

ELECTRICAL ENERGY

AND POWER

Electrical energy is defined as the product of electric charge and the potential difference between the points of transfer.

$$\text{Electrical Energy} = \text{Charge} \times \text{Voltage}$$

$$E = qV$$

But

$$q = It$$

$$E = (It)V$$

$$E = VIt$$

But

$$V = IR$$

$$E = (IR)t$$

$$E = I^2 Rt$$

$$I = \frac{V}{R}$$

$$E = \left(\frac{V}{R}\right)^2 Rt$$

$$E = \frac{V^2}{R} t$$

The commercial unit of Energy is kilowatt hour kWh and it is used by PHCN to calculate the cost of electricity

Electrical energy is also the product of electric power and time

$$E = Pt$$

$$Pt = VIt \quad P = VI$$

$$Pt = I^2 Rt$$

$$P = I^2 R$$

$$Pt = \frac{V^2}{R} t$$

$$P = \frac{V^2}{R}$$

EFFECTS OF CURRENTS

Electric current has many effects on substances which include

Chemical effects

Magnetic effects

Sound effects

Light effects

Mechanical effects

Heating effects

Etc.

HEATING EFFECT OF CURRENT

When energy flows through a material, the resistance of the material makes it easy for energy conversion from electrical energy to heat energy.

$$\text{Electrical Energy} = \text{Heat energy}$$

$$Pt = mc \Delta \theta = ml$$

$$VIt = mc \Delta \theta = ml$$

$$I^2 Rt = mc \Delta \theta = ml$$

$$\frac{V^2}{R} t = mc \Delta \theta = ml$$

ELECTRICAL ENERGY AND POWER TRANSMISSION

In the transmission of power, efforts must be made to ensure that power loss is minimized in the transmission. This can be achieved by two major ways

High tension Transmission: This is transmitting power at high voltage and low current.

Using transmitting cables of low resistances

Generally, power loss in transmission is expressed as

$$P_l = I^2 R$$

ELECTRIC FUSE

A fuse is defined as a safety device with a low melting point (i.e. it can easily melt). It prevents excess current from flowing into houses and appliances. A fuse will limit the amount of current flowing in a circuit hence preventing electrical damage. In most houses, the fuses used are 13A fuses. If the current entering the house is more than 13A, the fuse will blow.

A fuse must be connected to the live terminal (or live wire) which is painted brown or red.

It should be noted that the neutral wire is painted blue or black

The Earth wire is painted yellow or green or both.

The current rating (or fuse rating) of a fuse can be described as the ratio of the power to the voltage

$$I_f = \frac{P}{V}$$

All houses should be provided with fuses to prevent electrical damage.

Earthling is also needed in houses in order to prevent (or reduce) electric shock.

Home appliances are connected in parallel in order to prevent overheating of the wires and to reduce energy loss (or wastage). In parallel connection, the malfunctioning of one appliance does not affect the other.

WIRES

In current transmission, the wires used are

The live wire: This is painted brown or red and current comes into a socket or source through this wire

The neutral wire: This is painted blue or black and current goes out of the source or socket

The Earth wire: This is painted yellow or green or both.