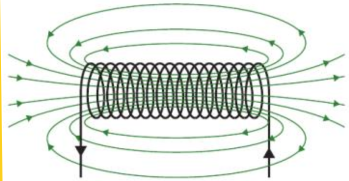
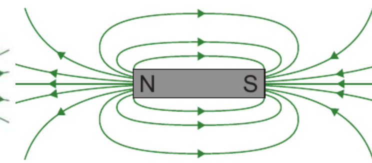
Knowledge Organiser: Physics, CP10-11a

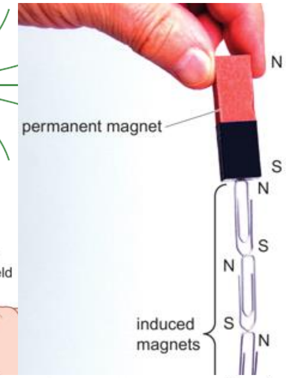
Jesus grew in wisdom and stature" Luke 2:52

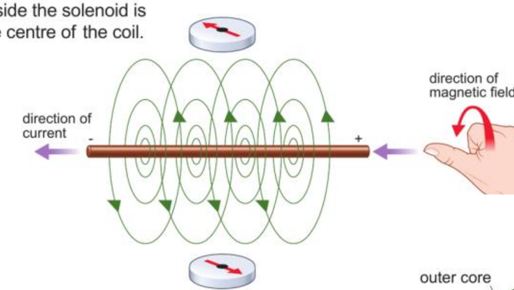
1	**Permanent magnets** always have a **magnetic field** , an area around them that can attract magnetic materials.
2	**Induced magnets** occur when a piece of magnetic material becomes a magnets when placed in a magnetic field.
3	There are three **magnetic** elements **Iron, Nickel** and **Cobalt.** Steel (~98% iron ~2% carbon) is magnetic .
4	Magnetic fields can be shown using **iron filings** and **plotting compasses** (also show field line direction). The ends of a magnets are called **Poles**. Magnetic field lines travel from **North pole to South pole**. Like poles **repel**, opposite poles **attract**.
5	Earth's magnetic field is produced by the **movement of charged particles** in the core. It shields us from **cosmic rays** and enables us to **navigate** using **compasses**.
6	A **compass** is a **bar magnet** that orientates itself in **Earth's magnetic field** pointing towards geographic north.
7	A **current** moving in a wire creates an **magnetic field**. The **higher the current the stronger the magnetic field**. The direction of the magnetic field can be found using the corkscrew rule (see below).
8	A **solenoid** is a coil of wire that produces a magnetic field like a bar magnet with poles at each end. A coil of wire with a current flowing through it is called an **electromagnet**. Electromagnets are strengthened by adding more **coils of wire**, increasing the **current** flowing through the wire or adding a **core**. **(higher tier only)**
9	A **core** is a magnetic material such as iron and which is placed in the centre of a coil of wire. It increases the strength of the electromagnet becoming a temporary magnet (induced magnet).

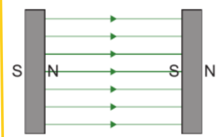


b The magnetic field inside the solenoid is almost uniform near the centre of the coil.

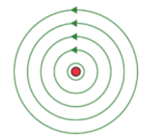




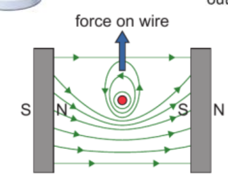




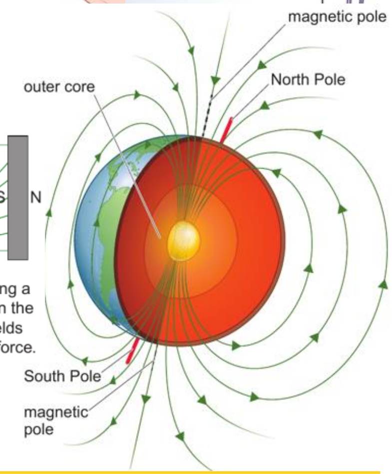
Two flat magnets produce a uniform magnetic field between them.



A magnetic field goes around a wire carrying a current.



When the wire carrying a current is put between the magnets, the two fields interact to produce a force.



10	**If you place a current carrying wire into a magnetic field then it will experience a force due to the interaction between with the two fields**
11	**Force on wire (at right angles to the magnetic field) = magnetic flux density x current x length (of wire) $F = B \times I \times L$**
12	Magnetic flux density is a measure of the strength of the magnet measured in Newtons per Ampere metre (N/Am) also called tesla T. Current is measured in Amperes (A) and length of the wire in metres (m)

St Michael's
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Knowledge Organiser: Physics, CP10-11b

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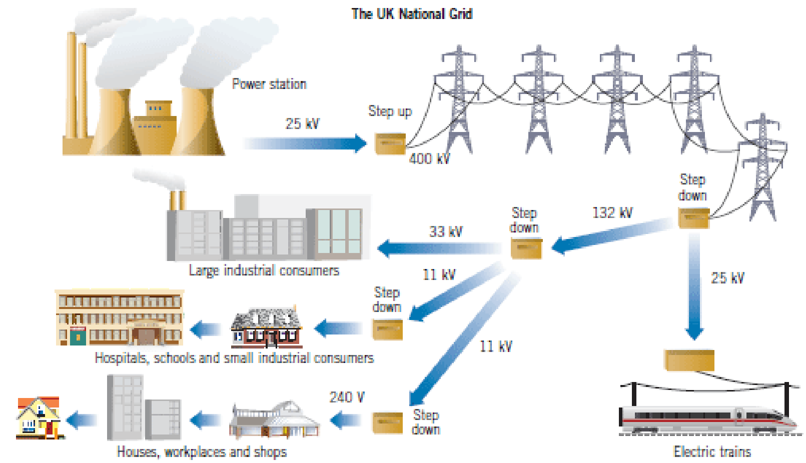
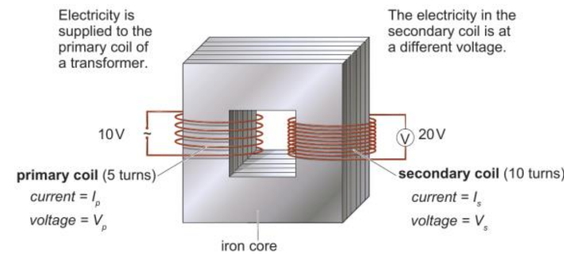
1	A **changing magnetic field** can **induce** a **voltage** or potential difference (p.d.) in a wire. A p.d. can also be **induced** if a **wire is moved in a magnetic field** this effect is called **electromagnetic induction**.
2	**Generators** are coils of wire moving in a magnetic field, power stations use them to make mains **(a.c.)** electricity. Generators use a slip ring to get an **a.c.—alternating current.**
3	A **Dynamo** is a coil of wire that moves in a magnetic field, it works in the same way as a generator but uses a **commutator** rather than **slip rings** so that the current only moves in one direction (**d.c.** electricity)
4	**Microphones** turns variations in **air pressure** from sound waves into to a varying **current**. Loud speakers turns variations in electrical **current** into **sound** by making a diaphragm move backwards and forwards.
5	**Transformers** are used to **change** the **potential difference** (**voltage**) of a supply. Transformers are made up of **two coils of wire w**rapped around a shared **iron core**. They only work with an alternating current.
6	In a transformer **current** flowing in the primary coil **induces** a **magnetic field** in the **iron core** which then **induces** an electric **current** in the secondary coil. By increasing or decreasing the number of turns in the primary coil we can decrease or increase the voltage of the current induced in the secondary coil.
7	Assuming the transformer is 100% efficient, power supplied equals the power that leaves. **Electrical power** = **current** x **potential difference** **P= I x V.** potential difference across primary coil (V) × current in primary coil (A) = potential difference across secondary coil (V) × current in secondary coil (A) **Vp x Ip = Vs x Is** allows us to work out the change in voltage.





8	**The national grid is a network of wires which deliver electricity safely from power stations. Step up transformer increase the voltage to reduce energy loss due to heat when moving large distances by transmission lines. Step down transformers decrease the voltage to safer levels.**
9	Using higher voltage increases the efficiency of power transmission as less energy is lost as **heat**. The three **power** equations are used to prove this:

power (W) = $\frac{\text{energy transferred (J)}}{\text{time taken (s)}}$, $P = \frac{E}{t}$

electrical power (W) = current (A) × potential difference (V), $P = I \times V$

electrical power (W) = current squared (A)^2 × resistance (Ω), $P = I^2 \times R$