WORK AND ENERGY POWER

Power

- 1. Power of a machine is defined as the rate of work done by the machine.
- 2. Power is defined as the rate of doing work.
- 3. Power of a machine is defined as work done by the machine per second.

If you lift a block of mass 1 kg through a distance of 1 m in 2 seconds, what is the work done? W = F × s = mg × h = 1 × 9.8 × 1 = 9.8 J

If you lift the same block through the same height in 1 minute, what is the work done? The answer comes out to be the same 9.8 J.

What is the work done if the time taken is 5 minutes? The work done is again 9.8 J.

But we are generally interested in time-oriented work, i.e., work should be completed in a particular amount of time. The physical quantity which takes care of 'how fast is the work done' is power.

Note:

If we want to find rate of work done by a man then the word 'machine' can be replaced by 'man

 $Power = \frac{Work}{time} \qquad P = \frac{W}{t}$

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PHYSICS

Power is scalar quantity Unit of power

SI unit of power is watt (W) 1 kW = 1000 W 1 MW (Mega watt) = 10⁶ W 1GW (giga watt) = 109 W Another unit of power is horse power (HP). 1 HP = 746W

Definition of Watt

When t = 1 s, W = 1J, then P = 1 W

One watt is the power of a man or a machine capable of doing work at the rate of one joule per second

1 watt = $\frac{1 \text{ joile}}{1 \sec ound}$ $W = j s^{-1}$

Power in terms of energy:

Since work and energy are interconvertible, therefore,

 $Power = \frac{Energy}{time}$ $P = \frac{E}{t}$ $E = p \times t$

Also, $W = F \times s$ When displacement is applied in the direction of force

$$P = \frac{W}{t} = F \times \frac{s}{t}$$

 \Rightarrow P = F × v This is power in terms of force and velocity.

Average power:

Average power of an agent is defined as the ratio of total work done to the total time taken.

Average Power $=\frac{total \ work \ done}{t \ total \ time \ taken}$