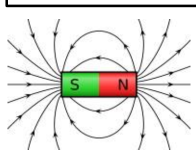
AQA MAGNETISM AND ELECTROMAGNETISM

Permanent and Induced Magnetism



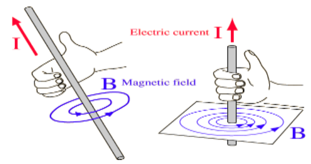
Magnets

Magnetic	***Materials attracted by magnets***	Uses non-contact force to attract magnetic materials.
North seeking pole	***End of magnet pointing north***	Compass needle is a bar magnet and points north.
South seeking pole	***End of magnet pointing south***	Like poles (N – N) repel, unlike poles (N – S) attract.
Magnetic field	***Region of force around magnet***	Field is strongest at the poles. The strength reduces as distance increases
Permanent	***A magnet that produces its own magnetic field***	Will repel or attract other magnets and magnetic materials. (steel)
Induced	***A temporary magnet***	Becomes magnet when placed in a magnetic field. (iron)

Magnetic field around a wire

Electric current flowing in a wire produces a magnetic field around it.

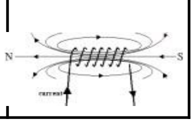
- If current is small, magnetic field is very weak.
- Current large enough, iron filings show circular magnetic field.
- Further away from the wire, magnetic field is weaker.
- Reverse current, magnetic field direction reverses.



Right hand grip rule

Thumb	Direction of current.
Fingers	Direction of magnetic field.

Motor effect

Relay	***A device using a small current to control a larger current in another circuit***	Solenoid is wound around an iron core. Small current magnetises the solenoid. This closes some electrical contacts, making a complete circuit so a current flows.
Electromagnet	***More turns of wire, and an iron core increases the magnets strength***	
	Turning off the current, switches off the magnet	
Solenoid	***A long coil of wire, acts like a bar magnet***	

Increase strength of magnetic field

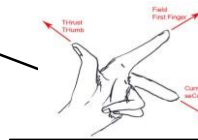
- ***Use larger current***
- ***Use more turns of wire***
- ***Put turns of wire closer together***
- ***Use iron core in middle***

Electric motor	***Coil of wire rotates between two permanent magnets***	Current flows through the wire generating a magnetic field. This magnetic field interacts with the field from the permanent magnets. The force causes the coil to rotate.

Fleming's left-hand rule

To predict the direction a straight conductor moves in a magnetic field.

Thumb	Direction of movement.
First finger	Direction of magnetic field.
Second finger	Direction of current.



HIGHER only

$F = B \times I \times l$

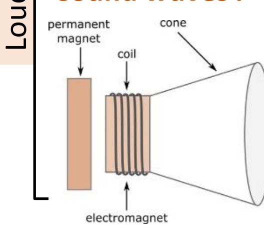
Force = magnetic flux density X current X length

If current and magnetic field are parallel to each other, no force on wire.

Magnetic flux	***Lines drawn to show magnetic field***	Lots of lines = stronger magnets.
Magnetic flux density	***Number of lines of magnetic flux in a given area***	Measures the strength of magnetic force.

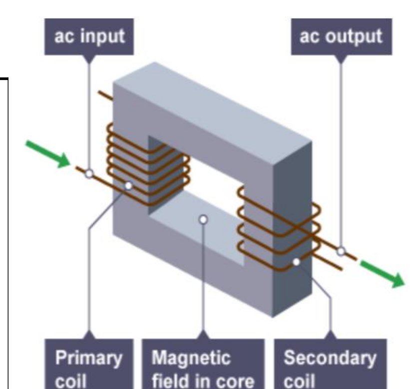
Force	***Newton (N)***
Magnetic flux density	***Tesla (T)***
Current	***Amperes (A)***
Length	***Metres (m)***
Power	***Watts (W)***
p.d.	***Voltage (V)***

Loud speakers	***Converts variations in electrical current into sound waves.***	ac current flows in a coil of wire, that is in a magnetic field. This produces a force that moves the coil. Coil connected to a diaphragm (speaker cone). Diaphragm movements produce sound waves.



Induced potential, transformers and National Grid

Generator effect	***Generates electricity as a coil of wire spins between magnets.***	
Dynamo	***Generates dc current***	Has a commutator
Alternator	***Generates ac current***	Has two slip rings
Induction	***Wire moving inside a magnetic field.***	Induces a p.d. that produces a current. But only when moving
Microphones	***Converts pressure variations in sound waves into variations in current in electrical circuits.***	
National Grid	***Distributes electricity generated in power stations around UK***	
Transformer	***Primary coil of wire wrapped around a soft iron core, then a secondary coil of wire also wrapped around the iron core.***	An alternating (ac) current in the primary coil generates a magnetic field in the iron core. This magnetic field induces a potential difference across the secondary coil, so an (ac) current flows in the secondary coil.



Step-up transformers	Step-down transformers
Increase voltage, decrease current	***Decrease voltage, increase current***
Increases efficiency by reducing amount of heat lost from wires.	Makes safer value of voltage for houses and factories.

Voltage across the coil X number of coils (primary) = Voltage across the coil X number of coils (secondary)

$V_p \div V_s = n_p \div n_s$

Power lost = Potential difference X Current

Power supplied to primary coil = power supplied to secondary coil

$V_p \times I_p = V_s \times I_s$