Brainbox learn easy

Chapter 11

WORK AND ENERGY

Power:

"Rate of doing work".

$$P = \frac{\text{Work}}{\text{Time}}$$

Units: J/s or Watt

1 W = 1 J/s

Larger units can be expressed as kW

1 kW = 1000 W = 1000 J/s

1 H.P = 746 watts

If work done by an agent vary with time, then consider average power. i.e.

$$\text{Avg. Power} = \frac{\text{Total work}}{\text{Total time}}$$

Commercial unit of energy:

Generally, electricity consumption is measured in kWh.

$$\boxed{1\ \text{Unit} = 1\ \text{kWh}}$$

"1 kWh is the energy used in one hour at the rate of 1000 J/s".

$$\therefore 1\text{kWh} = 1 \times 10^3 \times \frac{1\text{J}}{\cancel{\text{s}}} \times 3600\cancel{\text{s}}$$

$$= 3.6 \times 10^6\ \text{J}$$

Problem 5:

Find the power of an electric motor if it lifts 200 Kg of water in 5 minutes from a well of depth 120m.

Sol.

$$P = \frac{\text{Work}}{\text{Time}} = \frac{mgh}{\text{Time}}$$

$$= \frac{200 \times 9.8 \times 120}{5 \times 60}$$

= **784 Watt**

Problem 6:

Find the energy in kWh consumed in 10hrs by four devices of power 500W each.

Sol.

Power of 4 devices = 4 x 500 = 2 kW

∴ Total power consumed in 10 hrs = 10 x 2 kW

= **20 kWh**

i.e. **20 Units**