

ELECTRICITYELECTRIC POWER :-

Electric power is the electrical work done per unit time.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}} \Rightarrow P = \frac{W}{t}$$

(i) Unit of power is Joule/second or watt.

(ii) "The power of 1 watt is a rate of working of 1 joule per second."

$$1 \text{ watt} = \frac{1 \text{ joule}}{1 \text{ second}}$$

(i) Formula for calculating Electric Power :-

We know that,

$$P = \frac{W}{t}$$

$$\therefore (W = Vit)$$

So,

$$P = \frac{Vit}{t} = Vi$$

$$\Rightarrow \boxed{P = Vi}$$

where —

V = Potential difference

i = Current

(ii) Power  $P$  in terms of  $I$  and  $R$  :-

We know that -

$$P = VI \quad \text{--- (a)}$$

from Ohm's law,

$$V = IR$$

from equation (a)

$$P = iR \times i$$

$$\boxed{P = i^2 R}$$

(iii) Power ' $P$ ' in terms of  $V$  and  $R$  :-

We know that

$$P = Vi \quad \text{--- (a)}$$

from Ohm's law -

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

from equation (a)

$$P = V \times \frac{V}{R}$$

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

Ex- What will be the current drawn by an electric bulb of 40W when it is connected to source of 220 V?

$$P = V \times i$$

Given :-

$$V = 220 \text{ Volt}$$
$$P = 40 \text{ W}$$

$$i = \frac{P}{V} = \frac{40}{220}$$

$$i = 0.18 \text{ amp.} \quad \underline{\underline{\text{Ans.}}}$$

Ex- A current of 4A flows through a 12V car headlight bulb for 10 minutes. How much energy transfer occurs during this time?

$$\text{Energy} = \text{Power} \times \text{time}$$

$$E = P \times t$$

$$\therefore P = V \times i = 12 \times 4 = 48 \text{ W} = 0.048 \text{ kW}$$

$$E = 0.048 \times \frac{1}{6} = 0.008 \text{ kWh} \quad \underline{\underline{\text{Ans.}}}$$

## Questions

Que 1. What is meant by "electric power"?  
Write the formula for electric power  
in terms of potential difference and current.

Que 2. An electric motor takes  $5\text{ A}$  current  
from a  $220\text{ volt}$  supply line. Calculate the  
power of the motor and electrical energy  
consumed by it in  $2\text{ hours}$ .

Que 3. What is the maximum power in kilowatt  
of the appliance that can be connected  
safely to a ~~13 A~~  $13\text{ A}$  and  $230\text{ V}$  mains  
socket?

Que 4. In a house two  $60\text{ W}$  electric bulbs  
are lighted for  $4\text{ hours}$ , and three  $100\text{ W}$   
bulbs for  $5\text{ hours}$  everyday. Calculate  
the electric energy consumed in  $30\text{ days}$ .

Que 5. An electric fan runs from the  $230\text{ volt}$   
mains. The current flowing through it is  
 $0.4\text{ A}$ . At what rate is electrical energy  
transferred by the fan?