

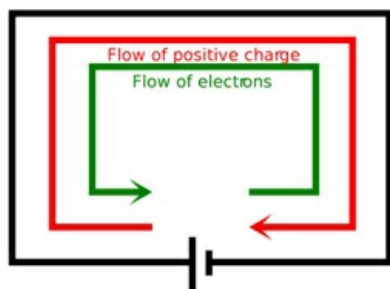
Class 7 Physics Electric Current and its Effects

Electric Current

An **electric current** is a **flow of electric charge**.

- This electric charge is carried by moving **electrons**(charge carriers) in a wire.
- Electric current is measured as rate of flow of charge.
- The SI unit for measuring an electric current is the Ampere (A).
- Electric current is measured using a device called an **Ammeter**.
- Electric current is denoted by symbol **I**.
- In past, it was considered that the current is the flow of **protons** from **positive battery terminal to negative battery terminal** through the circuit.
- Later it was discovered that the current is the flow of **electrons** from **negative battery terminal to positive battery terminal** through the circuit.

As a convention, current is still considered to flow from positive terminal to negative



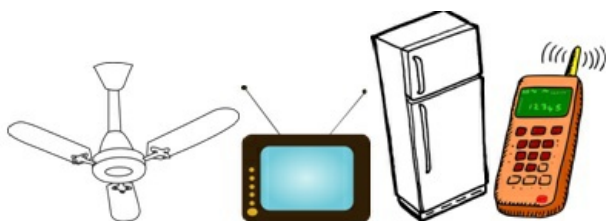
SI stands for "The International System of Units" (abbreviated from French: *Système international d'unités*)

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Applications of Electric Current

Applications of Electric Current or Electricity

- Electrical Appliances like Refrigerator, fan, tv, bulb, tube light etc.
- Cells, Batteries used in camera, remotes, mobiles, etc.
- Electronic components like computer chips.
- Electromagnets, Electrochemistry etc.



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
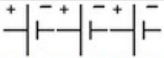
Hazards of Electric current

Hazards of Electric current

- Touching open wire carrying electricity or touching a plug with switch on results in flow of electric charge through human body called a **Electric shock**. This could result in pain, temporary or permanent burns, cardiac arrest, death etc.
- Lightning from sky may also cause similar effects as an Electric shock.
- Prolonged exposure to electromagnetic waves (mobile signal, wifi) affects human nervous system.




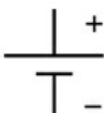

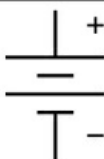

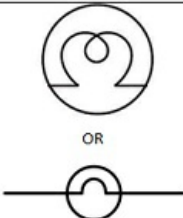
Cells Vs. Batteries








Cells	Batteries
<p>A cell is a device which produces electricity by means of electrochemical reaction.</p>	<p>A battery is a combination of two or more cells combined in series to produce higher electricity.</p>
	 <p>Cells connected in series back to back</p>  <p>Cells connected through wire</p>
	
<p>Used in smaller electricity requiring appliances like TV remote, wall clocks etc</p>	<p>Used in higher electricity requiring appliances like Car, toys, UPS/Inverters etc</p>

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Common Electric Components Symbols

Common Electric Components Symbols

S.No.	Electric Component	Component Physical Image	Symbol
1	Electric Cell		
2	Electric Battery		
3	Bulb		

S.No.	Electric Component	Component Physical Image	Symbol
4	Switch On		
5	Switch Off		
6	Electric Ground/Earth		
7	Wire		

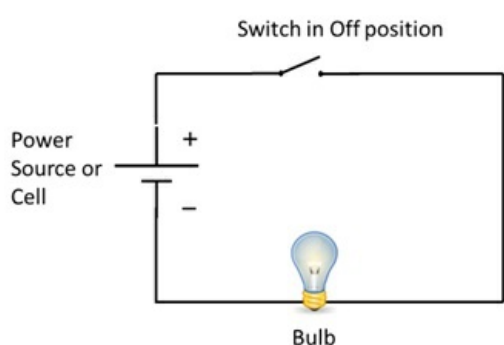
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Electric Circuit

Electric Circuit

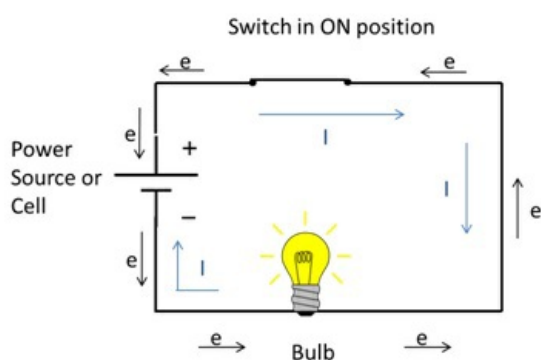
An electric circuit is a **path** in which electrons (or current) flow.

- If the circuit is incomplete or broken, the current doesn't flow. This type of circuit is called an **Open Circuit**.
- If the circuit is complete, the current flows. This type of circuit is called a **Closed Circuit**.
- If the circuit contains some material which does not allow current to flow through it, in that case too, even if the circuit is complete, the current doesn't flow. These materials are called **non-conductors**.
- A circuit usually contains a **Power Source**, which is the source of electrons and a **Load**, which is the electrical appliance, like a bulb, needing electricity to run.
- A **switch or key** in the circuit is used to make or break the circuit to start or stop current flow.
- An electric circuit is represented by a Circuit Diagram.
- **Circuit Diagram** is a pictorial representation of a circuit with electrical symbols for its corresponding parts.



A simple Open electric circuit diagram for a bulb when switch is OFF.

No current flows and the bulb is off.



A simple closed electric circuit diagram for a bulb when switch is ON.

Current is conventionally considered to flow from Positive to Negative terminal and the electrons actually flow from Negative to Positive.

The Bulb glows when current flows through it.

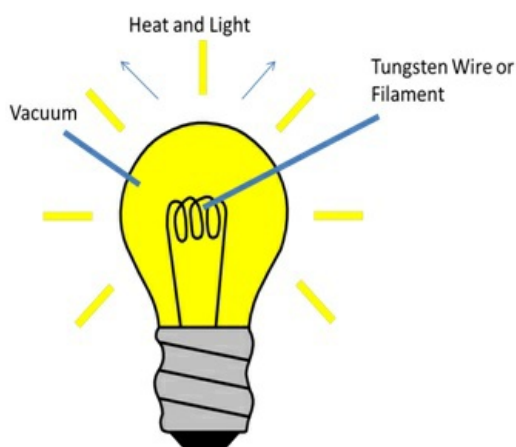
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Heating Effects of Current

Heating Effects of Current

When electric current is passed through a conductor, it generates heat due to the resistance it offers to the current flow.

- Appliances which require heating effect have conductors or the heating elements.
- Heating elements have high melting point so that they do not get damaged due to the heat generated.
- These elements have also low tendency to react with oxygen to avoid catching fire.
- The amount of heat generated in a wire depends upon
 - Material of the wire
 - Length of the wire
 - Thickness of the wire



When electricity passes through filament, it becomes hot and starts to glow. Due to high melting point, it does not melt. Absence of oxygen keeps it from catching fire.



A CFL saves energy lost in the form of heat in electric bulbs by using fluorescent effect of materials to generate light.

Class 7 Physics Electric Current and its Effects Applications of Heating effect of Current

Applications of Heating effect of Current



Electric Geyser



Iron Press



Water Heating Rod



Electric Kettle

Electrical Fuse and Circuit Breakers

A Fuse or a Circuit Breaker is a device which **protects appliances** from overcurrent or overload.

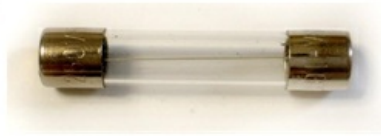
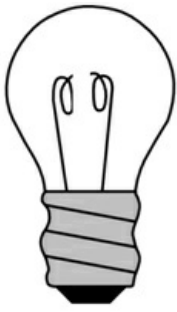
- In the circuit, it is placed after the power source and before the appliance.
- It has a wire of **low resistance** and **low melting point**.
- In case of excessive current, the wire of the fuse melts resulting in breaking of the circuit. Thus, no current flows through the main appliance, protecting it from damage and possible fire.
- Some of the causes of excessive current are
 - Short Circuit: can occur due to direct touching of two wires, water seepage inside and electric circuit etc
 - Overload: Connection of many devices into single socket.
 - Excessive current generated from power source.
- Every Fuse is labeled with the maximum rating (current and voltage it can withstand before breaking). So, appropriate fuse should be used according to the appliance/circuit requirements.
- Using a lower capacity fuse will result in frequent breaking of circuit. On the other hand, using a higher capacity fuse may not break in slightly excessive current and the appliance may damage.
- An **MCB (Miniature Circuit Breaker)** is a switching device which automatically turns off when current exceeds a safe limit.
- The automatic shutting off is called **tripping or trip**.
- MCB does not contain any wire but uses heating effect of current to break the circuit.
- In case of overload or overcurrent, a fuse gets burnt and needs to be replaced whereas a circuit breaker can be reset (like a normal switch) to resume normal operation.



Fuses used in houses.
Contain wire with low
melting point.



MCB (Miniature Circuit Breaker)
Increasingly replacing fuses to
reduce operational costs.



Fuse used in electrical appliances

A fused bulb does not glow because the circuit doesn't get completed due to break in filament.

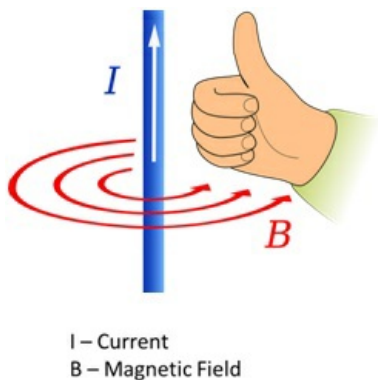
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Magnetic Effects of Current

Magnetic Effects of Current

When an electric current passes through a wire, it behaves like a magnet. This magnetic effect of electric current is known as **electromagnetic effect**.

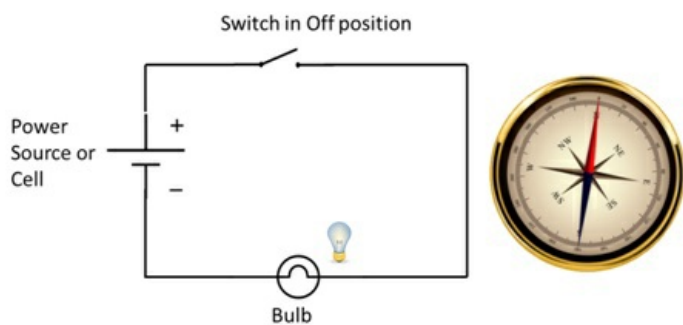
- Hans Christian Oersted (1777-1851) discovered magnetic effect of current in 1820.
- A **compass** is a watch like instrument which shows direction using the magnetic field produced inside the earth.
- The compass needle is a **tiny magnet** which always point in **North-South**
- If a compass is brought near **a magnet or a circuit carrying current** the needle gets deflected due to **magnetic field** produced by both of them.
- If the direction of current is reversed, the magnetic field also gets reversed.



Class 7 Physics Electric Current and its Effects

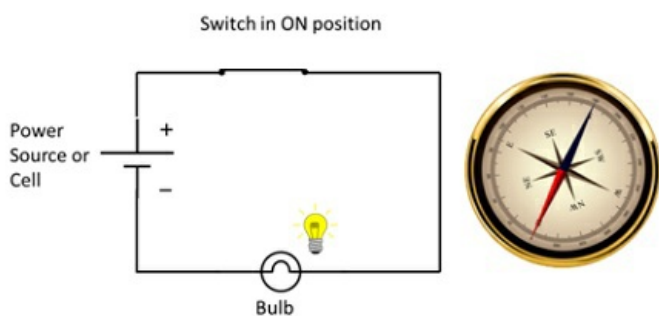
Oersted Experiment

Oersted Experiment



An open circuit with a compass placed near it.

No current flows, the bulb is off and compass shows no deflection.



A closed electric circuit with compass placed near it.

When current flows, compass shows a deflection due to magnetic field created by flowing current.

Class 7 Physics Electric Current and its Effects

Electromagnet

Electromagnet

An electromagnet is a type of magnet in which the **magnetic field is produced by an electric current**



Coil/Wire wound around a core (Iron nail). Charge through battery makes it an electromagnet.

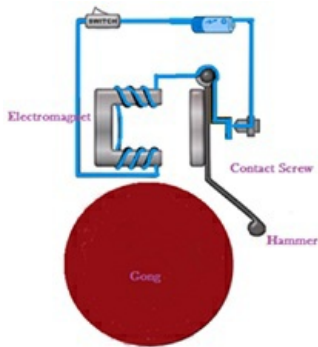
- The magnetic field disappears when the current is turned off.
- Electromagnets usually consist of a large number of **closely spaced turns of wire or coil** that create the magnetic field.
- The wire turns are often wound around a **magnetic core** made from a ferromagnetic or ferrimagnetic material such as iron.
- Advantage of an electromagnet over a permanent magnet is that the magnetic field is **controllable** (switching on/off electric current).
- Disadvantage of an electromagnet over a permanent magnet is that it **needs continuous supply**.
- Examples of Electromagnets used in day to day life are: Induction plate, electric bell, hard disk drives, Loudspeakers, Motors



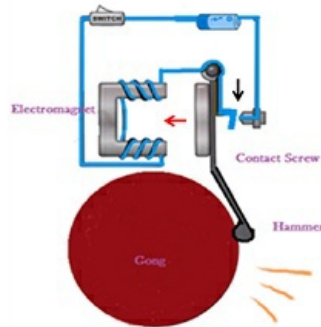
Class 7 Physics Electric Current and its Effects

Electric Bell

Electric Bell



Situation – 1. Hammer is away from Gong. No Sound.



Situation – 2. Hammer is hitting Gong resulting in sound.

- Initially electric bell is at Situation 1 when no current is flowing.
- When switch is pressed and current starts flowing, the electromagnet starts attracting iron bar (denoted by red arrow in Situation – 2).
- This results in hammer hitting gong producing sound and breaking of circuit (denoted by black arrow)
- When circuit breaks, current stops flowing and the bell goes to Position – 1 as the electromagnet loses its magnetism.
- Again at Position – 1, since the switch is pressed, the process repeats.
- Thus, charging and discharging of electromagnet results in hammer hitting the gong and producing sound.