

CHAPTER 07

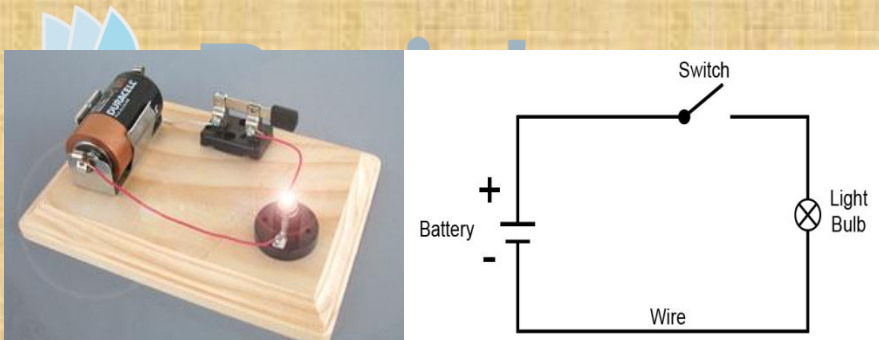
ELECTRICITY

Electricity

Electricity briefly defined as the flow of electric charge. It has been adapted for huge and growing number of uses in our daily life.

We use many electrical devices like TV, washing machines, lights etc. but have you ever wondered how pressing a switch makes light bulb glow? Electricity produced by the battery is the key factor to make these devices to function.

In order to understand these we need to know about basic electric components and circuit.

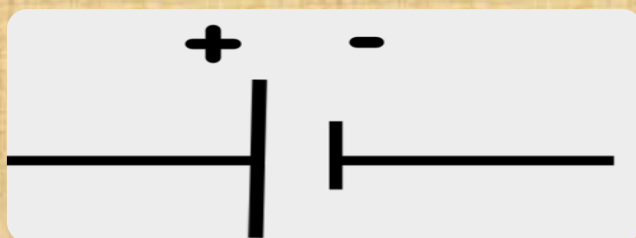
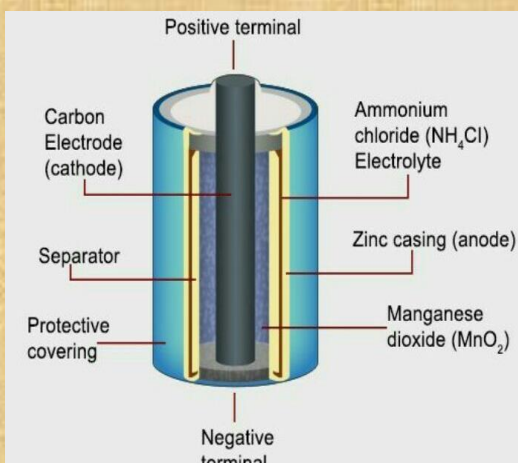
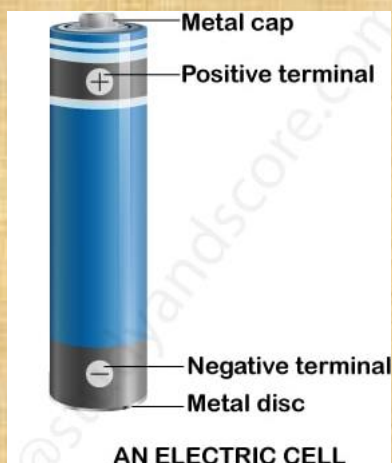


Basic electric circuit

Basic electric components

1. Electric cell

An electric cell is an “Electrical power supply”. It converts chemical energy into electrical energy to do useful work. An electric cell has two terminals – positive (+) and negative (-). Positive side of an electric cell has a metal cap and negative side has a flat metal disc. When two terminals connected to an electrical device, electric current flows through it.



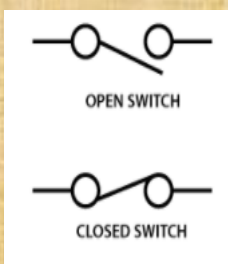
In electric cell, symbol long vertical line represents positive terminal and thicker small line represents negative terminal.

2. Switch

Switch is a device used to close or open an electric circuit.

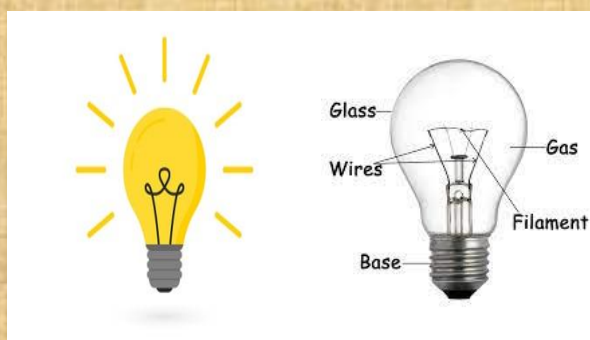
Switch off – Open circuit. It means the contacts separated and circuit is broken. No current is flowing.

Switch on – Closed circuit. It means the contacts are touching, circuit is closed and current is flowing.



Electric bulb

Electric bulb is a produces light on the application of electricity. It has a thin filament made of tungsten. Electric bulbs emit light and heat when electricity passed through the high resistant tungsten filaments.



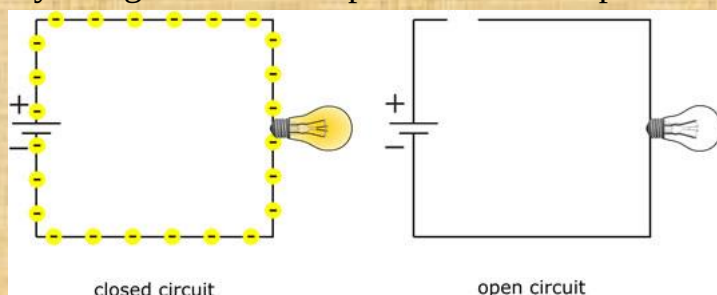
Electric bulb

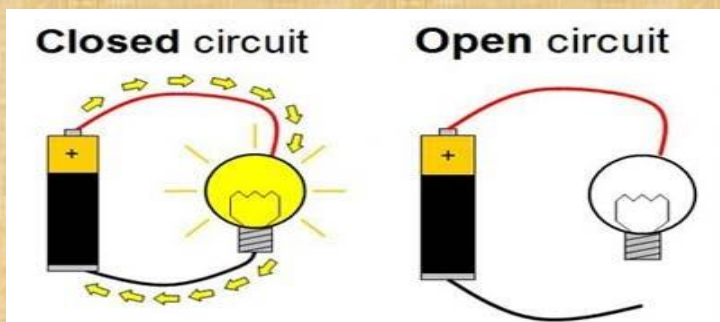
3. **Battery** – When two or more cells joined, together to create a flow of electrons in a circuit referred as battery.



4. **Connecting wires** – Wires of different materials and thickness, used for establishing electrical conductivity between two devices of an electrical circuit.

By using all these components lets complete circuit



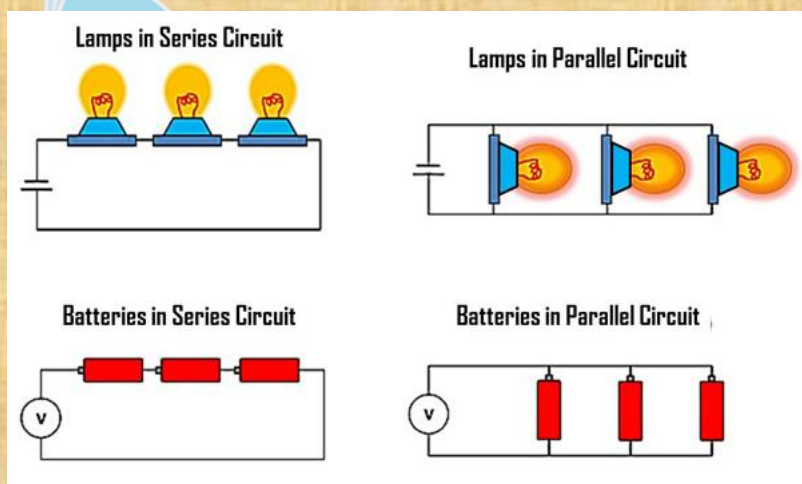


The sequence of components is as follows:

Positive terminal of the cell ----- Wire ----- Switch -----
 Wire ----- Bulb ----- Wire ----- Negative terminal of the cell.

Circuits

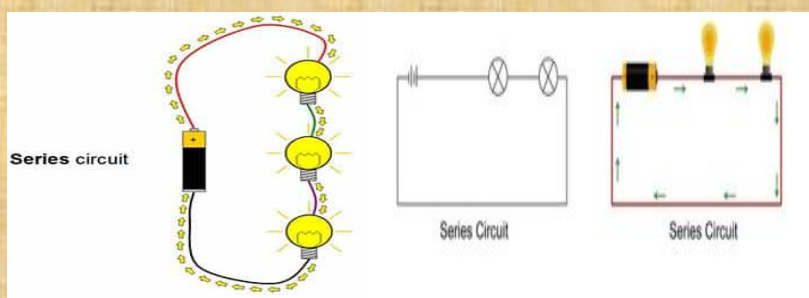
Circuits containing one battery and one load are simple to understand and analyze. Practically two or more components or electric devices in a circuit connected in two basic ways. They connect in series or parallel manner.



Series circuits

Series circuits have simple designs that are easy to understand. They have only one path through which current flow. The flow of current is same throughout all the components in the circuit. If any fault happens in the circuit, the current will not flow through the

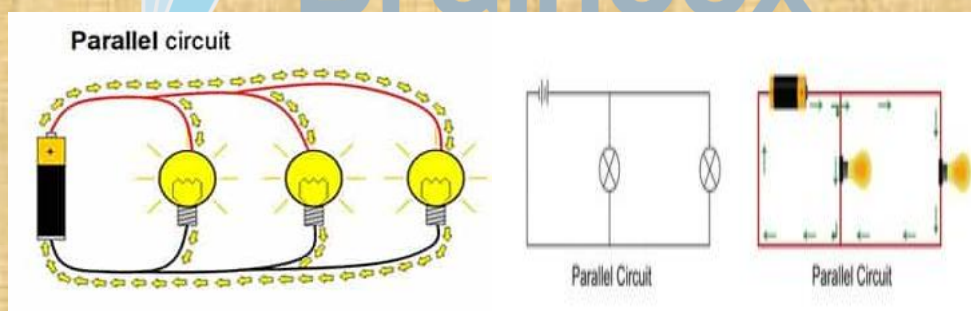
circuit and will be incomplete. All the components in series circuits are connected end-to-end, forming a single path for current flow.



Pictorial representation of series circuits

Parallel circuits

In parallel circuits, there are two or more paths for the current to flow. All the components have various branches for current flow. The flow of current is not same throughout the circuit. In a parallel circuit, if any one component damaged, the current does not stop and continues to flow through the other components and work efficiently.



Pictorial representation of parallel circuits

Series circuits

All the components arranged in a single line.

The flow of current is same throughout all the components in the circuit.

If fault occurs at one point, the total circuit will break.

Parallel circuits

All components arranged parallel to each other.

There are two or more paths for the current to flow.

If any one component damaged the current, flow does not stop and continues to flow through other components.

Heating effects of electric current

Before we go to any function, school or office we like to iron our clothes. If we want to drink hot water we switch on electric kettle and like to have hot water bath, we switch on electric geyser immediately.

- What is the mechanism behind the working of these electrical appliances?

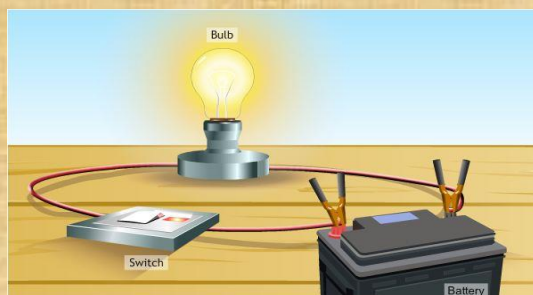
All these devices work based on the heating effects of electric current. They play important role in our daily life.



When an electric current passed through a conductor or resistant wire, the conductor becomes hot after some time and produces heat. The change in temperature is due to transformation of some electric energy into heat energy. This effect called the heating effect of electric current.

This heating effect used in many appliances like electric kettles, iron, geysers, electric cookers, electric bulbs etc.

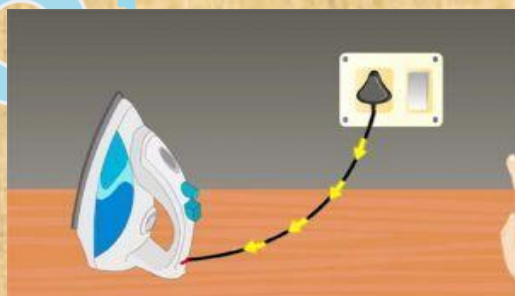
Electric bulbs – Filament made of tungsten wire enclosed in glass bulbs. When current flows through the tungsten wire, it become hot and emits light. Some of the electric energy dissipated in the form of heat and rest emitted in the form of light energy.



Fluorescent lamps are more efficient and last much longer compared to filament lamps. They are expensive to install but their running cost is much less.

Electric kettles – The heating element placed at the bottom of the kettle becomes hot when there is flow of current. The heat absorbed by the water in kettle distributes throughout the liquid.

Electric irons – When current flows through the heating element, the heat energy transfers to the heavy metal base raising its temperature. This energy is used to press the clothes.



Fuse – A fuse is a safety device preventing damage to electrical circuits and possible fires. When large electric current flows the fuse wires melt quickly and break. In this way fuses stop the excess current flow.



Miniature circuit breaker (MCB):

These days MCB, are more preferred to use than fuse. It automatically switches off electrical circuit during any abnormal conditions in the electrical network such as overload and short circuit conditions.



Know your electricity bill

- 1 kilowatt = 1000 watts
- 1 kw per hour = 1 unit of electricity
- The unit cost differs in different areas.

For example:

An air conditioner has a rating of 2kW. Find the cost of operating it for 10hrs. Given cost per unit is 3Rs.

Cost for 10hrs? → kWhs?

$P = 2\text{ kW}$
 $t = 10\text{ hrs}$
 cost/unit = 3Rs
 → kWh

$E = 2\text{ kW} \times 10\text{ hrs}$
 $= 20\text{ kWh}$
 $E = 20\text{ units}$
 Cost = $20 \times 3\text{Rs} = 60\text{Rs}$

The cost of operating air conditioner for 10 hours is Rs. 60/-.

Glossary

Battery – two or more cells join together to form a battery.

Bulbs in Series – Bulbs connected in series for flow of charge in single pathway.

Bulbs in Parallel – Bulbs connected in separate paths through which electricity can flow.

Cell – A source of electric energy.

Circuit Diagram – A graphical representation of electrical circuit.

Fuse – Safety device used in electric circuit.

Heating effect of Current – Heat produced by the flow of electric current through conductor.

Miniature Circuit Breaker – Switches which turn off automatically when there is excess of current flow.

Parallel Circuit – Circuits having more than one path for flow of electricity.

Series Circuit – Circuits having single path for current flow.

Switch – Device used to close or open an circuit.

Watt – A unit of power.