Foxford Learning Plan | KS4 Physics Magnetism

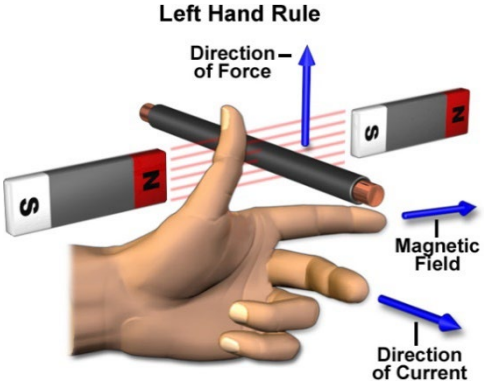
Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this.

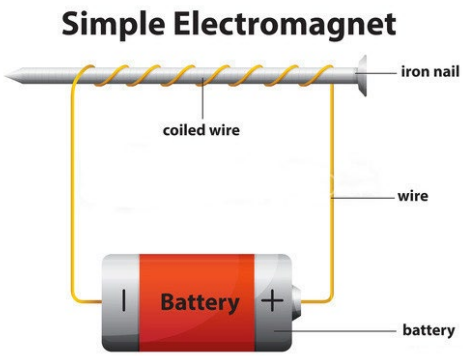
Understanding - Over the course of the topic, I will understand:

- ☐ What an electromagnet is and how it works.
- ☐ What is meant by the generator and motor effect and how they are useful.
- ☐ How to use Flemming's left hand rule to identify different quantities.
- ☐ How transformers work and why they are important for the national grid.
- ☐ Be able to draw magnetic field lines
- ☐ Be able to carry out practical work to investigate electromagnets, motor and generator effects
- ☐ To explain using models how generators work.
- ☐ Be able to calculate the changing voltage when given information about different transformers

Skills - Over the course of the topic, I will:

- ☐ Carry out an appropriate investigation to change between a solid, liquid and gas using water
- ☐ Identify hazards and follow safety precautions
- ☐ Investigate how temperature effects the rate of diffusion and dissolving
- ☐ Measure the mass of reactants and products using a balance
- ☐ Separate mixtures using filter paper, chromatography, and distillation





Magnets

The magnetic field is strongest around the _____.

When two magnets are brought close together they exert a _____ on each other.

Two like poles (eg S-S and N-N) will _____ each other.

Two different poles (eg S-n) will _____ each other.

A _____ magnet produces its own magnetic field.

An _____ magnet is when a material becomes a magnet when it is placed in a magnetic field.

Draw and label a diagram of a magnet

TIF: Describe what makes a material a magnet and how that is different to something being magnetic.

Magnets 2

There are 4 magnetic materials _____, _____, _____ & _____.

A magnetic _____ will form around a magnet. The magnetic field is strongest at the _____ of a magnet.

Conventionally we say that a magnetic field acts from _____ to _____.

A magnetic compass contains a small bar magnet, this small magnet aligns itself with the _____ magnetic field.

A compass could be used to plot _____ _____ around a magnet,

Describe how you would find the poles on an unknown magnet, using a known magnet

TIF: Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.

Electromagnets 1

When a _____ flows through a conducting _____ a _____ _____ is produced around the wire.

The strength of a the magnetic field depends on the _____ through the wire and the _____ from the wire.

Shaping the wire to form a _____ increases the _____ of the magnetic field created by a current through the wire. Adding an _____ _____ increases the strength of the _____

Draw and label a diagram of a magnetic field round a current carrying wire

TIF: Explain how a solenoid arrangement can increase the magnetic effect of the current.

Electromagnets 2

The magnetic field around a solenoid has a similar shape to that of a _____ _____. An electromagnet is useful because the magnetic field can be _____ __ or _____.

The _____ of an electromagnet can be increased by adding an _____ _____ or increasing the strength of the _____.

Draw and label a diagram of a solenoid, including an iron core.

TIF: Describe how you would demonstrate the magnetic effect of a current.

Electromagnets 3

You can make an _____ by coiling a _____ around an _____ _____ and running a _____ through the wire.
You can increase the _____ of this electromagnet by_____ the number of _____ or increasing the _____ of the _____.

TIF: Describe how you could test the strength of an electromagnet in a classroom.

Draw and label a diagram of an electromagnet made from a nail, battery and wire.

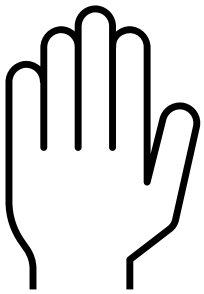
Motor effect 1

When a _____ carrying a _____ is placed in a _____ _____ the magnet producing the field and the conductor exert a _____ on each other. This is called the _____ _____.

We can use _____ _____ _____ rule to represent the direction of the _____, _____ and _____ _____.

TIF: Explain what things would affect the size of the force experienced by the wire

Correctly label the hand below with force, field and current to show Flemming's left hand rule.



Motor effect 2

A simple _____ _____ can be built using a _____ of wire that is _____ to _____ between two opposite _____ _____. When a _____ is passed through the coil, the coil experiences a _____ and will move.
To keep the coil moving the _____ must be reversed every half turn. A _____ ring or commutator is put into the circuit to achieve this and keep the motor running.

Draw and label a diagram showing a simple motor.

TIF: Describe what would happen if there wasn't a split ring used as part of the motor?

F = BIL 1

For a conductor at right angles to a magnetic field and carrying a current then the following equation can be used.

_____ = _____ x_____ x_____

Where

F is measured in _____

B is measured in _____

I is measure in _____

L is measured in _____

Complete the questions below.

1. A wire is in a 0.05T magnetic field and is 0.3m long, it also carries a current of 22A. What is the magnetic force on the wire?

2. A wire is in a 0.004T magnetic field, and is 3m long, it also carries a current of 24A. What is the magnetic force on the wire?

F= BIL -> TIF complete these calculations (don't forget you might need to convert units).

1. A 90cm wire is in a 0.8T magnetic field, carrying a current of 3.5A. Calculate the magnetic force on the wire.

2. A 5mm length of wire is in a 40micro T magnetic field carrying a current of 2mA. Calculate the magnetic force on the wire.

3. A 50cm wire experiences a magnetic force of 0.5N due to a magnetic field. The current is 10A. What is the magnetic flux density?

Super challenge

A 15mm wire is in a magnetic field of 0.35mT. There is a force of 0.2N upwards on the wire. Calculate the current in the wire.

Key Vocabulary	
Alternator	A device that makes use of the generator effect to generate alternating current.
Attraction	Opposite poles will experience a force of attraction, meaning they will experience a force towards each other. The force between a magnet and magnetic material is always one of attraction.
Current carrying wire	When current flows through a wire, a magnetic field is generated around it. The strength of the field is dependent on the magnitude of the current and the distance from the wire.
Dynamo	A device that makes use of the generator effect to generate direct current.
Electric motor	A current-carrying coil of wire in a magnetic field. The two sides of the coil that are perpendicular to the magnetic field experience forces in opposite directions, causing rotation
Electromagnet	A solenoid with an iron core.
Flemmings left hand rule	A rule used to determine the orientation of the force (thumb), current (second finger) and magnetic field (first finger) when a current- carrying wire is placed in a magnetic field (motor effect)
Generator effect	When there is relative motion between an electrical conductor and a magnetic field, a potential difference will be induced across the ends of the conductor. A current will flow if this conductor is part of a complete circuit
Induced magnet	A material that becomes a magnet when it is placed in an existing magnetic field, but loses its magnetism quickly once it is removed. Induced magnetism always produces attractive forces
Magnetic field	The region around a magnet in which another magnet or magnetic material will experience a force
Magnetic materials	Iron, steel, cobalt and nickel
Magnetic poles	The regions of a magnet where the magnetic forces are at their strongest
Microphone	A device that uses the generator effect to convert the pressure variations of sound waves into variations in the electrical current of a circuit.
Motor effect	When a current-carrying wire is placed in a magnetic field, a force will be experienced between the wire and the magnet responsible for the field
Permanent magnet	A magnet that produces its own magnetic field. Repulsion: Like-poles will experience a force of repulsion, meaning they will experience forces in opposite directions
Solenoid	A wire wrapped into the shape of a coil, that has a strong and uniform magnetic field inside of it. The solenoid's magnetic field strength can be increased by adding an iron core.
Transformer	An iron core with a primary and secondary coil of wire wound around opposite ends
Tesla	The unit of magnetic flux density