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CHAPTER-2(C)
NUMERICALS

TENDER HEART HIGH SCHOOL, SEC 33B, CHD.
SUBJECT- PHYSICS
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Dated: 29.04.24

Numerical 4 of Exercise-2(C)

(a) Change in gravitational Potential Energy between A and B is
gravitational P.E at A − gravitational P.E at B

$= mg(75) - mg(15)$

$= 60 \times 10 \times 75 - 60 \times 10 \times 15$

$= 60 \times 10 (75 - 15)$

(Change in gravitational P.E) $\Rightarrow 600 \times 60 = 36000 = 36 \times 10^3$ J or $3.6 \times 10^4$ J

(b) K.E at B = 75% of $3.6 \times 10^4$ J or

$\Rightarrow \frac{75}{100} \times 36 \times 10^3$

$\Rightarrow \frac{75}{100} \times 36 \times 1000 = 27000$ J

As $K.E = \frac{1}{2} mv^2 \Rightarrow \frac{1}{2} \times 60 \times v^2$

(∵ K.E = 27000 J) $27000 = \frac{1}{2} \times 60 \times v^2$

$\frac{27000 \times 2}{60} = v^2$ or $v^2 = 900 \Rightarrow v = \sqrt{900} = 30$

$\boxed{v = 30\text{ m/s}}$

Numerical No. 5 :-

Given height = 50 m, Power output = 1 MW
" $= 10^6$ W

Efficiency = 40%, t = 1 sec.

As Efficiency $= \frac{\text{Power o/p}}{\text{Power Input}}$ —(1) (o/p - output)

So I/p Power $= \frac{\text{workdone}}{\text{time}} = \frac{mgh}{t}$ (I/p - Input)

Power Input $= \dfrac{m \times 10 \times 50}{1 sec.}$

Power I/p $=$ 500m watt

So from (1) ; Efficiency $= \dfrac{\text{O/p Power}}{\text{I/p Power}}$

$40\% = \dfrac{1MW = 10^6 w}{500m \quad 500m}$

or $\dfrac{40}{100} = \dfrac{10^6}{500m}$

or $40 \times 500m = 10^6 \times 100$

$\Rightarrow m = \dfrac{10^8}{500 \times 40} = \dfrac{1 \times 10^5}{20} = \dfrac{1}{2} \times 10^4$

$= 0.5 \times 10^4 kg$

$\therefore m = \dfrac{5}{10} \times 10^4 = 5000 kg$

$\boxed{m = 5000 kg}$

Numerical No:- 6 :→ $v = 5 m/s$

$h = ?$

60% of K.E is lost in overcoming the friction of air.

So Available energy is 40%. [$\because$ (100 − 60 = 40)]

So By Law of Conservation of Energy ;

P.E at Extreme position = K.E available

$mg \times h = \dfrac{1}{2} \times m \times v^2 \times 40\%$

$\cancel{m} g h = \dfrac{1}{2} \times \cancel{m} \times \dfrac{40}{100} \times (5)^2$

$10 \times h = \dfrac{1}{\cancel{2}} \times \dfrac{\cancel{4}^2}{\cancel{10}_8} \times \cancel{25}^5 \quad (g = 10 m s^{-2})$

$\boxed{h = \dfrac{5}{10} = 0.5 m}$

Numerical No. 7 :→ $m = 200g = \frac{200}{1000} = 0.2\,Kg$

$g = 10\,ms^{-2}$ , $h = 5m$

(a) P.E at Position B is $mgh = 0.2 \times 10 \times 5 = 10J$

(b) Total mechanical energy $= 10J$ (∵ It remains same at all the points of the path due to Law of Conservation of energy)

(c) At position A; P.E is Converted into K.E

So P.E at B is $= 10J = \frac{1}{2} \times m \times v^2$

$$10 = \frac{1}{2} \times 0.2 \times v^2$$

$$\frac{10 \times 2}{0.2} = v^2$$

$$\Rightarrow 100 = v^2$$

or $\boxed{v = 10\,m/s}$