WJEC (Eduqas) Physics GCSE

8.1: Permanent and Induced Magnetism

Detailed Notes

(Content in **bold** is for higher tier **only**)

Magnets

Magnets have a **north** and **south** pole which can exert a **magnetic force** on other magnetic objects around them. This magnetic force is a **non-contact** force meaning it can act at a **distance** without the objects having to touch.

Between two magnets, two **like** poles will **repel** whereas two **opposite** poles will **attract**.

Permanent & Induced Magnets

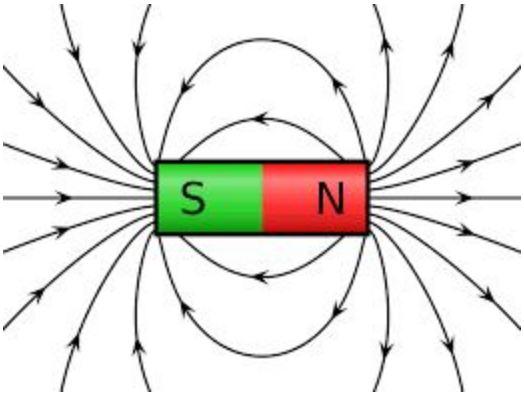
Permanent Magnets are always magnetic and always have poles.

Induced magnets can be produced from materials that are magnetic but do not have fixed poles. These can be made into temporary magnets by **'stroking'** them with a permanent magnet. This causes the **domains** to align within the material, all in the same direction creating a temporary magnet. Iron, Nickel and Cobalt are common induced magnetic materials.

Magnetic Fields

Magnetic fields form around **magnets** but cannot be seen with the eye. **Forces** act within the field from the north pole to the south pole. These can be **attractive** or **repulsive** forces. **Iron filings** can be used to show the pattern of the magnetic field as they align along the field lines.

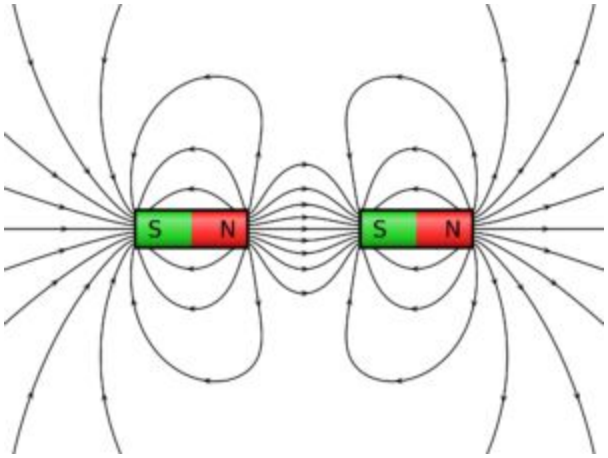
Small **plotting compasses** which show the direction of the magnetic field at a certain point can be used to draw the shape of a magnetic field around a small magnetised object.



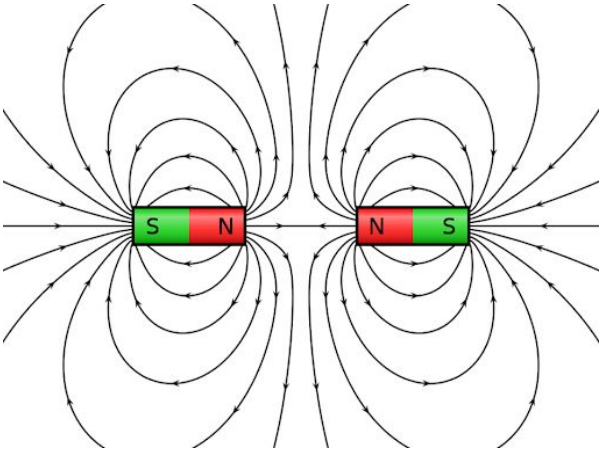
Field lines around a single bar magnet (clipartart.com).

Field lines must always have **arrows** showing the direction of the force from north to south. The **greater the concentration** of field lines in an area, the **stronger** the magnetic field in that area.

The fields of two bar magnets will **interact** when brought into close proximity to one another. Two **like poles** will **repel** whereas two **opposite** poles will **attract**. When attracting, the field lines from the north pole will join up with the south pole on the other magnet.



Attraction between two like magnetic poles (toppr.com).



Repulsion between two like magnetic poles (physbot.co.uk).

Where the field lines are **equally spaced**, the magnetic field is said to be **uniform** as the **same force** is experienced everywhere.

Earth's Magnetism

The Earth's **core is magnetic** as currents within it create a large magnetic field around the Earth. This is known because a freely **suspended magnetic compass** will **align** itself with the **Earth's field lines** and point **North**. It doesn't point to the Geographic North Pole, instead it points to the magnetic north pole which is over northern Canada.

The compass effectively acts as a suspended **bar magnet**, with its own north pole lining up with Earth's north pole. However, like poles repel, therefore Earth's magnetic pole above Canada is actually the **Magnetic South Pole**! (and the Geographic South Pole is close to the Magnetic North Pole).