Electromagnetism (Trilogy Physics)

1. Key Terms in this sub-unit

Permanent magnet	A permanent magnet produces its own magnetic force.
Induced magnet	A material that becomes a magnet when placed in a magnetic field, but quickly loses its magnetism when removed from the field.
Magnetic materials	Iron, steel, nickel, cobalt
Magnetic field	The region around a magnet where a force acts on another magnet or magnetic material. The field is strongest at the poles of the magnet.
Magnetic field lines	The direction of a magnetic field line is from the north pole of a magnet to the south pole of the magnet.
Compass	This contains a small bar magnet and the magnet aligns itself with the surrounding magnetic field.
Earth's magnetic field	The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field.
Magnetic field of a conductor	When a current flows through a conducting wire a magnetic field is produced around the wire. The strength of the magnetic field depends on the current through the wire and the distance from the wire.
Motor effect	When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other.
Solenoid	A coil of wire which carries an electric current.
Soft iron core	A solenoid is wrapped around this to increase the strength of its magnetic field. The core is an induced magnet.
Electromagnet	A solenoid wrapped around an iron core, whose magnetism can be turned on an off by an electric current.
Magnetic flux density	A measure of how many field (flux) lines there are in a region – it shows the strength of the magnetic field.
Electric motor	A coil of wire placed between the poles of a magnet and able to spin.
Alternating current	Current where the direction is constantly changing direction.
Direct current	Current is a flow of charge, and conventional current (direct current, d.c.) flows from positive to negative. Flows from **+** → **-**
Oscilloscope	Used to see the generated potential difference and how it changes over time.
transformers	Change the potential difference only in alternating current. Can increase or decrease the potential difference.

2. Quantities & Units

Force (F)	Newton (N)
Magnetic flux density (B)	Tesla (T)
Length (*l*)	Metre (m)
Potential difference (*V*)	Volt (V)
Number of turns (N)	-
Current (I)	Ampere (A)

3. Equations

HT: - Force on a conductor

$$F = BIl$$

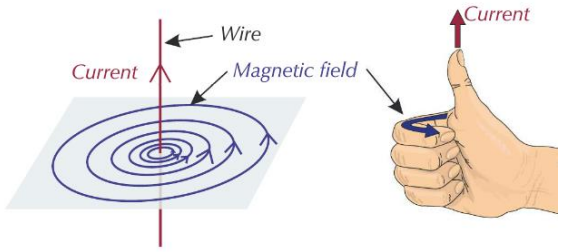
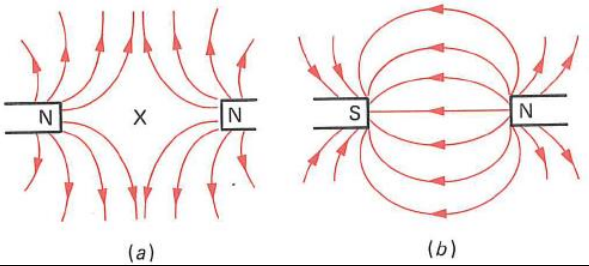
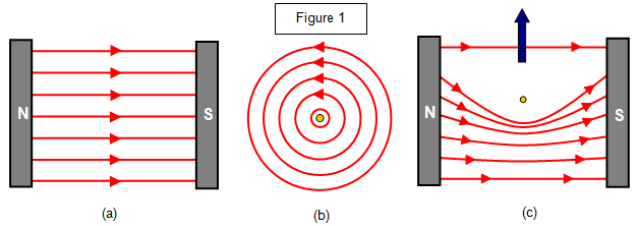
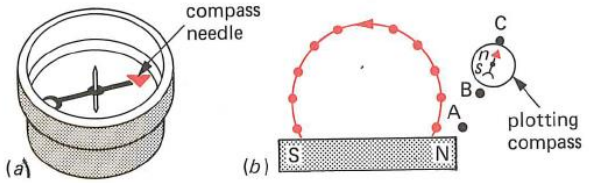
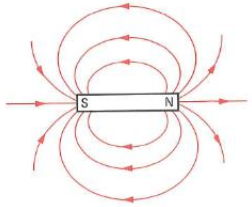
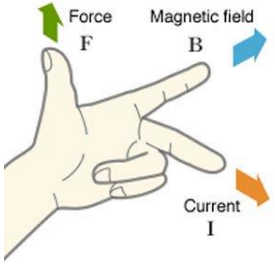
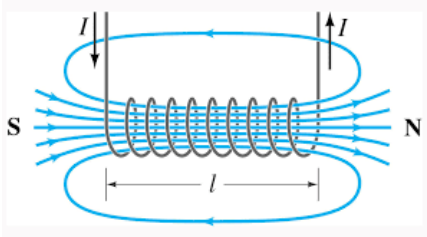
4. Electric Motors

Increase speed by	Increasing current
	Increasing the n^{o} of **turns**
	Increasing the field **strength**
Reverse direction	Reversing direction of current
	Swapping magnetic poles

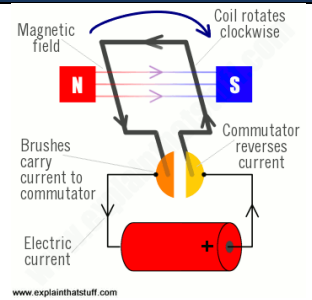
5. Electromagnets

Increase the strength by	Adding more **turns** to the coil.
	Insert an iron coil into the centre of the coil.
	Increase the voltage.

6. Diagrams to interpret

Field around a conductor (Right-hand grip rule)		**Forces between magnets**	
Force on a conductor (you may have to draw diagrams a and b)		**Plotting a magnetic field pattern**	
Induced magnet poles		**Magnetic Field**	
HT: - Fleming's Left-hand rule: - to determine the direction of force in the motor effect		When a wire carrying a current cuts through a magnetic field, it experiences a force. The direction of the force can be predicted using FLH. This can cause the wire to move.	**Solenoid** 

7. Motors and Generators : - Higher Tier

Electric Motor- apply Flemings left hand rule for direction of force.		- The Current in the wire creates a magnetic field around the wire. - This interacts with the magnetic field of the permanent magnets - The sides of the coil (parallel to the magnet) experience a force (in opposite directions). - The forces cause moments that act in the same (clockwise / anticlockwise) direction **or** the moments cause the coil to rotate (clockwise / anticlockwise). - Each half-revolution, the two halves of the (rotating) commutator swap from one (carbon) brush to the other. - This reverses the direction of the current in the coil. - Keeping the forces in the same direction. - Keeping the coil rotating in the same direction.