THE ELECTRIC CURRENT

We have already noted that like, or similar charges repel each other, whereas unlike, or opposite charges attract each other. Thus, charged particles within a material are in the state of constant movement. But, when some external forces act on them, these charged particles may be made to move continuously in the same direction for some time. Such continuous movement is an electric current.

In 1862, Georg Simon Ohm, a German scientist, first established reliable and experimentally proved facts about electricity. He found the connection between the three values on which the transfer of electricity from one end of the conductor to the other depends. These three values,

electromotive force

current and

resistance

led to the postulation of the fundamental law in electricity: Ohm’s law.



Figure 2 - Difference between amounts of potential energy makes electrons flow through a conductor

Electromotive force (abbreviated EMF), usually called voltage (V), is the force or pressure that moves electrons through a conductor. If electrons are piled at one end of the conductor, and if there are fewer electrons at the other end, the excess of electrons will flow toward the point of deficiency, i.e. the current will flow through the conductor from the negative end to the positive one. The unit of the electromotive force is the volt, V, named after the Italian scientist, Alessandro Volta.

The flow of electrons from one end of the conductor to the other is not always the same. On their way, they collide with atoms and molecules, atoms and molecules oppose them and that property of the conductor is called electric resistance. The greater the number of free electrons in the conductor, the lower is its resistance.

Most metals are good conductors, but the resistance of a conductor does not depend only on the material of which the conductor is made. It also depends on the cross-section of the conductor. The greater the cross-section, the lower is the resistance of the conductor. The third element is the length of the conductor. The longer the conductor, the greater is its resistance. And at last, there is the temperature of the substance. If the temperature of a metal wire is higher, the resistance will be higher. The unit of the resistance is the ohm, Ω, named in the honour of G. S. Ohm.

I stands for intensity, strength or amount of current. It is, in fact, determined by the number or quantity of electrons which pass through the cross-section of a conductor per unit of time. The intensity depends upon the potential difference, and the resistance of the conductor. The greater the potential difference, the larger the quantity of electrons flowing through the conductor – the greater the resistance, the smaller the quantity of electrons. The unit of the intensity is the ampere, A, named for a French scientist, André Ampère. The relationship between the voltage (V), the current (I), and the resistance (R) is stated in Ohm’s law:

𝐼=𝑉𝑅

The greater the electromotive force (R = constant), the greater will be the current.

The greater the resistance (V = constant) the smaller the current.

The current is directly proportional to the voltage and inversely proportional to the resistance

DISCUSSION QUESTIONS

1) How do like/unlike charges behave?

2) What happens when some external forces start acting on charged particles within the material?

3) What is an electric current?

4) What did G. S. Ohm find?

5) What is voltage?

6) How do electrons flow through a conductor?

7) What makes electrons move through a conductor?

8) What is resistance?

9) Explain the relationship between the number of free electrons in the conductor and its resistance.

10) What does the resistance of a conductor depend on?

11) How does the resistance of a conductor depend on:

a) the material of which the conductor is made,

b) the cross-section,

c) the length and

d) the temperature?

12) What does the symbol “I” stand for?

13) What is the intensity of the current determined by?

14) State Ohm’s law.

TRANSLATE INTO SPANISH AND HAND IN

CURRENT KILLS

Electric devices and circuits can be dangerous. Safe practices are necessary to prevent shock, fires, explosions, mechanical damage, and injuries resulting from the improper use of tools.

Perhaps the greatest of these hazards is electrical shock. A current through the human body in excess of 10 milliamperes can paralyse the victim and make it impossible to let go of a “live” conductor. Ten milliamperes is a small amount of electrical flow: It is ten on one thousandths of an ampere. An ordinary flashlight uses more than 100 times that amount of current! If a shock victim is exposed to currents over 100 milliamperes, the shock is often fatal. This is still far less current than the flashlight uses.

A flashlight cell can deliver more than enough current to kill a human being. Yet it is safe to handle a flashlight cell because the resistance of human skin normally will be high enough to greatly limit the flow of electric current. Human skin usually has a resistance of several hundred thousand ohms. In low-voltage systems, a high resistance restricts current flow to very low values. Thus, there is little danger of an electrical shock.

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The greater the resistance (V = constant) the smaller the current.

The current is directly proportional to the voltage and inversely proportional to the resistance.

High voltage, on the other hand, can force enough current through the skin to produce a shock. The danger of harmful shock increases as the voltage increases. Those who work on very high-voltage circuits must use special equipment and procedures for protection.

When human skin is moist or cut, its resistance can drop to several hundred ohms. Much less voltage is then required to produce a shock. Potentials as low as 40 volts can produce a fatal shock if the skin is broken! Although most technicians and electrical workers refer to 40 volts as a low voltage, it does not necessarily mean safe voltage. Obviously, you should be very cautious even when working with the so-called low voltages.

Safety is an attitude; safety is knowledge. Safe workers are not fooled by terms such as low voltage. They do not assume protective devices are working. They do not assume a circuit is off even though the switch is in the OFF position. They know that the switch can be defective. Before they act, they investigate, they follow procedures, when in doubt, they do not act, and they consult their instructor.

PUT IN THE MISSING WORDS (the same words may be used several times)

negative electron(s) battery flow attract positive pump terminal repel current circuit negatively components

An electric current is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ charged particles called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ flowing through the wires and electronic \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ built-in the electric \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It can be compared to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of water through pipes, radiators etc. As water is pushed through pipes by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, electric current is pushed through wires by a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Like charges\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ each other and unlike charges \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Two negatives will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ each other. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will \_\_\_\_\_\_\_\_\_\_\_\_\_ each other.

The negative terminal of a battery will push \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ along a wire. The positive terminal of a battery will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ negative \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ along a wire. Electric \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ will therefore flow from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ terminal of a battery, through the lamp, to the positive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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