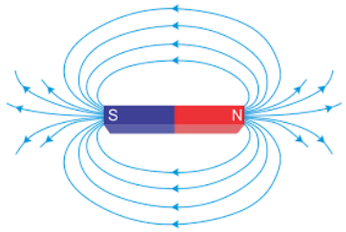
AQA P7 Magnetism and Electromagnetism Combined Higher

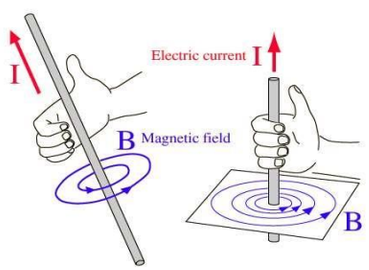


Permanent and Induced Magnetism

Key word	Definition	Detail
magnetic material	materials attracted by magnets	**The magnet uses a non-contact force to attract magnetic materials.**
north seeking pole	end of a magnet pointing north	**A compass needle is a bar magnet and points north.**
south seeking pole	end of a magnet pointing south	**Like pole (N-N) repel, unlike pole (N-S) attract.**
magnetic field	region of force around a magnet	**Field lines close together → strong field → large force.** **Field lines far apart → weak field → small force.** **Field/force is strongest at the poles.** **Arrows on field lines are drawn in the direction of north to south.**
permanent	a magnet that produces its own magnetic field	**Will repel or attract other magnets. Will attract magnetic materials.**
induced	a temporary magnet	**Becomes a magnet when placed in a magnetic field.**

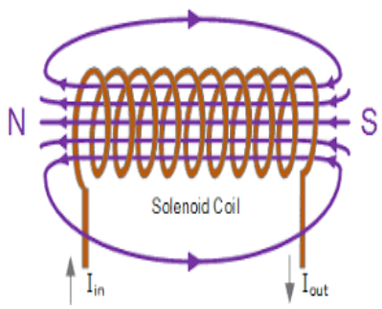
Electromagnetism

- Current flowing through a wire produces a magnetic field around it.
- **thumb → direction of current**
- **fingers → direction of magnetic field**



- If the current is small, the magnetic field is weak
- If the current is large, the magnetic field is strong
- Further away from the wire the magnetic field is weaker
- If the current is reversed, the direction of the magnetic field reverses

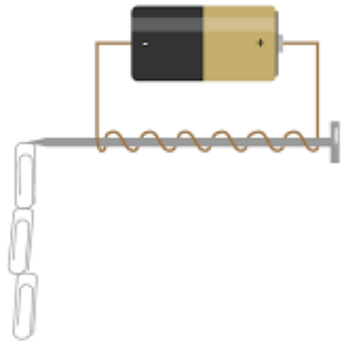
- A solenoid is a coil of wire with a current flowing through it
- The magnetic field from each loop (turn) adds to the next
- **The advantage of an electromagnet like this is it can be turned off**



An electromagnet can be made stronger by:
- using a larger current
- adding more turns of the wire
- putting the turns of the wire closer together
- using an iron core through the coil

We can investigate the strength of an electromagnet by :
- coiling a wire around an iron nail
- connect the ends of the wire to an electrical supply like a battery
- measure how many paper clips can be picked up
- change either the number of turns of the wire or the voltage of the power supply
- measure again the number of paper clips the electromagnet can hold

NOTES:
- The direction of the current does not effect the strength of the magnetic.
- Changing more than one variable e.g. number of turns in the coil and the voltage will give an invalid result as you will not be able to tell which variable caused the change.



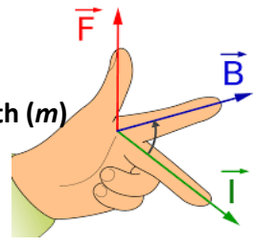
Fleming's Left- Hand Rule and the Motor Effect

Key word	Definition	Detail
magnetic flux	lines drawn to show magnetic field	**The closer the lines are together the stronger the magnet**
magnetic flux density, B	number of lines of magnetic flux in a given area	**Measurement of the strength of the magnetic force**

When a current passes through a wire it produces a magnetic field.
If that wire is then placed between the poles of a permanent magnet then the magnetic fields of both interact, causing a force and the wire moves.

The size of the force can be calculated using the equation:
force (*N*) = magnetic flux density (*Tesla*) x current (*A*) x length (*m*)

$F = B \times I \times l$



If the current and the magnetic field are in the same direction there is no force

To find the direction of movement of the wire we must use **Fleming's left hand rule**:
Thumb → direction of the force and so movement, F. First finger → direction of magnetic field, B
Second finger → direction of current, I

Application of **Fleming's left hand rule** can explain the motor effect:
- . coil of wire rotates about an axle.
- Current flows through the wire causing an upward movement on one side of the coil and a downward movement on the other side of the coil and so the coil rotates.
- To reverse the direction of rotation, reverse the direction of the current or the magnetic field.

<u>Use: Loudspeaker</u> - a changing current in a magnetic field, the force on the wire moves backwards and forwards as the current changes. The coil is connected to a diaphragm. As the diaphragm moves is produces sound waves.

Transformers

- **Step up** transformers increase voltage and decrease current to increase efficiency by reducing the amount of heat lost.
- **Step down** transformers decrease voltage and increase current to make it safer for domestic use.