ATOMIC ENERGY CENTRAL SCHOOL-03, TARAPUR.

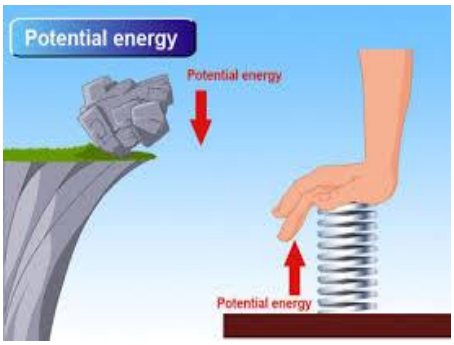
CLASS: IX **SUBJECT: PHYSICS**
CHAPTER: 11

"WORK AND ENERGY": MODULE-2

Topics to be learn…

- *Potential Energy.*
- *Potential Energy of an Object at a Height.*
- *Law of Conservation of Energy.*
- *Power*
- *Commercial Unit of Energy.*

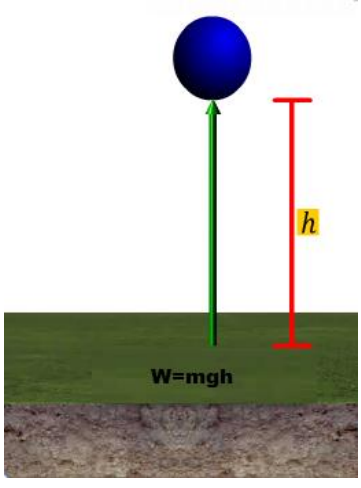
Potential Energy:



- It is the energy possessed by the object due to its position or condition.
- It is same as stored energy.

Potential Energy of an Object at a Height:

- Potential energy of an object at a height is the Gravitational Potential Energy.
- The work done in raising an object from the ground to the height against gravity is called as Gravitational Potential Energy.
    - *Let an object of mass 'm',*
    - *Raised through a height 'h',*
    - *Minimum force required to raise the object, Weight = mg,*
    - *Let the work done on the object against gravity, 'W'.*



W = force × displacement
W = mg × h
W = mgh

- *By the definition of potential energy,*

  PE = Work done

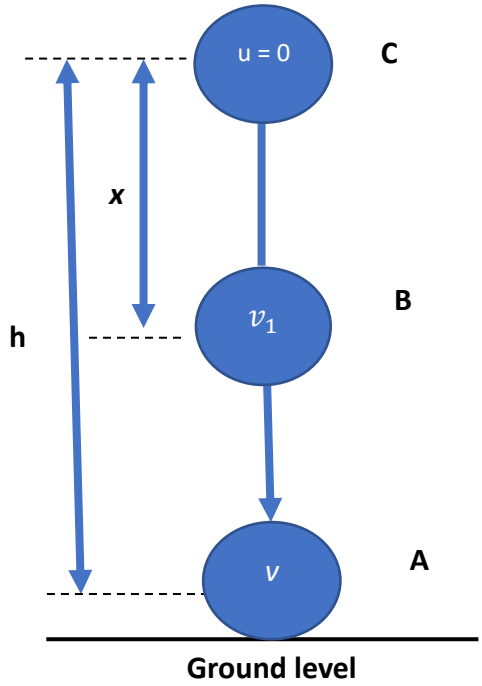
  PE= mgh

- *Gravitational Energy depends on the initial and final positions of object and not on the path.*

Law of conservation of Energy:

- *Energy can only be converted from one form to another.*
- *Energy can neither be created not destroyed.*
- *After and before the transformation total energy remains same.*

Freely falling body:



- **At position C:**

  KE = 0

  PE = mgh

  Total Energy = 0 + mgh = mgh .... (1)

- **At position B:**

  Let v_1 be velocity of body, then u = 0, S = x.

  From equation: $v^2 = u^2 + 2$ a S

  $$v_1^2 = 0 + 2\ g\ x = 2gx$$

  Since $KE = \frac{1}{2}mv^2 = \frac{1}{2}mv_1^2 = \frac{1}{2}m \times 2gx$

  And $PE = mg(h-x) = mgh - mgx$

  Therefore $Total\ Energy = mgx + mgh - mgx$

  $$Total\ Energy = mgh \ldots. (2)$$

At position A:

- Let velocity of body be v, then u = 0, S = h.
- From equation: $v^2 = u^2 + 2\,a\,S$

$$v^2 = 0 + 2\,g\,h = 2\,g\,h$$

$$\text{Since KE} = \frac{1}{2}mv^2 = \frac{1}{2}m \times 2\,g\,h = mgh$$

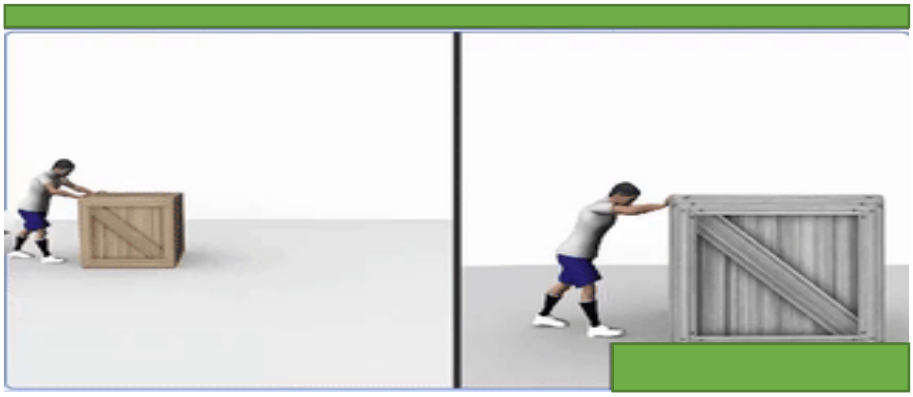
$$\text{And} \quad PE = 0$$

Therefore, Total Energy = mgh + 0 = mgh …. (3)

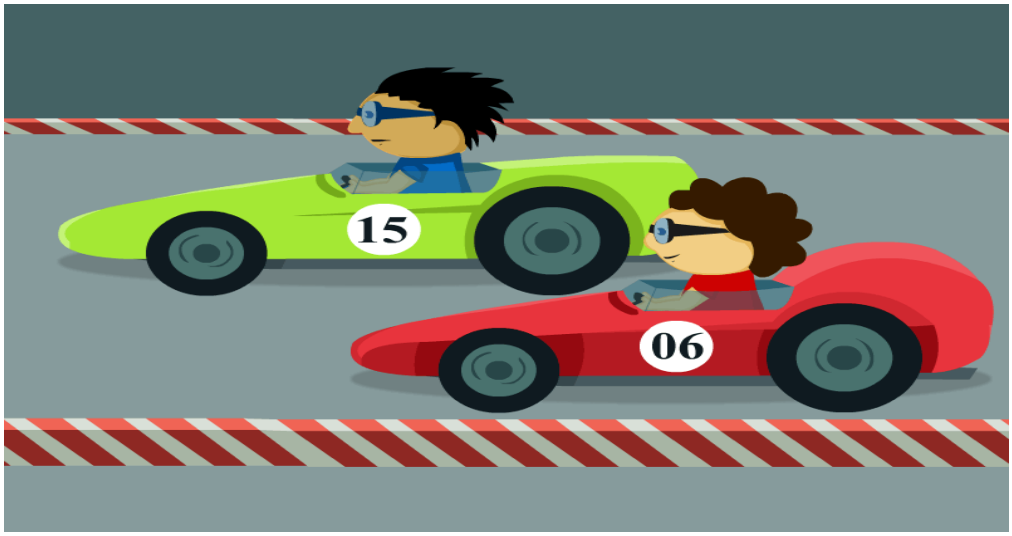
- *"During free fall of an object, the decrease in potential energy, at any point in its path, appears as an equal amount of increase in kinetic energy."*

Rate of Doing Work: Examples

1. ***Stronger person may do certain Work in relatively less time.***



2. ***A more powerful vehicle would complete the journey in shorter time than a less powerful one.***



Power

Definition: "Power is defined as the rate of doing work."

- Let an agent does a work 'W',
- Takes time 't',
- Then Power 'P', => $\text{Power} = \frac{\text{Work}}{\text{time}}$

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

  - SI unit of power is watt (W).
  - *Definition: "1 watt is the power of an agent, which does work at the rate of 1 joule per second."*

$$1\ watt = \frac{1\ joule}{1\ second} \Rightarrow\ 1\ W = \frac{1J}{1s}$$

  - *Larger rates of energy transferred expressed in kilowatts (kW)*

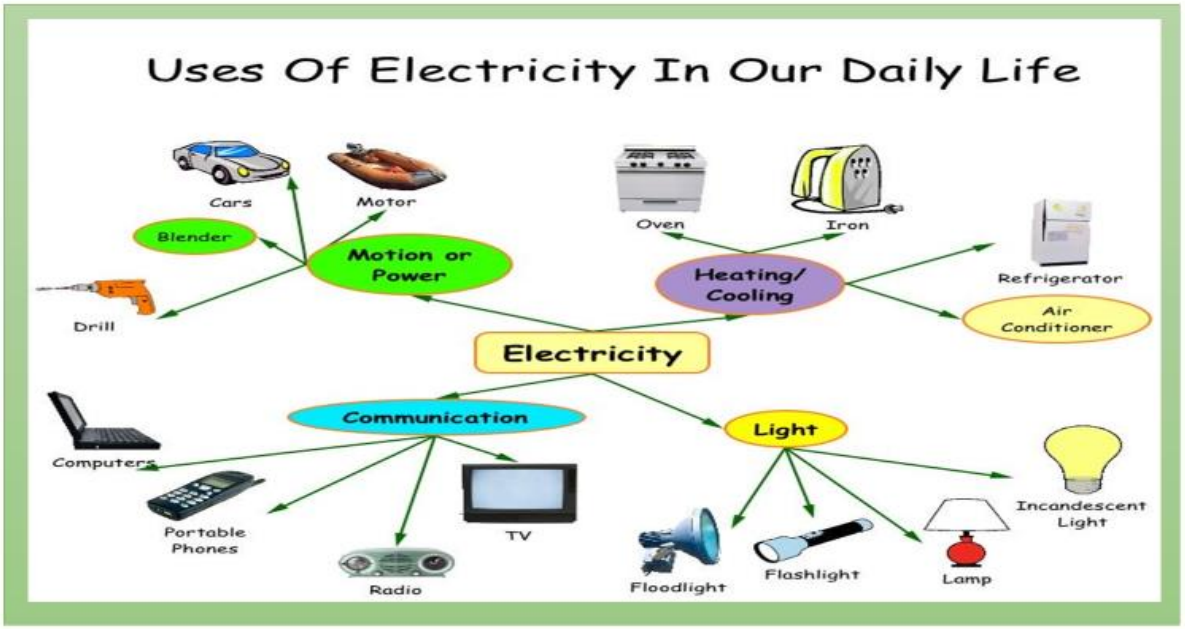
$$Average\ Power = \frac{Total\ Energy\ Consumed}{Total\ Time\ Taken}$$

Commercial unit of energy:

One kilowatt hour (kWh) is a bigger unit of energy.

Definition: "One kilowatt hour is the energy used in one hour at the rate of 1000 joule per second."

$$1\ kWh = 1\ kW \times 1\ h$$
$$= 1000\ W \times 3600\ s$$
$$= 3600000J$$
$$1kWh = 3.6 \times 10^6\ J$$



Industries

Commercial establishments

- Electrical energy used during a month is expressed in terms of units.
- 1 unit = 1 kilowatt hour.

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(PGT-PHYSICS)