Chapter 12 - Electricity

Introduction

Electricity originated from the Greek words “Electrica” and “Elektron”.
The Greek Philosopher Thales was the first to observe the attracting capacity of certain materials when rubbed on other materials.
Gilbert classified these materials as Vitreous and Resinous.
These names were later changed to positive and negative charges.

Frictional Electricity

Fur, Flannel, Wax, Glass, Cotton, Paper, Silk, Human skin, Wood, Metals, Rubber, Resin, Amber, Sulphur, Ebonite.
If any two materials in this series are rubbed against each other the element occurring first in series will acquire positive charge and the element occurring later will acquire negative charge.

Fundamental Laws of Electrostatics

There are two kinds of charges- positive and negative.
Like charges repel and unlike charges attract each other.

Coulomb’s Law

$F \alpha (q_1q_2)/r^2$
The electrostatic force of attraction or repulsion between a pair of charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between them.
$F = (Kq_1q_2)/r^2$
K is the constant of proportionality and is equal to 9×10^9 Nm^2/C^2 for free space.
For similar charges the force is repulsive and for dissimilar charges it is attractive.

Charge Conservation

When an ebonite rod is rubbed with fur, the ebonite rod acquires negative charge and the fur acquires positive charge. This means electrons have moved from fur to ebonite. The net charge in the system remains the same. So charges are neither created nor destroyed but transferred from one material to the other.

Insulators and Conductors

Insulators are bad conductors of charges but they can be charged easily by friction.
Conductors allow free flow of charges.

Current

Current is the rate of flow of charge.
If q is the charge in coulomb and t is the time is seconds then current I=q/t
The SI unit of current is ampere (A).
Current is a scalar quantity.