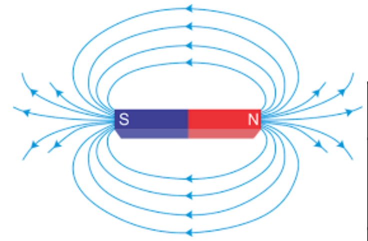
AQA P7 Magnetism and Electromagnetism Triple physics

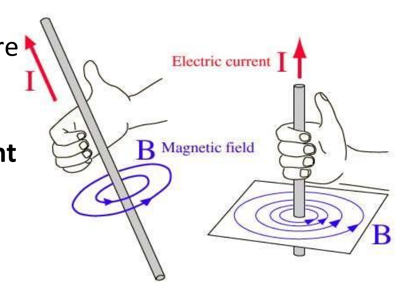


Permanent and Induced Magnetism

Key word	Definition	Detail
Magnet	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 fore 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.**

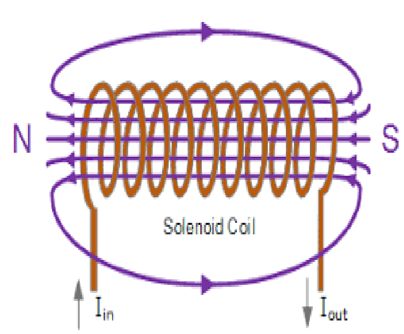
Electromagnetism

- 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:

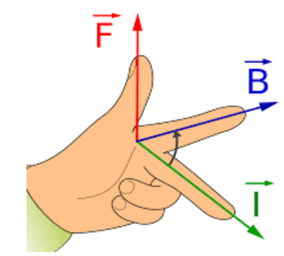
- Using a larger current
- Adding more turns of the wire
- Putting the turns of the wire closer together
- Using an iron core through the coil

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 = magnetic flux density x current x length
F = B x I x 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:

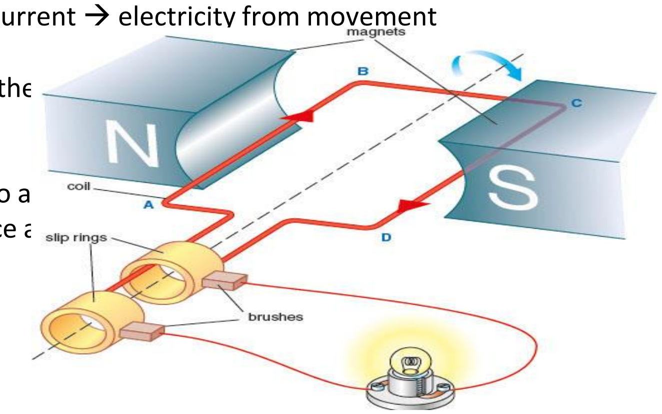
- A coil of wire rotates about an axle
- Current flows through the wire causing an upward movement on one side of the coil and a downward movement on the other side of the coil and so the coil rotates
- To reverse the direction of rotation, reverse the direction of the current or the magnetic field

<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.

The Generator Effect

The exact reverse of the motor effect – moving a conducting wire through a magnetic field produces a potential difference (voltage) which induces a current → electricity from movement

- Coil of wire rotating inside a magnetic field, the ends of the wire are connected to slip rings
- This produces an alternating current
- Not all devices use alternating current and so a split ring commutator can be used to produce a direct current, the device is known as a dynamo.



<u>Use: Microphones</u> – uses a diaphragm connected to a coil of wire in a magnetic field to convert pressure variations in sound into variations in current in electrical circuits.

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

Voltage across the primary coil x number of coils = voltage across the secondary coil x number of coils
$V_p \times n_p = V_s \times n_s$