



Magnetic Materials	Magnetic Fields	Earth's Magnetic Field	Electromagnets	Uses of Electromagnets	DC Motors
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Key Words

Key Word	Definition
Magnetic materials	A material that interacts with magnets and magnetic fields
Magnetic Field	The area around a magnet where a magnetic force may be felt
Attract	To pull together by force
Repel	To push apart by force
Magnetic Pole	The ends of magnets. Magnetic field lines flow out of North poles and into South poles
Electromagnet	A magnet produced using electric current. It is built using a coil of wire around an iron core
Motor Effect	When a current-carrying wire in a magnetic field experiences a force

Misconceptions

Copper and aluminium are magnetic

- They aren't.

You can tell is a material is a magnet because it can attract another magnet.

- This just tells you it is magnetic. It should repel as well

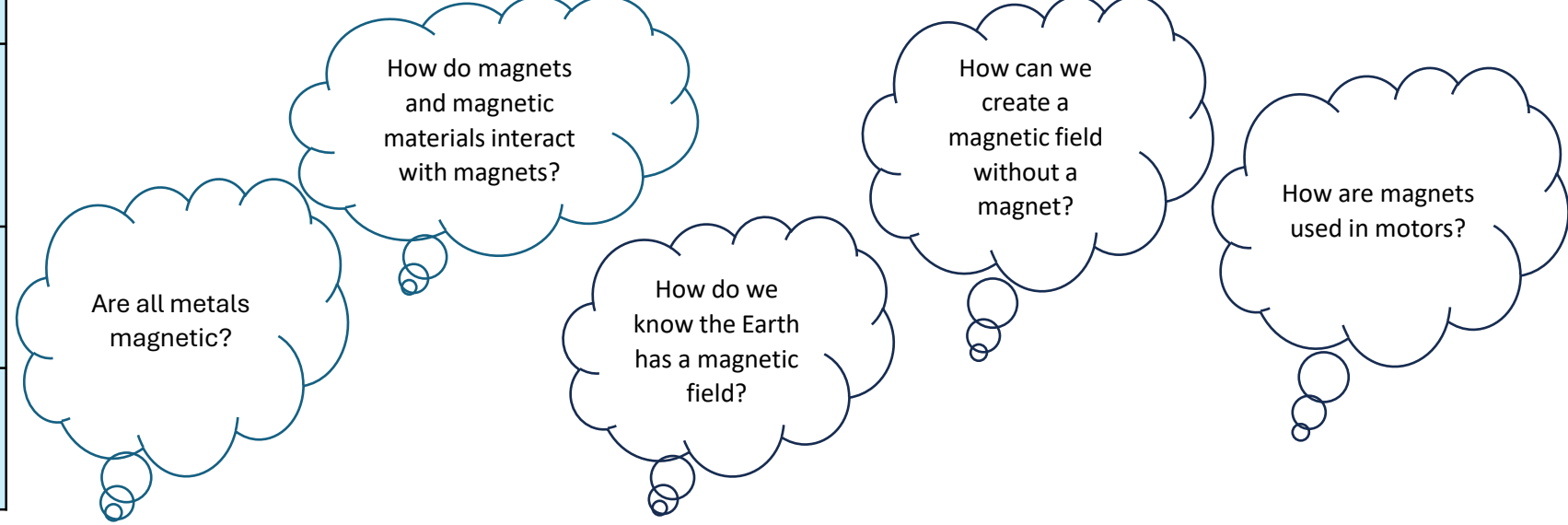
Field lines go in circles around a bar magnet

- They flow from north to south

The Earth's magnetic north pole is at the geographic north pole.

- The magnetic south pole is.

Key questions



Magnets and Magnetic Materials

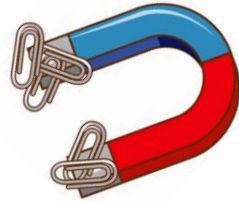
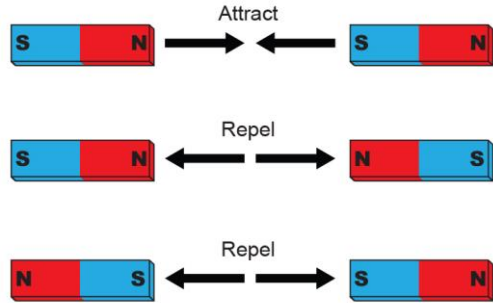
Magnets produce magnetic fields.

They have a North and South pole.

Similar poles of a magnet attract.
Opposite poles repel.

Magnetic materials are attracted to both poles of a magnet.

The magnetic materials are iron, nickel, cobalt, and steel.
Steel is magnetic as it contains iron.



MAGNETIC METALS



NON-MAGNETIC METALS



Iron



Nickel



Aluminum



Gold



Cobalt



Steel

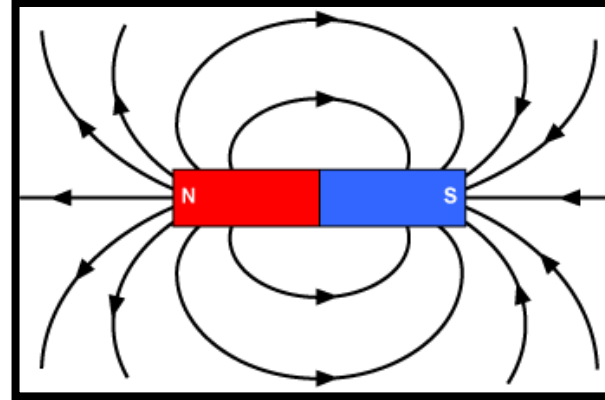


Silver



Copper

Magnetic Fields



Field lines are drawn to represent the strength and direction of magnetic fields.

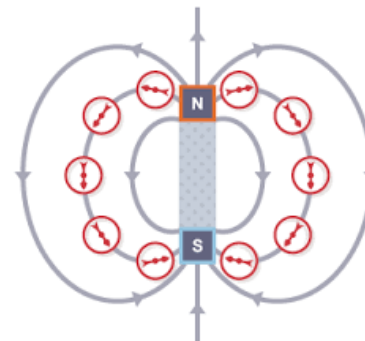
Fields lines...

- flow from North to South poles
- never cross
- are closer when the field is stronger



The second paper clip is attracted to the first paper clip even though it is not a permanent magnet.

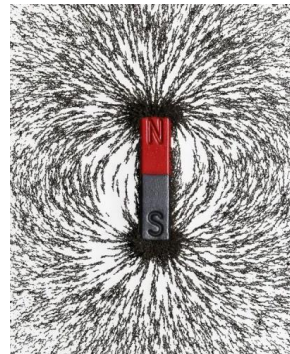
Both paper clips have become induced magnets. They both now have North and South poles such that they are attracted.



Compasses line up with magnetic field lines.

They can show the shape and direction of a magnetic field.

Iron filings can show the shape a magnetic field, but not the direction.



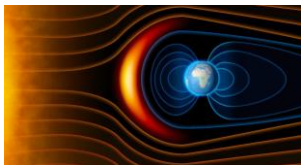
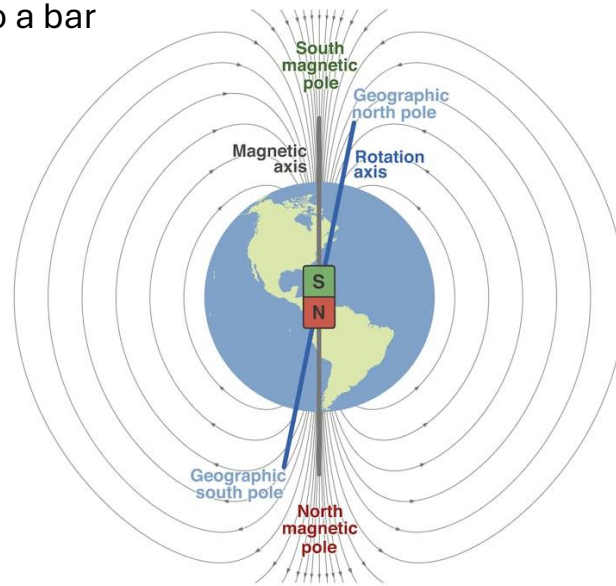
Earth's Magnetic Field

The Earth's magnetic field is similar to a bar magnet's. It is created due to flowing molten iron and nickel.

We know this exists as compasses point in the same direction.

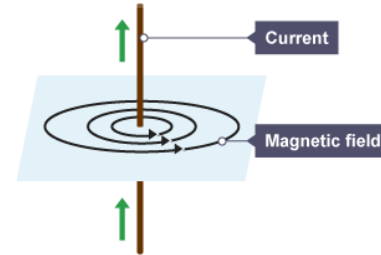
The magnetic south pole is close to the geographic north pole.

The magnetic poles and geographic poles aren't in the same place. This is called magnetic deviation.



The Earth's magnetic field also protects us from much of the Sun's radiation.

Electromagnets

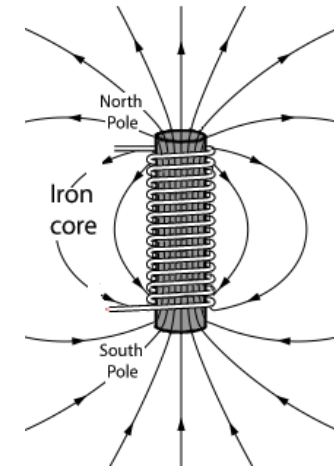


A circular magnetic field is produced around current-carrying wire.

To strengthen the field from a wire we can coil it around an iron core. This is called an electromagnet.

The field around an electromagnet is similar to a bar magnet's.

They can be made stronger using more turns of the coil, using an iron core, and using more current. Reversing the current also reverses the field.



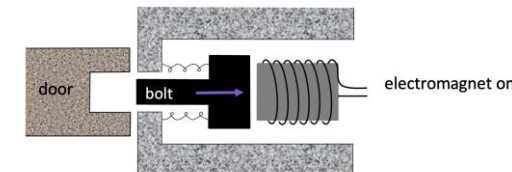
Uses of Electromagnets



Electromagnets are used in scrapyards. The main advantage is that you can turn off the electromagnet by turning off the current to drop the metals.

Other uses include relays, school bells, and electronic locks.

Electronic door-locks use electromagnets. In the figure, turning the current on creates a magnetic field that attracts the bolt and unlocks the door.



DC Motors

A current-carrying wire produces a magnetic field. If there is a nearby permanent magnet, it can interact with the magnet's field. This causes the wire to experience a force and move. This is called the motor effect.

