

## UNIT

# 4

# ELECTRIC CHARGE AND ELECTRIC CURRENT

## Learning Objectives

After completing this lesson, students will be able to:

- understand the electric charge, electric field and Coulomb's law.
- explain the concepts of electric current, voltage, resistance and Ohm's law.
- draw electrical circuit diagrams for series and parallel circuits.
- explain the effects of electric current like. heating or thermal effect, chemical effect, and magnetic effect.
- understand direct and alternating currents.
- know the safety aspects related to electricity.



## Introduction

Like mass and length, electric charge also is a fundamental property of all matter. We know that matter is made up of atoms and molecules. Atoms have particles like electrons, protons and neutrons. By nature, electrons and protons have negative and positive charge respectively and neutrons do not have charge. An electric current consists of moving electric charges. Electricity is an important source of energy in the modern times. In this lesson, we will study about electric charges, electric current, electric circuit diagram and the effects of electric current.

### 4.1 Electric charges

Inside each atom there is a nucleus with positively charged protons and chargeless neutrons and negatively charged electrons orbiting the nucleus. Usually there are as many electrons as there are protons and the atoms themselves are neutral.

If an electron is removed from the atom, the atom becomes positively charged. Then it is called a positive ion. If an electron is added in excess to an atom then the atom is negatively charged and it is called negative ion.

When you rub a plastic comb on your dry hair, the comb obtains power to attract small pieces of paper, is it not? When you rub the comb vigorously, electrons from your hair leave and accumulate on the edge of the comb. Your hair is now positively charged as it has lost electrons and the comb is negatively charged as it has gained electrons.

#### 4.1.1 Measuring electric charge

Electric charge is measured in coulomb and the symbol for the same is C. The charge of an electron is numerically a very tiny value. The charge of an electron (represented as  $e$ ) is the fundamental unit with a charge equal to  $1.6 \times 10^{-19}$  C. This indicates that any charge ( $q$ ) has to be an integral multiple ( $n$ ) of this fundamental unit of electron charge ( $e$ ).  
 $q = ne$ . Here,  $n$  is a whole number.