

MAGNETISM

Specification

Magnetism and electromagnetism

Magnetism

understand that magnets repel and attract other magnets and attract magnetic substances

describe the properties of magnetically hard and soft materials

understand the term 'magnetic field line'

understand that magnetism is induced in some materials when they are placed in a magnetic field

describe experiments to investigate the magnetic field pattern for a permanent bar magnet and that between two bar magnets

describe how to use two permanent magnets to produce a uniform magnetic field pattern.

Magnets and magnetic materials

Magnets attract objects made of magnetic materials

Magnetic materials include the elements **iron, nickel, cobalt**, alloys containing some of these such as **steel** and some of their compounds.



iron

nickel



cobalt



**stainless
steel**

Hard and soft magnetic materials

Permanent magnets are made of magnetically **HARD** materials such as **steel**. These materials retain their magnetisation once magnetised.

Magnetically **SOFT** materials, such as **iron**, lose their magnetisation easily. They are suitable for temporary magnets such as **electromagnets**.



Magnetic poles

Magnetic poles are the parts of a magnet that exert the greatest force.

Magnetic poles occur in pairs usually called **north (N)** and **south (S)**



Iron filing are attracted mostly to the poles of a magnet

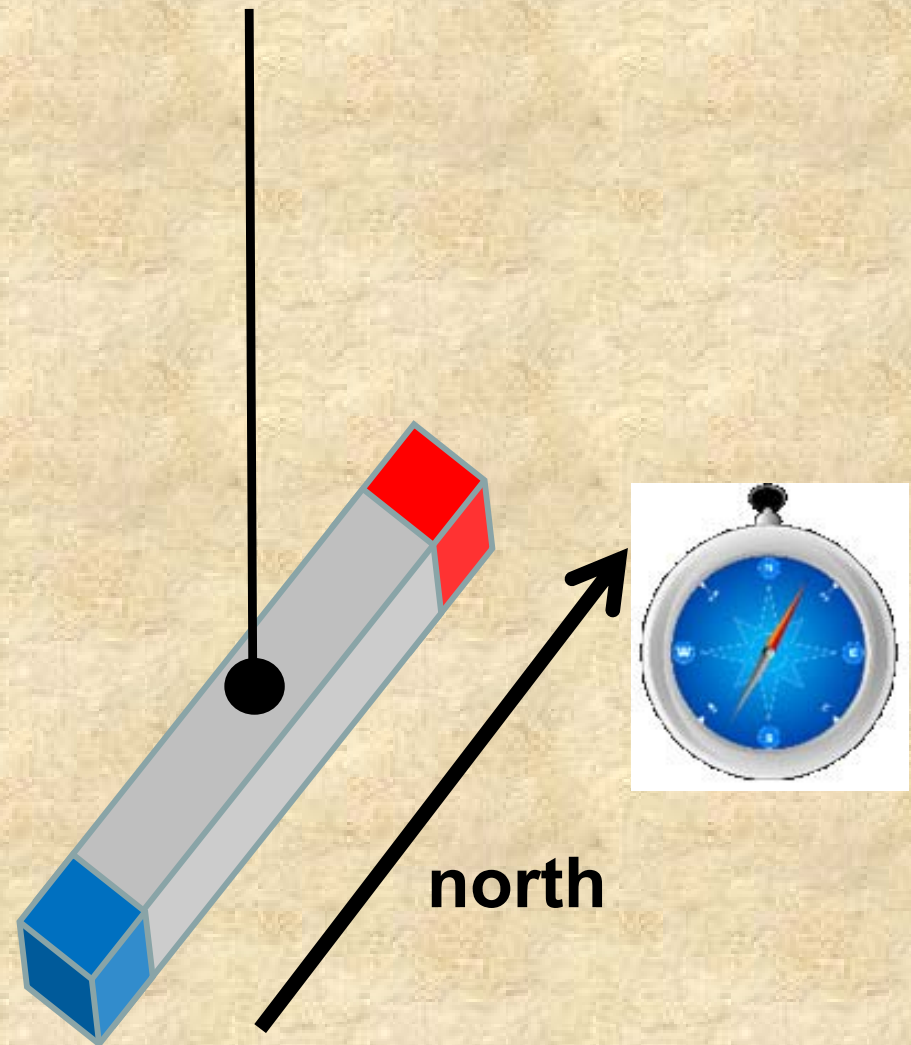
Why poles are called **north** and **south**

A magnet suspended so that it can rotate freely horizontally will eventually settle down with one pole facing north and the other south.

This pole is therefore called the '**north seeking pole**', usually shortened to just '**north pole**'.

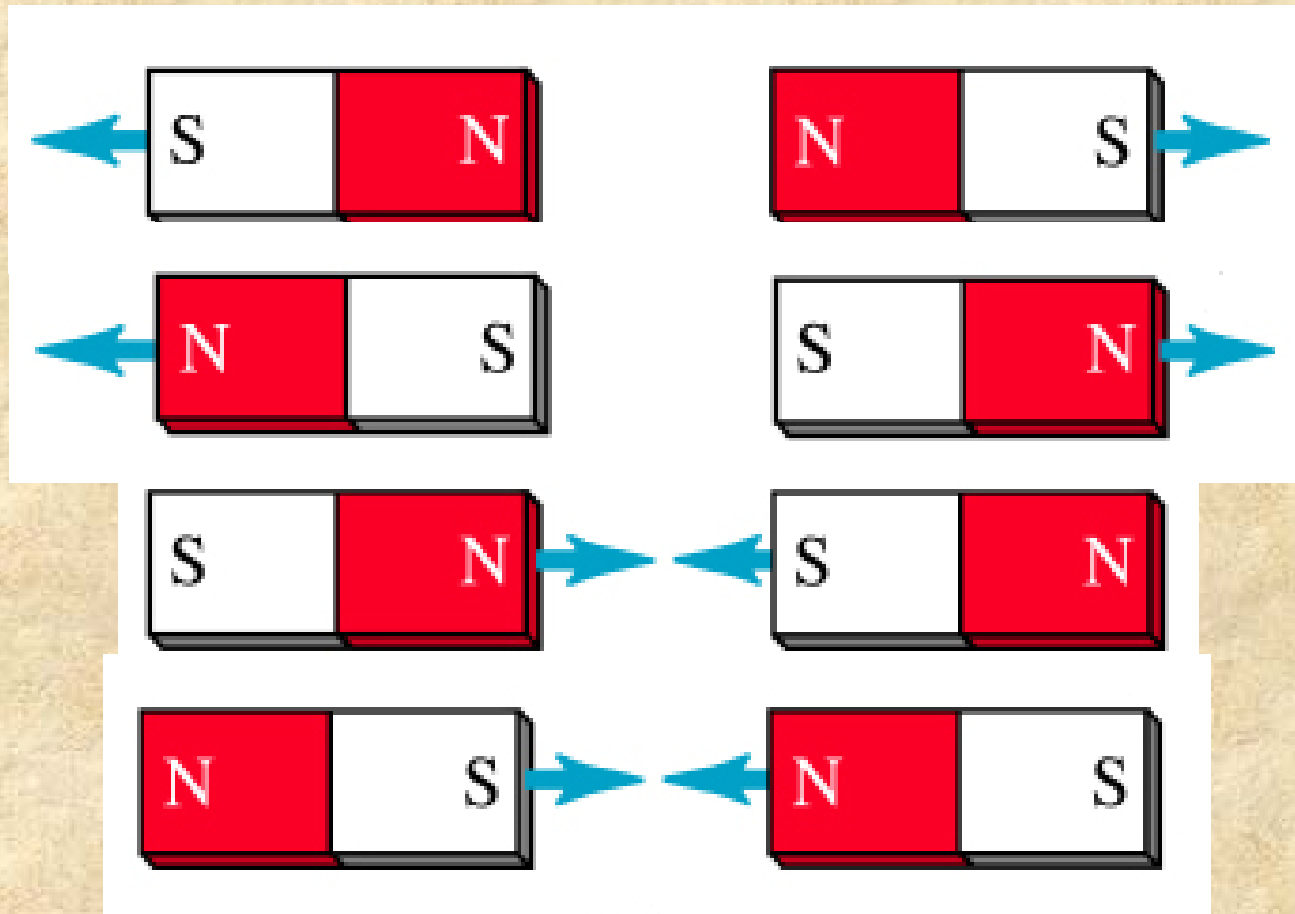
The magnet has been orientated by the Earth's magnetic field.

A **compass** is an application of this effect.



The law of magnets

Like poles repel **unlike poles attract**

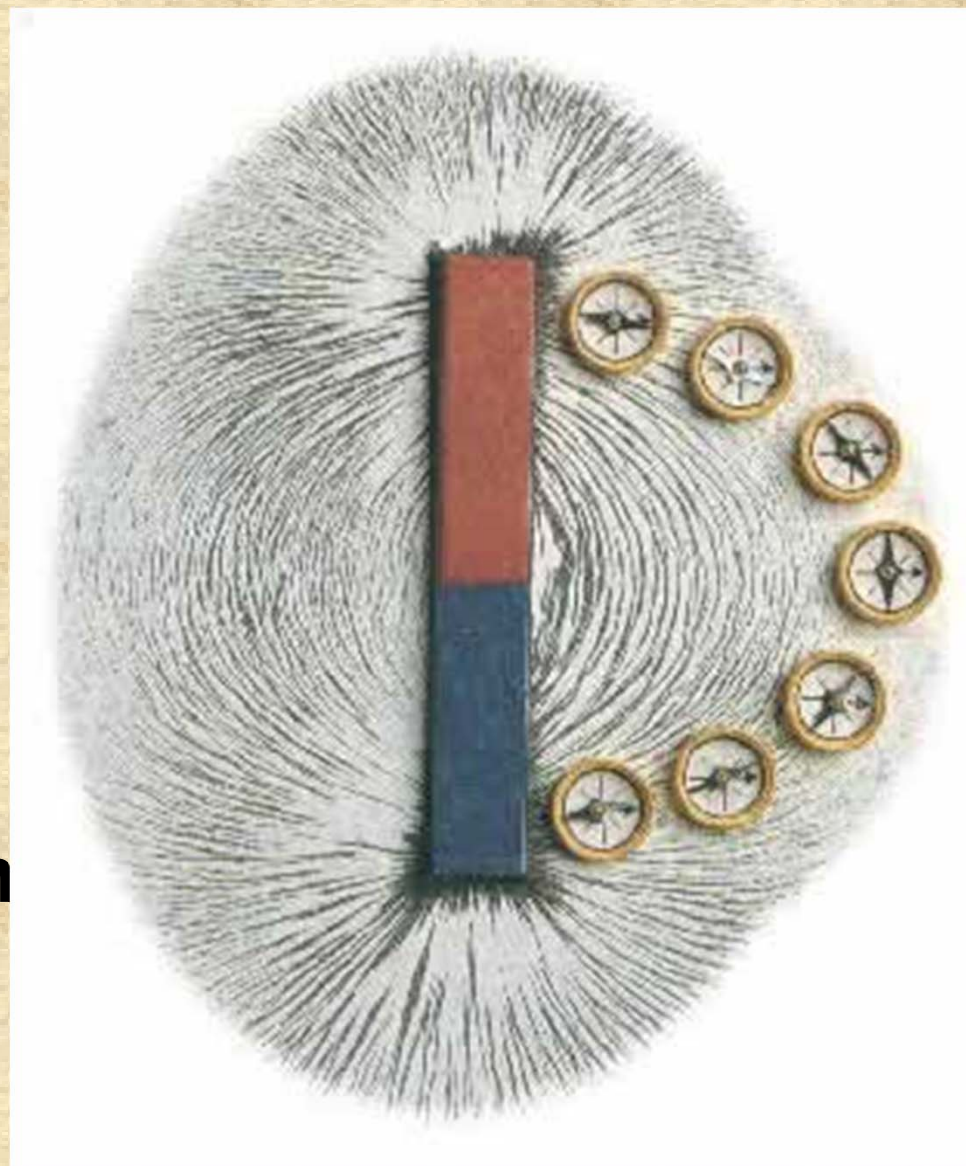


Magnetic fields

A magnetic field is a volume of space where magnetic force is exerted.

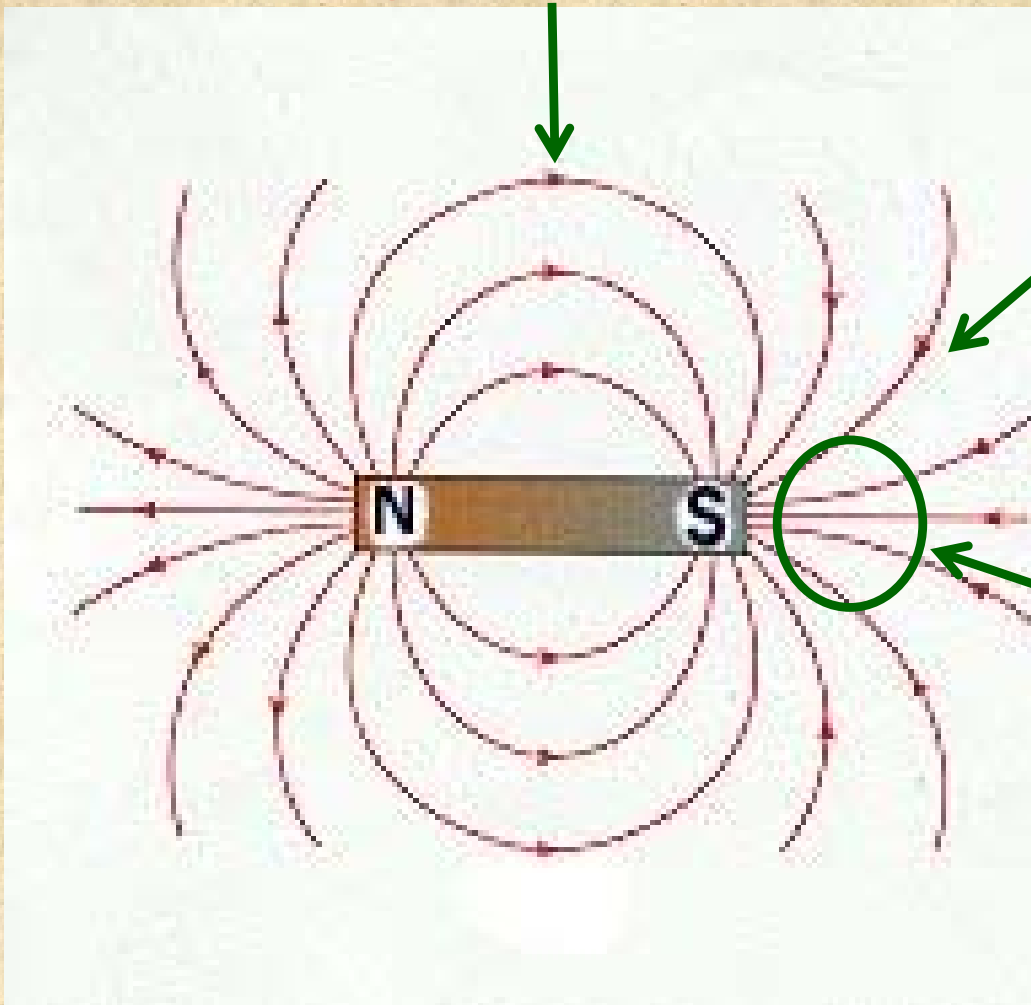
All magnets are surrounded by magnetic fields.

The shape of a magnetic field can be shown by **iron filings** or **plotting compasses**.



Magnetic field around a bar magnet

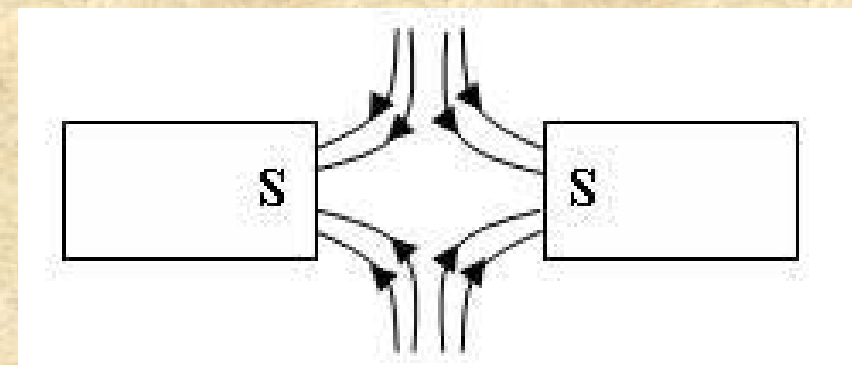
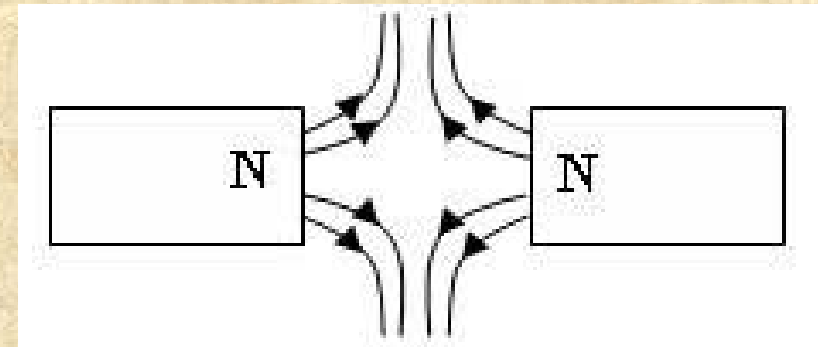
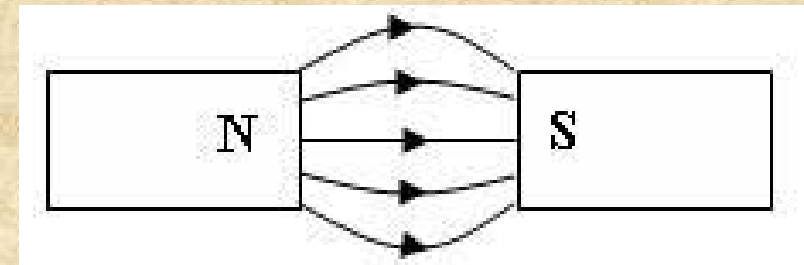
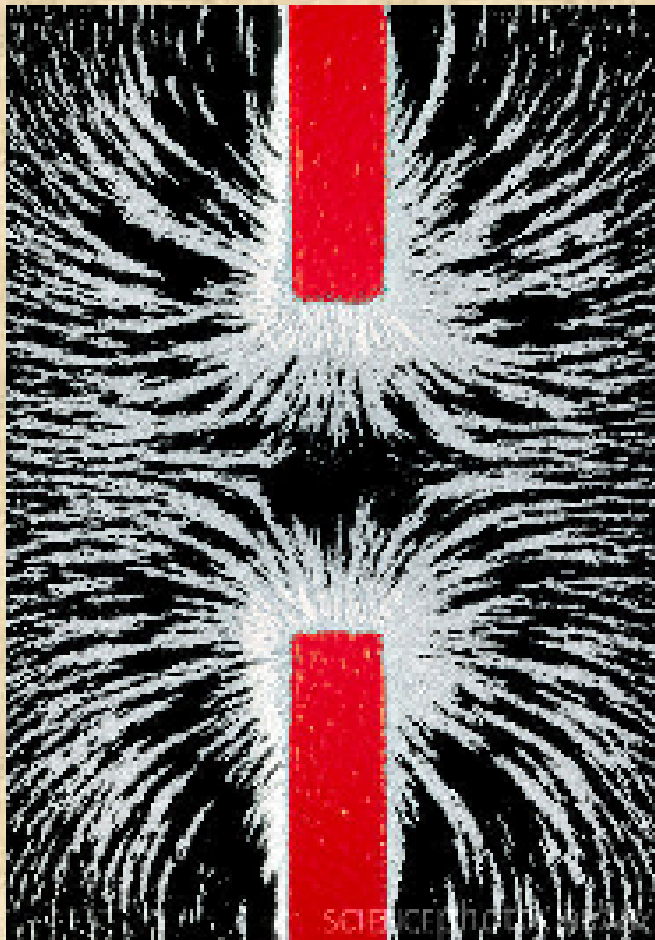
magnetic field line



Arrows on the field lines show the direction of the force on a free to move north pole

The stronger the magnetic field the denser the magnetic field lines.

Magnetic fields between two bar magnets

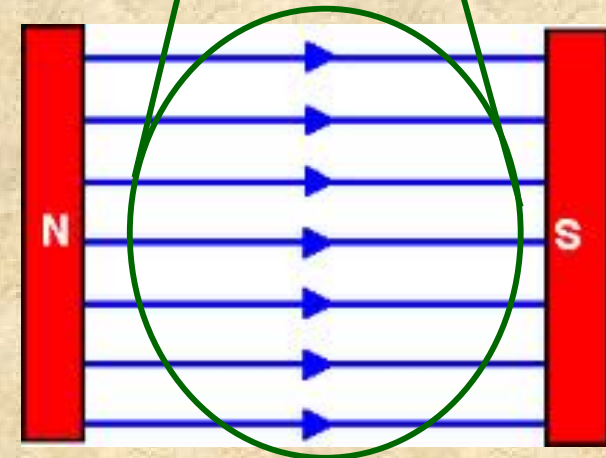
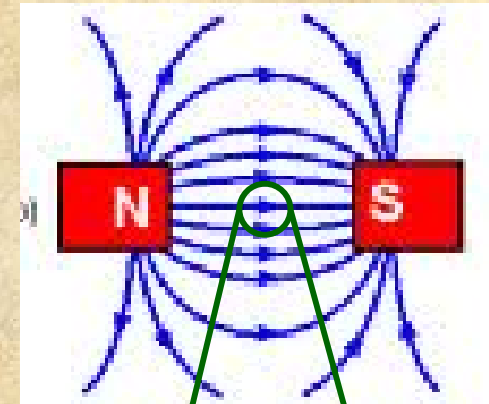


Producing a uniform magnetic field

A uniform magnetic field exerts a constant force over a region.

Such a field will consist of parallel equally spaced magnetic field lines.

This type of field can almost be found between a north and south magnetic pole.



The Earth's magnetic field

The earth's magnetic field is similar in shape to that around a bar magnet.

It is thought to be caused by electric currents flowing through the molten outer core of the Earth.

At the present the field pattern is like that with a magnetic **SOUTH** pole situated somewhere below northern Greenland

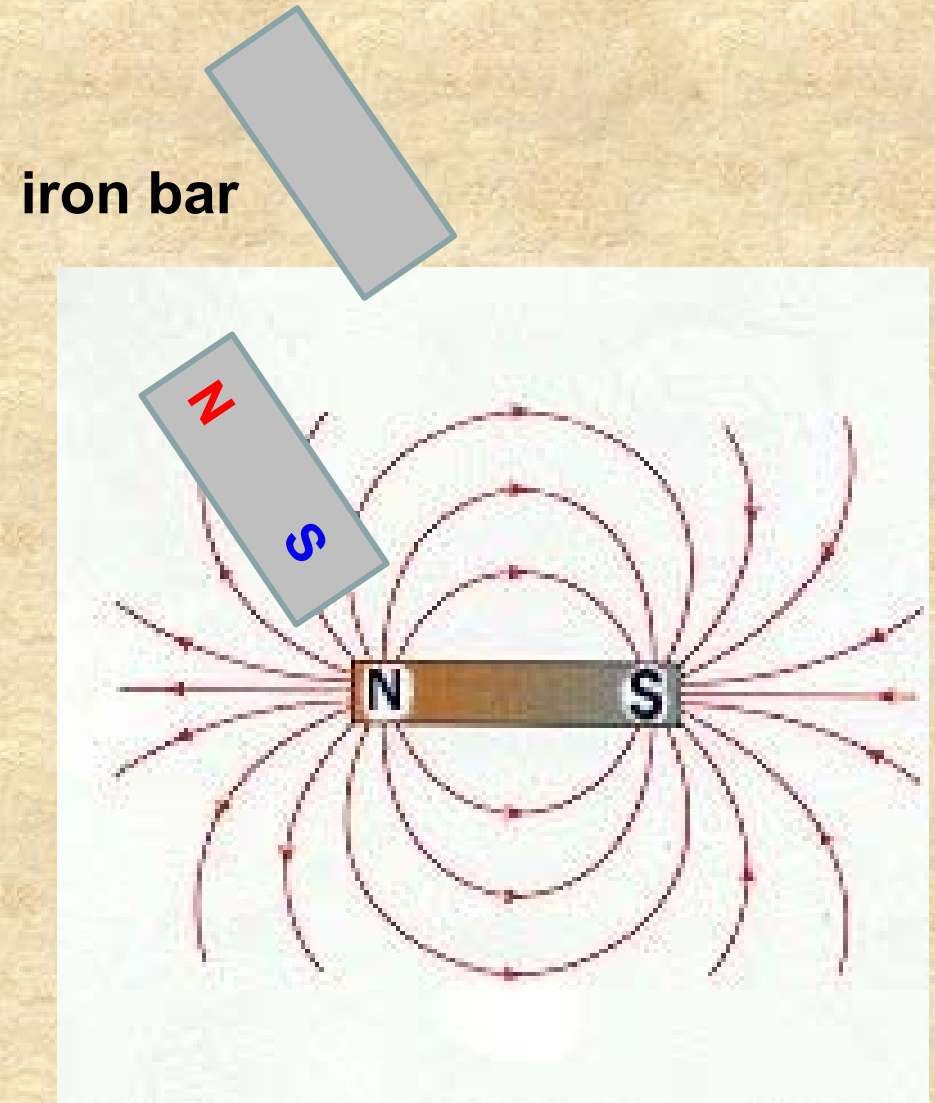


Induced magnetism

Magnetism can be induced in a magnetic material if it is placed within a magnetic field.

If the material is magnetically **hard** it will retain its magnetism once removed from the field.

Certain rocks in the Earth's crust such as **lodestone** have been magnetised in this way by the Earth's magnetic field.



Choose appropriate words to fill in the gaps below:

Magnetic materials are either hard or _____. Hard magnetic materials such as _____ retain their magnetisation once magnetised.

A magnetic _____ is a region where the magnetic force is greatest. Magnetic poles always occur in _____. Like poles _____, unlike attract.

A magnetic _____ is a region where magnetic force is exerted. The _____ of the magnetic field around a bar magnet is from north to south.

WORD SELECTION:

pole repel steel pairs field direction soft

Choose appropriate words to fill in the gaps below:

Magnetic materials are either hard or soft. Hard magnetic materials such as steel retain their magnetisation once magnetised.

A magnetic pole is a region where the magnetic force is greatest. Magnetic poles always occur in pairs. Like poles repel, unlike attract.

A magnetic field is a region where magnetic force is exerted. The direction of the magnetic field around a bar magnet is from north to south.

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