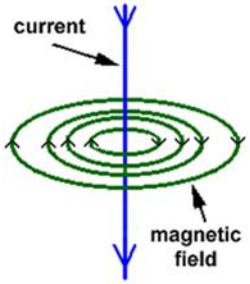
P7: MAGNETISM

Section 1: Magnetism and electromagnetism Key Terms	
1 Pole	The **places** on a magnet where the **magnetic forces** are **strongest**.
2 Magnetic Field	The **area** around a magnet where a **force acts** on another magnet or magnetic material.
2 Repel	Occurs when two **like poles** are brought close together. The magnets **push apart**.
3 Attract	Occurs when two **opposite poles** are brought close together. The magnets **move together**.
4 Permanent magnet	A magnet that produces its **own magnetic field**.
5 Induced magnet	A magnetic material that **becomes a magnet** when it is placed in a **magnetic field**. When **removed** from the **field** it **quickly loses its magnetism**.
6 Magnetic material	There are four magnetic materials: **iron**, **steel**, **cobalt** and **nickel**.
7 Compass	Compasses contain small bar magnets which **points** to the **north pole** of the **Earth's magnetic field**.
10 Solenoid	A **coil of wire** that will create a **magnetic field** when **current** is passed through it. The magnetic field **inside** the solenoid is **strong** and **uniform**. It acts in the same way as a bar magnet.
11 Electromagnet	A **solenoid containing an iron core** which increases its strength.
12 Motor effect (HT)	When a **conductor carrying a current is placed in a magnetic field, the magnet producing the field and the conductor exert a force on each other**. This can be used to create a motor.
14 Fleming's Left Hand Rule (HT)	A rule that shows the **relative direction** of the **current**, **force** and **magnetic field** in the motor effect.

Section 3: Electromagnets

Magnetic field around a single wire. The direction of the magnetic field can be found from the **right hand grip rule.** Thumb in the direction of current and fingers point in the direction of magnetic field.

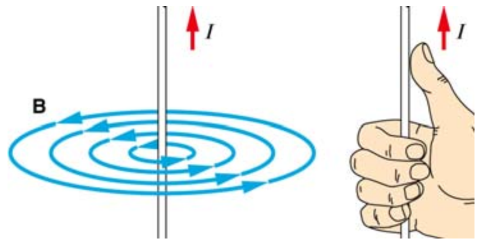


The magnetic field consists of concentric circles centred on the wire.

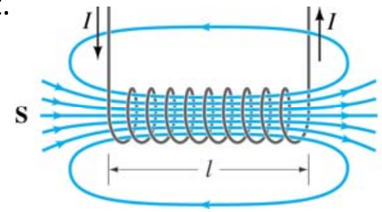
The magnetic field is strongest near the wire.

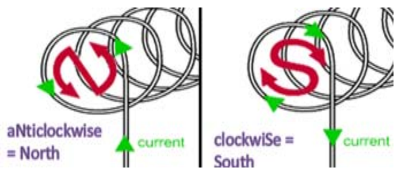
This is shown by the field lines being closest together near to the wire.

The strength of the field increases if the electric current is increased.



When a current moves through a wire, a magnetic field is produced. If you increase the current you increase the strength of the field. The closer an object is to the wire the greater the field strength. Rolling the wire into a **solenoid** increases the field strength. The field is strong and uniform within the solenoid. The field shape outside a solenoid is similar to that of a bar magnet.

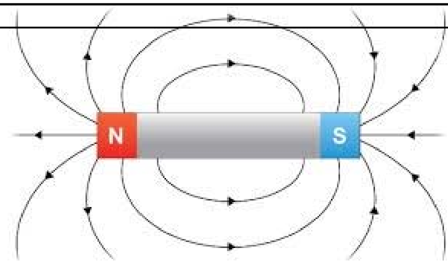




Section 2: Poles of a Magnet

The **poles** of a magnet are where the magnetic forces are the strongest. When magnets are brought together they exert a force on each other: like poles repel, opposites attract. **Attraction** and **repulsion** are examples of non-contact forces.

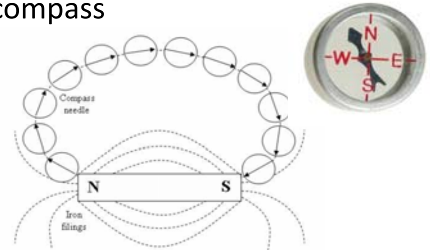
A permanent magnet makes its own magnetic field whereas an induced magnet is a material that only becomes magnetic when placed in a magnetic field. **Induced magnetism** always causes a force of attraction. Induced magnets lose their magnetism when taken out of a magnetic field.



Section 4: Magnetic field

The region around a magnet where a force acts on another magnet or a magnetic material is called the magnetic field. The force between a magnetic material and a magnet is always of attraction. The force is greater the nearer it is to the magnet and is strongest nearest to the poles. The direction of a magnetic field line is always from the north (seeking) pole to the south seeking pole.

A magnetic **compass** contains a small bar magnet. The compass needle points in the direction of the Earth's magnetic field. You can use a compass to plot the magnetic field pattern of a magnet. The core of the earth must be magnetic due to the effect it has on the magnet in a compass



Section 5: Motor effect

Motor effect: When a **conductor** is placed in a magnetic field the magnet produce the field and the conductor exert a force on each other

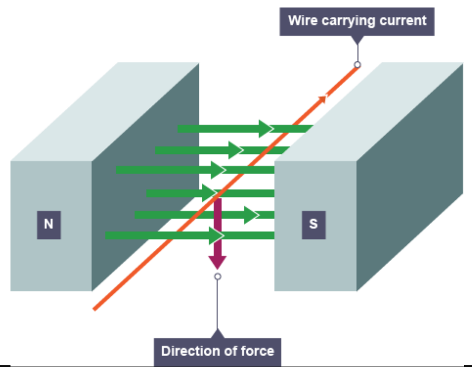
The size of the force can increased by:

- Increasing the currer
- Using a stronger mo

Size of the force depends on the angle between the wire and magnetic field line:

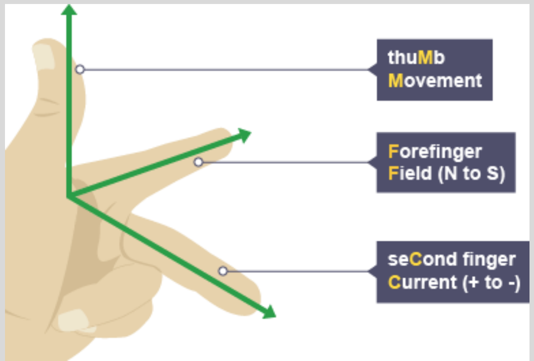
- Greatest when perpendicular (right angles) to magnetic field.
- 0 when parallel.

Direction is always at right angles to the wire and the field lines.



Section 6: left hand rule

Use Fleming's left-hand rule to remember the direction of motion in an electric motor



Align fingers to the field and the direction of the current to work out the way the wire moves.

Force = Magnetic Flux Density x Current x Length

(N) (T) (A) (m)

(You will be given this equation in the exam)

Section 7: Electric Motors (HT only)

A coil of wire carrying a current in a magnetic field has a tendency to rotate. This is how motors work. The force on a conductor in a magnetic field makes the coil spin in an electric motor.

If the direction of the current is reversed the motor will spin in the opposite direction. The same occurs if the direction of the magnetic field is reversed.

The higher the current the faster the motor will spin. The higher the magnetic field strength the faster it will spin. The more coils in the motor the faster it will spin.