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CLASS - IX

Chapter - Work, Power and Energy

Page No.

Date :

Page 1/20

⇒ * Work done by the force of gravity is same whether the body comes down from a certain height using stairs or slope or a lift i.e. $W = mgh$

⇒ * Similarly work done by the force of gravity ^{is same} whether the body goes up to a certain height through stairs or slope or a lift.
i.e. $W = -mgh$

⇒ S.I unit of Work is Joule (J)

$$W = \text{Force} \times \text{displacement}$$

$$\therefore 1J = 1\text{newton} \times 1\text{metre}$$

⇒ 1 Joule of Work is said to be done when a force of 1 newton displaces a body through a distance of 1 metre.

C.G.S Unit of Work is Erg

$$W = F \times \text{displacement}$$

$$1\text{erg} = 1\text{dyne} \times 1\text{cm}$$

* Relation b/w Joule and Erg : →

$$1\text{Joule} = 1\text{N} \times 1\text{m}$$

$$1\text{Joule} = 10^5 \text{ dynes} \times 100 \text{ cm}$$

$$\therefore 1J = 10^5 \text{ dynes} \times 10^2 \text{ cm} \quad [1\text{N} = 10^5 \text{ dynes}]$$

$$1J = 10^7 \text{ dynes cm}$$

$$\text{So } 1J = 10^7 \text{ erg}$$

$$(\because \text{erg} = \text{dyne cm})$$

⇒ Power : → Power is the rate of doing work.

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

W = Work done, t = time taken

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⇒ S.I unit of Power is watt.

$$\text{Power} = \frac{\text{work done}}{\text{time taken}} = \frac{1 \text{ Joule}}{1 \text{ second}} = 1 \text{ watt}$$

So if 1 Joule of work is done in one second, the power spent is said to be one watt.

⇒ Bigger units of Power are Gigawatt (GW), Kilowatt (kW) and megawatt (MW).

→ 1 megawatt = 10^6 watt

→ 1 kW = 10^3 watt

→ 1 Horse Power = 1 H.P = 746 watt

⇒ Energy :→ It is defined as the Capability of a body to do work.

⇒ * work, Power and Energy, all are scalar quantities

Units of Energy :→ The S.I unit of Energy is Joule (J) and C.G.S unit is Erg

where $1 \text{ J} = 10^7 \text{ Erg}$

* watt hour and kilowatt hour are also the Units of Energy.

→ 1 Watt hour = 1 Watt × 1 hour = $\frac{1 \text{ Joule}}{1 \text{ second}} \times 1 \text{ hour}$
 $\left(\begin{aligned} 1 \text{ watt} &= \frac{1 \text{ Joule}}{1 \text{ second}} \\ 1 \text{ hour} &= 3600 \text{ sec} \end{aligned} \right)$

$$= \frac{1 \text{ J}}{1 \text{ s}} \times 3600 \text{ s}$$

$1 \text{ Watt} = 3600 \text{ J}$

→ to be Continued