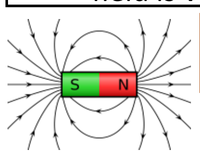
AQA MAGNETISM AND ELECTROMAGNETISM

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*	Strong field, force big. Weak field, force small. Field is strongest at the poles.
Permanent	*A magnet that produces its own magnetic field*	Will repel or attract other magnets and magnetic materials.
Induced	*A temporary magnet*	Becomes magnet when placed in a magnetic field.

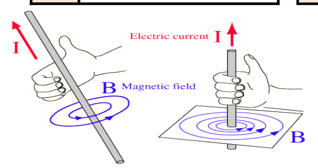
Magnetic field around a wire

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

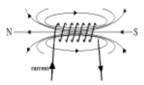
- If current is small, magnetic field is very weak.
- Current large enough, iron filings show circular magnetic field.
- Further away from the wire, magnetic field is weaker.
- Reverse current, magnetic field direction reverses.

Right hand rule

Thumb	Direction of current.
Fingers	Direction of magnetic field.



Solenoid



Solenoid	*A long coil of wire* — Magnetic field from each loop adds to the next.

Electromagnet

Electromagnet	*Lots of turns of wire increase the magnetising effect when current flows*
	Turn current off, magnetism lost.

Increase strength of magnetic field

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

Relay

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 attracts to electrical contacts, making a complete circuit. Current flows from battery to starter motor.

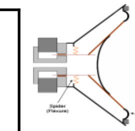
Motor effect

HIGHER only

Magnetic fields from the permanent magnet and current in the foil interact. This is called the motor effect.

- Reverse the current, foil moves upwards.
- Aluminium foil placed between two poles of a strong magnet, will move downwards when current flows through the foil.
- Size of force acting on foil depends on magnetic flux density between poles, size of current, length of foil between poles.

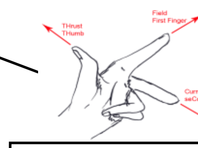
Electric motor	*Coil of wire rotates about an axle*	Current flows through the wire causing a downward movement on one side and an upward movement on the other side.
Generators	*Coil of wire rotating inside a magnetic field. The end of the coil is connected to slip rings.*	Produces altering current.
Split-ring commutator	*Split ring touching two carbon brush contacts*	
Loud speakers	*Converts variations in electrical current into sound waves .*	Varying current flows through a coil that is in a magnetic field. A force on the wire moves backwards and forwards as current varies. Coil connected to a diaphragm. Diaphragm movements produce sound waves.
Microphones	*Converts pressure variations in sound waves into variations in current in electrical circuits.*	



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.



F = B X I X 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.

Induced potential, transformers and National Grid

National Grid	*Distributes electricity generated in power stations around UK*

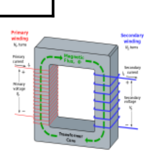
PHYSICS HIGHER only

Induced potential	*When a conducting wire moves through a magnetic field, p.d. is produced*
Generator effect	*Generates electricity by inducing current or p.d.*
Uses of the generator effect	*Dynamo, Microphones*

Transformer	*Two coils of wire onto an iron core*	Alternating current supplied to primary coil, making magnetic field change. Iron core becomes magnetised, carries changing magnetic field to secondary coil. This induces p.d.

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.

Power lost = Potential difference X Current



Power supplied to primary coil = power supplied to secondary coil

$V_p \times I_p = V_s \times I_s$

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

$V_p \div V_s = n_p \div n_s$

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