Homework

Sol:- 1. $W = F \times s$

$F = ma$

$s = ut + \frac{1}{2}at^2$ (with $u = 0$)

$\Rightarrow s = \frac{1}{2}at^2$

$W = ma \times \frac{1}{2}at^2$

$\Rightarrow W = m\left(\frac{v}{t_1}\right) \times \frac{1}{2}\left(\frac{v}{t_1}\right)t^2$

$\Rightarrow W = \frac{1}{2} m \frac{v^2}{t_1^2} t^2$ (4)

~~Sol~~ Sol 2. Power = $F \times v$

$v = at = \frac{2F}{m}$

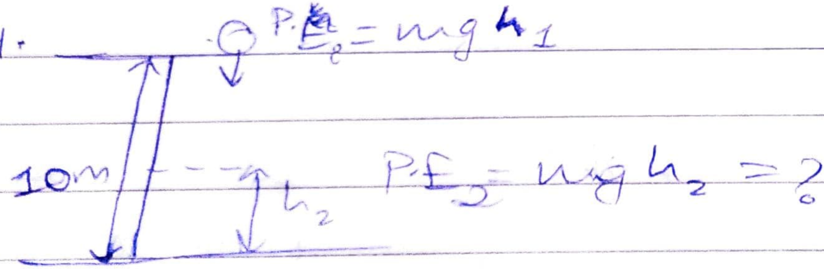
Power $= F \times \frac{2F}{m} = \frac{2F^2}{m}$ (4)

Sol 3. ~~Pow~~ Power $= F \times v$

$\Rightarrow$ Power $= 100 \times 20$

$\Rightarrow$ Power $= 2000\ W = 2\ kW$ (1)

Sol 4.



$P.E = mgh$

$\Rightarrow P.E_1 = m \times 10 \times 10 = 100m\ J$

On striking the ground, loss in energy of body = 40%

$\therefore$ Energy in body after striking the ground $= \frac{60}{100} \times 100m = 60m\ J$

$\Rightarrow PE_2 = 60m\ J$

$\Rightarrow mgh_2 = 60m$

$\Rightarrow$ ~~10~~ $10 \times h_2 = 60$

$\Rightarrow h_2 = 6m$

$\therefore$ The ball bounces back upto a height of 6m.

Solⁿ 5. (a) The law of conservation of energy states that energy can neither be created nor destroyed. It may be transformed from one form to another form, but the total energy of an isolated system remains constant.

<u>Example</u>:- When a ball ~~of~~ falls from a height, at highest point

P.E = maximum = mgh

K.E = 0 as velocity is zero.

$\therefore$ Total energy = P.E + K.E

= mgh + 0 = mgh

At height $\frac{h}{2}$ i.e. mid-point of path, P.E. = $\frac{mgh}{2}$

K.E = $\frac{1}{2}mv^2$

$v = u + gt \Rightarrow v = gt$

$\Rightarrow K.E = \frac{1}{2} m \times g^2 t^2$

$s = ut + \frac{1}{2} g t^2$

$\Rightarrow \frac{h}{2} = \frac{1}{2} g t^2 \Rightarrow g t^2 = h$

$\Rightarrow K.E = \frac{1}{2} mg(gt^2) = \frac{mgh}{2}$

Total energy $= K.E + P.E$

$= \frac{mgh}{2} + \frac{mgh}{2}$

$= mgh$

∴ Total Energy is same at all points.
Hence, energy is conserved.

(b) Weight of each girl $= 400N$
Height they have to climb $= 8m$
Time taken by girl A $= 20s$
Power expended by girl A

$= \frac{mgh}{t_1} = \frac{400 \times 8}{20} = 160 W$

Time taken by girl B $= 50s$
Power expended by girl B $=$

$\frac{mgh}{t_2} = \frac{400 \times 8}{50} = 64 W$

(c) $\text{Power} = \frac{\text{Energy}}{\text{Time}}$

$\Rightarrow \text{Energy} = \text{Power} \times \text{Time}$

~~$\Rightarrow \text{Energy} = 1500 \times 10 \times 60 \times 60$~~

~~$= 54 \times 10^6 \text{ J}$~~

$\Rightarrow \text{Energy} = 1500 \times 10 = 15000 \text{ Wh}$

$\Rightarrow \text{Energy} = 15 \text{ kWh}$

Sol 26. (a) Work done $= \Delta K.E$

$\Rightarrow \text{Work done} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$

$\Rightarrow \text{Work done} = \frac{1}{2} \times 1500 \left[\left(\frac{72000}{60 \times 60} \right)^2 - \left(\frac{36000}{60 \times 60} \right)^2 \right]$

$\Rightarrow W = 750 (400 - 100)$

$\Rightarrow W = 750 \times 300 = 225000 \text{ J}$

$\therefore$ Work done is 225000 J

(b) An oscillating pendulum has maximum P.E at the extreme positions.
An oscillating pendulum has maximum K.E. at the mean position.