Magnetism

- Materials are classified into magnetic and non magnetic marietials.
- Both materials have tiny magnetic particles called dipoles which behave as magnets
- In a non magnetic material these dipoles will remain haphazardly aligned hence a non magnetic material can never be magnetised examples include all non metals and metals such as silver, gold, aluminium, zinc, copper, brass etc
- In magnetic materials originally the dipoles are haphazardly aligned however it is possible for them to be aligned in a fixed direction. Once this happens the magnetic material is said to have been magnetised. Examples include cobalt, nickel, iron and steel

Properties of iron

- Iron behaves as a temporary magnet (easy to magnetise and demagnetise)
- Iron never repels, it always attracts
- It can easily arrange/change it's dipoles whenever needed
- When the magnet is removed iron immidiatwlt demagnetizes

Properties of steel

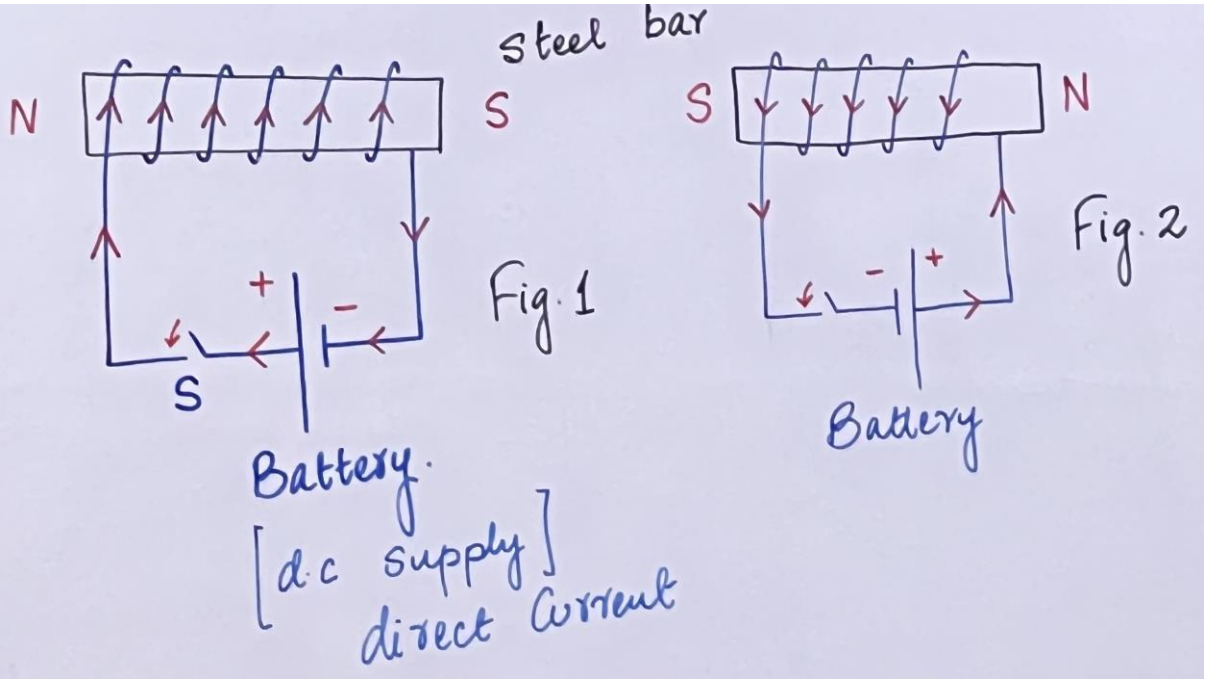
- steel acts as a permenant magnet (difficult to magnetise and demagnetise)
- Once the dipoles of steel are aligned it is difficult to change their alignment
- If one end of steel gets attracted to a magnet, the other end will get repelled away hence a repulsion test can be used to distinguish between iron and steel

How to magnetise steel

The best method is the electrical method.
A solenoid(an insulated coil made of copper wire) is wrapped around a steel bar.
To determine the North Pole of the steel bar we use the **right hand grip rule** according to this rule we curl our fingers in the direction of the current and the thumb will point to indicate the north end of the steel bar

To produce a more powerful magnet we can make the following changes:

- Use a more powerful battery
- Allow the current to flow for a longer duration before turning of the switch
- Increase the numbers of turns of the solenoid
- Reduce the distance between the tray and the solenoid



How to demagnetise steel

The same electrical method is used again for demagnetisation but in this case we use an alternating current supply. We will close the switch and allow the current to flow for a few minutes and then remove the steel bar from the circuit to complete the process. In a.c supply the direction of the current changes continuously this results in the haphazard alignment of the dipoles which causes demagnetisation

Uses of iron in electromagnets

- Device which can be used to separate magnetic particles from non magnetic particles
- When the switch is closed the current begins to flow in the direction indicated
- This current magnetised the iron rod and as a result all the magnetic particles gets attached to the rod

Magnetic shielding

The term magnetic shielding refers to protecting delicate instruments for example a hard drive, from the influence of the magnetic field. The diagram below illustrates that the hard drive might get damaged if placed close to a magnet. It is therefore recommended that you place the hard drive inside a hollow box. Iron is very permeable to magnetic field lines, which means that it allows magnetic field lines to pass through itself easily. This technique can protect a hard drive from the influence of strong magnetic field lines

Reed relay

This relay behaves as a switching device, this means that it operates on a *low voltage* but it can be used to activate or deactivate a high voltage circuit. When the switch is closed the current begins to flow in the direction indicated. This current magnetizes the iron bar. Induced magnetism causes the L shaped iron rod to move in the direction indicated on the diagram. This allows the contact to close and the external circuit is activated. When the switch is opened the iron bar demagnetizes and this causes the iron rod to return back to its original position, thereby opening the contacts and the external circuit is deactivated
A reed switch is a circuit which is similar to the relay which means it operates on a low voltage, but can be used to activate or deactivate a machine which is known to operate on a very high voltage

Reed switcher

A reed switch is a circuit which is similar to the relay which means it operates on a low voltage, but can be used to activate or deactivate a machine which is known to operate on a very high voltage

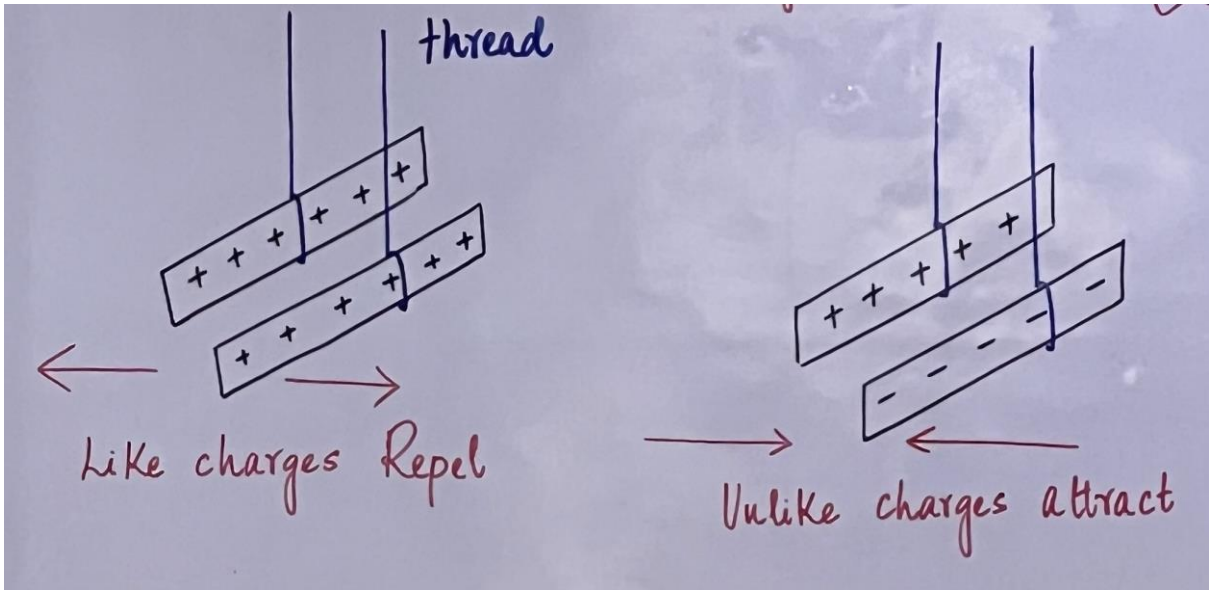
The two strips on this diagram which are labelled as A and B are called iron reeds. When the switch is closed, current flows in the direction indicated and this current magnetises the iron reeds. This causes the irons reeds to get attracted and as they come in contact the external circuit is activated. When the switch is opened the iron reeds are demagnitized and they return to their original position and the external circuit is deactivated

Electric bell
When the switch is closed current begins to flow in the direction indicated, this current magnetizes the iron bar, induced magnetism causes A and B to be attracted to each other, this results in the hammer striking the bong and a sound affect is produced. The forward movement of the hammer breaks the contact at C. As the contact breaks demagnetisation occurs and the system returns back to its original position. The contact is reestablished and the entire process is repeated again.

Circuit breaker

The purpose of this circuit breaker is to disconnect the appliance from the main supply of the current reaches an extremely high value. For example if the normal working current of an appliance is 6 amps, in this scenario the circuit breaker simply lets the current pass through. If due to some fault the incoming current becomes very high, the circuit breaker trips

The reset button provided by the manufacturer allows the circuit breaker to return back to its original position.



Properties of magnets:

- Every magnet has 2 poles, north and south
- The strength of a magnet is concentrated at its poles
- Like poles repel and unlike poles attract
- The strength of a magnet can be shown by constructing magnetic field lines around it. These field lines originate from the North Pole and go through the South Pole. For a stronger magnet we should construct more field lines or make the field lines look more concentrated as shown below

Uses of steel

Steel is used in the making of permenant magnets
Steel is used in making the needle of a plotting compass

How can a plotting compass be used to construct a magnetic field:

Place the compass close to the north end of the magnet and make a dot to mark the direction where the head of the needle points. Now reposition the compass such that it's tail coincides with the dot and make another dot to mark the direction where the head of the needle points. Continue repeating this procedure until you reach the other end of the magnet. Join all these points to form the magnetic field. Use different starting points and repeat the above steps, use of small compass is preferred.