

Electricity

Learning Objective

1. Introduction
2. Electric charge
3. Electric current
4. Electric cell
5. Electric circuit
6. Different components of an electric circuit
7. Conductors and insulators

INTRODUCTION

Electricity plays a very important role in our everyday life. It is one of the most useful forms of energy used by us. We use electricity for various purposes like to heat or cool our rooms, to run our televisions, to light up our houses etc.

Various electrical appliances are used by us. Let us discuss the source of the electrical energy and how the appliances work in an electric circuit.

ELECTRIC CHARGE

Do You Know

The rubbing induces a build-up of static electrical charge. The rain drops and hailstones are usually negatively charged acquired by rubbing.

It was observed that when a glass rod rubbed with a silk cloth, is brought near another glass rod rubbed with silk, both the glass rods repel each other. But if a glass rod rubbed with silk is brought near an ebonite rod rubbed with fur, then they attract each other.

This happens because on rubbing a glass rod with silk or ebonite rod with fur, there is a transfer of charge from one body to another. The charges acquired by glass rods are of same nature but charge acquired by ebonite is of different nature.

So all these observations lead to a conclusion that (i) There are only two types of charges viz. positive (proton) and negative (electron) charge.

(ii) Like charges repel each other and unlike charges attract each other.

The positively charged particles present in the nucleus of an atom are called **protons** and the negatively charged particles present outside the nucleus are called **electrons**.

Electric charge is a fundamental property of matter. An atom on the whole is neutral (no charge) but transfer of electrons creates positive charge on the object which delivers the electrons and

negative charge on the object which receives those electrons.

The **S.I. unit** of charge (Q) is coulomb (C).

ELECTRIC CURRENT

Do You Know

On average, a current of 20,000 A flows in a lightning bolt, even if the bolt lasts for only a fraction of a second. 50 mA is enough to be fatal for a human.

The orderly motion of electrons in a particular direction gives rise to electric current.

Mathematically, electric current (I) is defined as

the rate of flow of charge. $I = \frac{Q}{t}$

The S.I. unit of electric current is ampere (A)

$$1A = \frac{1\text{coulomb}}{1\text{sec.}}$$

When a source of current is connected, to an electrical appliance, the electric current flows in one direction i.e., from negative terminal to the positive terminal within the cell and from positive to negative terminal outside the cell.

ELECTRIC CELL

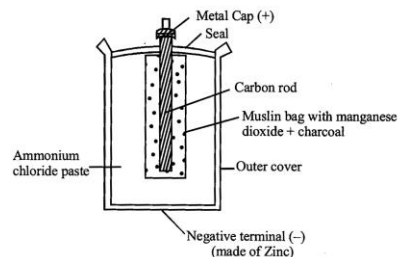
Electric cell is a device which converts chemical energy into electrical energy.

It is a source of electric current. It has two terminals viz. positive and negative.

Dry cell is the most commonly used cell in torches, transistors, toys, calculators and other electrical appliances.

Do You Know

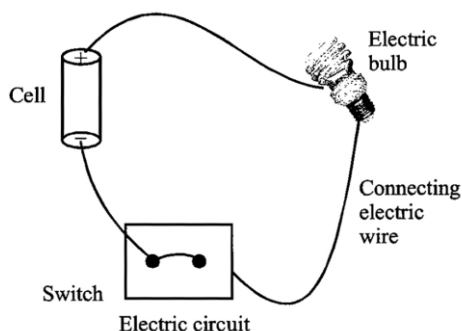
Battery was developed by Alessandro Volta about 200 years ago. He discovered that when two strips of different metals were put in a sulphuric acid solution and connected with a wire, electricity began to flow.



The chemicals in the cell react to produce current. A dry cell supplies current till the chemicals are exhausted and cannot react anymore.

The combination of more than one cells is termed as a battery. Battery is used when one cell cannot provide sufficient amount of current to the appliance.

ELECTRIC CIRCUIT



Electricity requires a path to flow from the positive terminal to the negative terminal of a cell. An arrangement or connection that provides the path to the current to flow from positive to the negative terminal outside the electrical cell via different electrical components is known as an electrical circuit.

It is important to note here that the bulb will glow only if positive and negative terminal of an electric cell are connected to the two terminals of the bulb.

Open circuit: If no current is flowing through the electric circuit, then it is said to be open circuit. When the switch is in OFF mode, then it is an open circuit.

Closed circuit: The electric circuit through which the current is flowing, is known as closed circuit. When the switch is ON then the circuit is closed.

Do You Know

Electric cell can produce strong electric shocks of around 500 volts, for both self defense and hunting.

DIFFERENT COMPONENTS OF AN ELECTRIC CIRCUIT

- 1. Connecting wire:** A metal wire usually made of copper or aluminium acts as a connecting wire. It connects all the components of an electrical circuit.

Symbol of connecting wire: —————

- 2. Cell:** The source of current in an electric circuit

Symbol of cell:

- 3. Battery:** A combination of two or more cells joined in series is called a battery.

Symbol of battery:

- 4. Plug key (or switch):** A plug key is the electric switch in the circuit which controls the flow of current.

Symbol of Open key (OFF) Closed key (ON)

- 5. Ammeter:** It is an instrument used for measuring the magnitude of current in an electric circuit.

Symbol of ammeter:

CONDUCTORS AND INSULATORS

The materials which allow the electric current to flow through them are called **conductors**. Most of the metals conduct electricity, so they are used as connecting wires. For e.g., silver, copper, aluminium, etc. Silver is the best conductor of electricity.

Materials which do not allow the electric current to flow through them are **called insulators**. For e.g., plastic, rubber, bakelite, leather etc. are insulators.

Insulating material is used for insulation of connecting wires. PVC is the most commonly used insulating material.