip will lose its magnetic force. **Electromagnets** are temporary magnets as they are only magnets when an electric current flows through them. When we switch off the current the electromagnet loses its magnetism.



https://mocomi.com/transfer-of-magnetism/

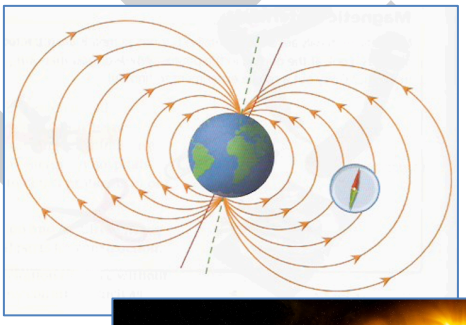
The screw is a temporary magnet. It attracts paperclips which it is joined to a magnet.

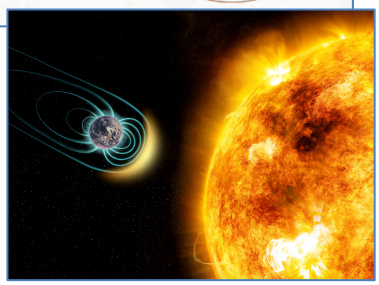
HOW CAN WE IDENTIFY A MAGNET?

Think about what magnets attract and what they repel. Magnets attract other magnets, and also other substances: some of these substances may be magnets, but some are not.

Magnets repel other magnets, but they don't repel other substances. So, we can identify a magnet by testing what it repels.

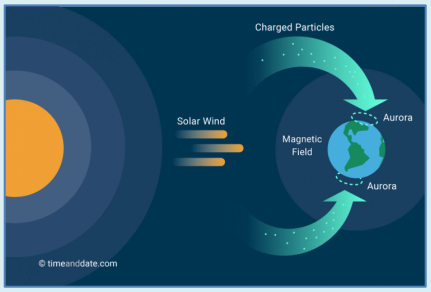
3. THE EARTH IS A MAGNET





The Earth's molten **iron** and **nickel core** acts like a huge magnet. Because it's liquid, it moves slowly as the Earth rotates on its axis. Like all magnets, it creates a magnetic field around itself. This magnetic field is called the **magnetosphere** and it deflects (changes direction) cosmic rays and **protects our atmosphere**. The magnetosphere extends all around the Earth and into the atmosphere around it. Without the magnetosphere, the outer layers of the atmosphere would be **damaged** by **solar radiation**. As a result, dangerous radiation would reach the surface of the Earth and harm plants and animals and many species would quickly become extinct.

AURORAS



The Earth's magnetic field protects our planet from **cosmic rays**. However, some of them enter the Earth's atmosphere at the magnetic poles. They combine with the **gases** in the atmosphere to produce incredible light effects. These are called ***Aurora Borealis*** in the Northern Hemisphere and the ***Aurora Australis*** in the Southern Hemisphere.

4. MAGNETISM AND ELECTRICITY

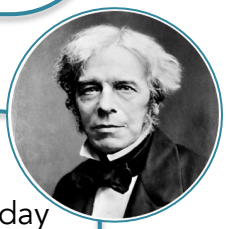
The connection between electricity and magnetism was discovered by **Hans Christian Oersted** in 1820. He noticed that his compass was affected when an electric current was switched on and off nearby.

HANS CHRISTIAN OERSTED

Oersted discovered that, in addition to producing thermal energy, an **electric current produces a magnetic force**. This force can be seen if we place a compass next to a wire in a simple electric circuit. When the circuit is switched on, the compass needle moves. When the circuit is switched off, the needle returns to its original position. Oersted saw this happen, but he couldn't explain the phenomenon. Two other scientists heard about his discovery and decided to investigate further.

ANDRÉ -MARIE AMPERE

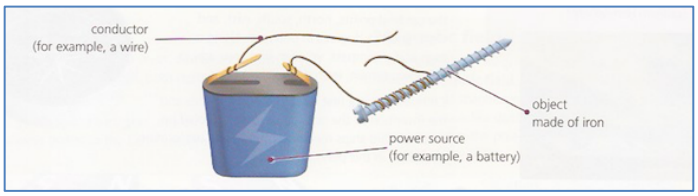
When Ampere heard about Oersted's discovery, he studied the relationship between electricity and magnetism. One of his most important discoveries was the **electron**. Ampere discovered that a **common particle was producing both electricity and magnetism**. He called this particle the **"electrodynamic molecule"**. Many years later, other scientist renamed the particle that Ampere had discovered: they called it the "electron".

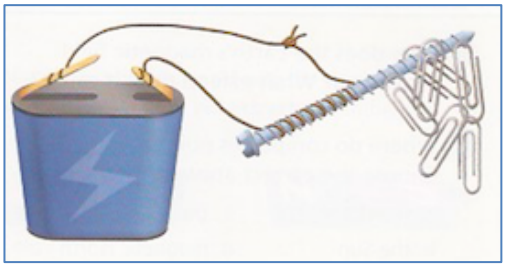


MICHAEL FARADAY

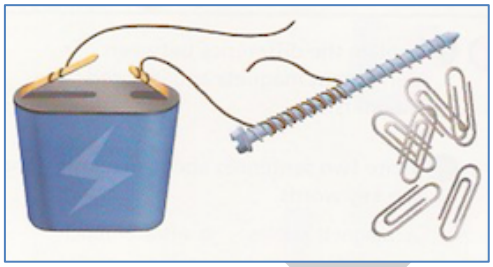
Like Oersted and Ampere, Faraday experimented with electricity and magnetism. He showed that by moving a loop of wire over a magnet, and electric current was produced in the wire. His experiments proved that a **changing magnetic field produces an electric field**. He called this invention the **"electromagnetic rotatory device"**. This invention was the basis for the first electric motor, or **dynamo**. Modern electrical generators are still based on this principle.

ELECTROMAGNET





The iron object becomes magnetised when the circuit is **closed**.



When the circuit is **open**, the iron object loses its magnetic force.

6. MAGNETS AND ELECTROMAGNETS AROUND US

An **electromagnet** is made by rolling **copper wire** around a **bar made of iron**. When the copper wire is connected to a source of electricity, such as a battery, a magnetic field is created. The **iron core becomes a magnet** and attracts objects made of magnetic metals. When there is no flow of electric current, electromagnets lose their magnetism.

We use **magnets** every day, from holding a list in the refrigerator door, or to listen to music through headphones, or to pay with a credit card.

Electromagnets are much stronger than ordinary magnets. When we increase the electric current that flows through them, they become even stronger. They are used in motors, generators, electric bells, loudspeakers and in the hard disks of a computer. Many **home appliances**, such as hairdryers, blenders or washing machines, use motors to convert electricity into mechanical energy. In **hospitals**, magnetic resonance imaging (MRI) is used to detect problems in our organs. It uses electromagnets too.

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