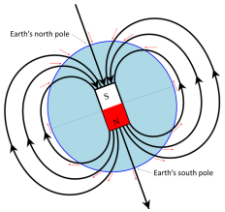
Permanent and Induced Magnets

Permanent magnets always have a magnetic field around them.
North pole and north pole – repel
South pole and south pole – repel
North pole and south pole - attract

Induced magnets are materials **(iron, steel, nickel and cobalt)** which become magnetic when they are placed in a magnetic field. They lose their magnetism when they are removed from the field.
Induced magnets always attract!

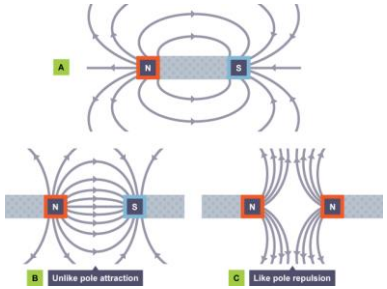
The Earth's liquid iron core produces a magnetic field. It's south magnetic pole is actually at the Earth's geographical North pole. So the north pole of a compass points north



Magnetic Fields

Magnetic field lines always point north to south.

We can plot the field lines by using:
a) iron filings
b) Plotting compasses.



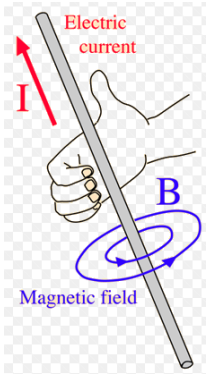
The strongest part of a magnetic field is at the poles, you can see this as the field lines are closest together.

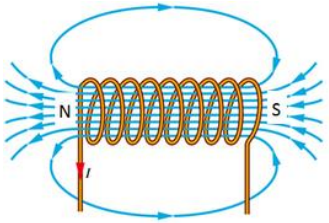
The further away you move from the pole the weaker the magnetic field becomes.

The Motor Effect

When an electrical current passes through a wire it produces a magnetic field in the direction shown in the diagram.

The larger the electrical current the stronger the magnetic field produced.

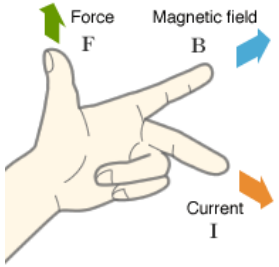




Solenoid
Coiling the wire to form a solenoid produces a magnetic field similar to a bar magnet.
The strength of the magnetic field can be increased by increasing the current or adding an iron core

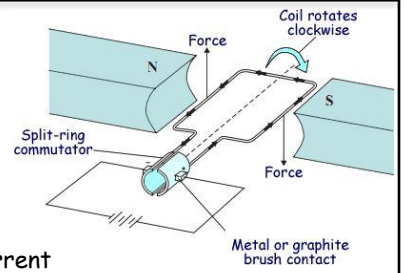
Fleming's Left Hand Rule

If a wire carrying a current is placed in a magnetic field they both exert a force on each other. The force on the wire is shown using Fleming's Left Hand rule.



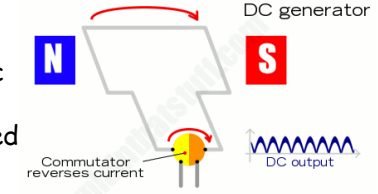
Electric Motor

If a loop of wire is placed within a magnetic field it will rotate.
The commutator changes the direction of the current around the loop every half turn, this ensures that it will continue to rotate.
The current must be DC!!

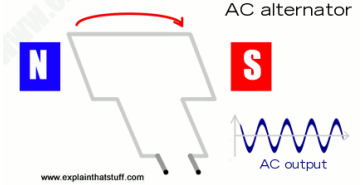


The Generator Effect (Triple Only)

As a coil of wire spins in a magnetic field an electrical current is produced



An alternating current (AC) is produced, unless a commutator is used which only allows the current to travel in one direction. This is a direct current (DC).

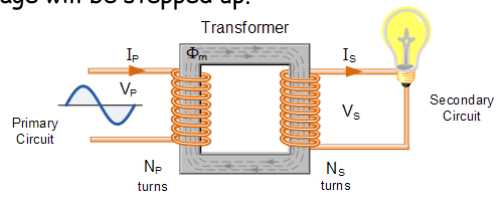


The current produced can be increased by:
* Spinning the coil faster
* Having more coils
* Stronger magnetic field.

The current produces a magnetic field which opposes the original change in direction.

Transformers (Triple Only)

Transformers increase (step-up) or decrease (step-down) the voltage.
If there are more coils in the secondary side the voltage will be stepped up.



Transformers are used to step-up the voltage, which reduces the current, this makes it more efficient as less energy is wasted as heat. Step-down transformers are then used to make the voltage safe for public use.

If we assume that the transformer is 100% efficient then;

$$Power_p = Power_s$$

So: $I_p \times V_p = I_s \times I_s$