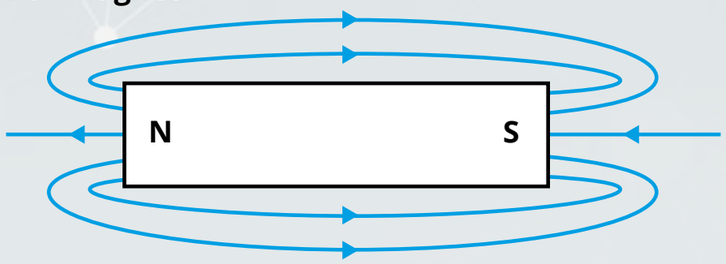
Magnetic fields

A magnetic field shows the area where a magnetic force will be felt. The strength of the field can be shown by how close together the lines are.

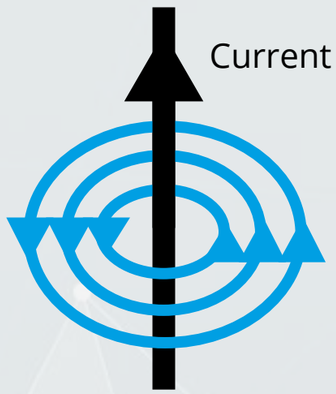
Bar magnet



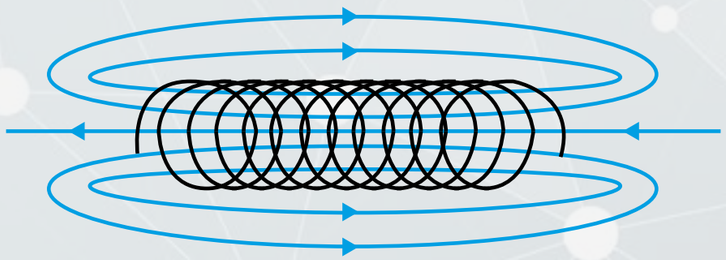
A wire carrying a current will create a magnetic field.

Long straight wire

A larger current will create a stronger field but changing the direction of the current will reverse the direction of the field.



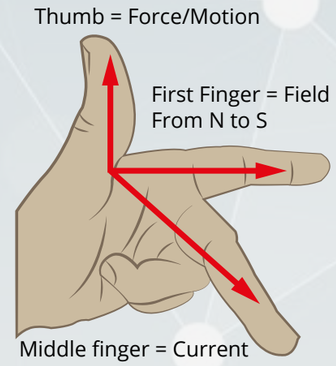
Coil



A larger current will create a stronger field, more turns on the coil will create a stronger field but changing the direction of the current will reverse the direction of the field.

Motor

A wire carrying a **current** through a **magnetic field** will have a **force** acting on it.
The **direction** of the force is given by Fleming's **Left** Hand Rule.



The size of the force can be calculated using the equation

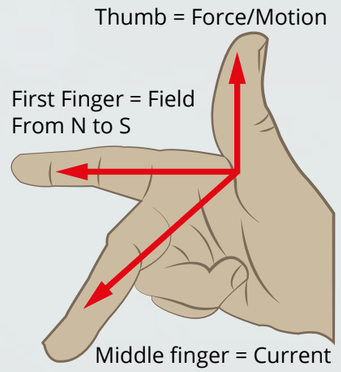
$$F=BIl$$

Where F = force in N, B = Magnetic field strength in T, I = current in A and l = length in m.

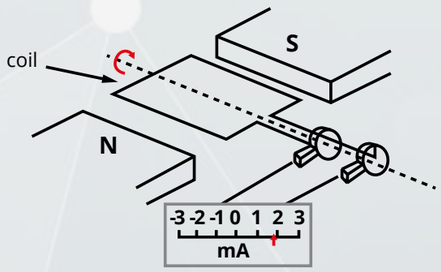
Generator

When a wire is **moved** through a **magnetic field** a **current** is generated.

The **direction** of the force is given by Fleming's **Right** Hand Rule.



This can be used to create an Alternating Current in a generator.



To generate a **larger** current, you can use a coil with **more turns**, use **stronger magnets** or a coil with a **larger area**. Turning the coil **faster** will also increase the current but will make the **frequency** of the current increase too.

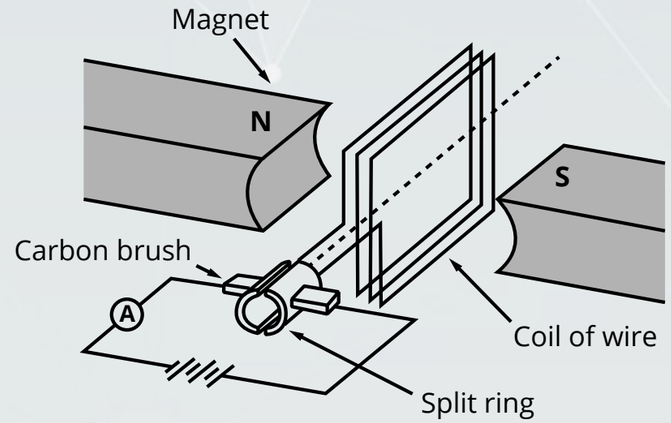
Transformer

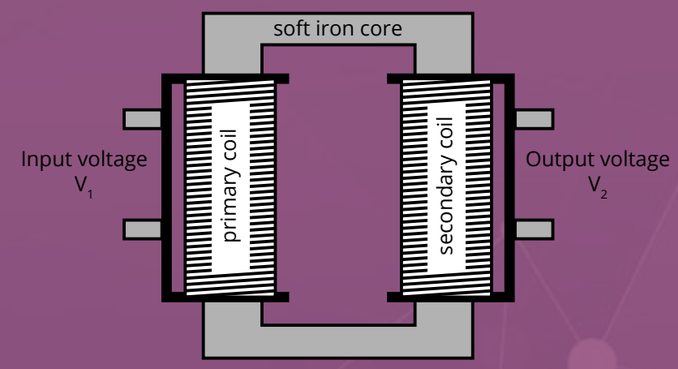
Magnetic field is used in transformers to step up and step down the voltage. There are 3 steps:

1. The **alternating** current in the primary coil creates an **alternating magnetic field** in the coil.
2. The core **strengthens** the field and **connects** it to the secondary coil.
3. The **alternating field** inside the secondary coil generates an **alternating current**.

This can be used to make a motor spin. To make the motor spin **faster**, you can use a coil with **more turns**, use a **larger current**, use **stronger magnets** or a coil with a **larger area**.

To change direction of the motor, you can **change the direction** of the current or **reverse** the field.





The coil with the most coils will have the higher voltage. e.g. In a step-up transformer the **secondary coil will have the most turns** to increase the voltage.

The ratio of turns and voltage can be calculated using this equation.

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$