Home Assignment

1. If the kinetic energy of a body increase by 300%. by what % shall the linear momentum of the body increase

Kinetic energy $k = \frac{1}{2}mv^2 = \frac{P^2}{2m}$

where, P is the momentum & m is mass.

$k_1 = k$, $k_2 = k + 300\%$ of $k = 4k$

$\Rightarrow \frac{P_2}{P_1} = \sqrt{\frac{k_2}{k_1}} = \sqrt{\frac{4k}{2}} = 2$

$\Rightarrow P_2 = P_1 + 100\%$ of P_1

Hence, momentum will increase by 100%.

2. A standard 100W electric bulb in series with a heater is connected across the mains. If the 100W bulb is now replaced by a 200W bulb, the power output of the heater

$P_H = \left(\frac{V}{R+R_H}\right)^2 \cdot R_H = \left(\frac{V}{100+R_H}\right)^2 \cdot R_H$

$P_H' = \left(\frac{V}{200+R_H}\right) \cdot RH$

$= \frac{P_H'}{P_H} = \frac{(200+R_H)}{(100+R_H)^2} = 4$ times (Ans)

CW

105

3. A lorry & a car moving with the same K.E are brought to rest by applying the same retarding force, then
Both come to rest in same distance

4. A man weighing 60 kg climbs up 45 steps staircase of building in 9 secs. If the height of each step is 10 cm, then how much power the man has employed? (Take $g = 10\ m/s^2$)
45 steps each of height 10 cm
$\Rightarrow$ Total ~~length~~ height $= 45 \times 10$
$= 450\ cm$
$= 4.5\ m$

Loss in Potential energy $= mgh$
$= 60 \times 10 \times 4.5$
$= 2700$

$P = \frac{\text{Work done}}{\text{Time taken}}$
$= \frac{2700}{9}$
$= 300\ W$

Ques

(6) If the momentum of body is increased by 3 times of its initial momentum, then by how much its K.E is increased above its initial value was 100 J?

$p = \sqrt{2mKE}$

$p^2 = 2mKE$

$(3p)^2 = 2mKE$

$9p^2 = 2mKE$

$KE \propto P$

Increasing P by 3 times increases K.E by 9 times

K.E = 100 J

KE = 9 × 100

= 900 J

$\Delta KE = 900 - 100$

= 800 J

The kinetic energy will increased by 800 Joules.

Law

Log

6. A pump draws 1000kg of water/min from a well 12m deep. Then the power of the pump in H.P unit would be very nearly equal to (given $g = 10 m/s^2$)

$m = 1000 kg$

$h = 12m$

Change in potential energy

$mgh - 0$

$= 1000 \times 10 \times 12 = 12 \times 10^4$ Joule

$P = \frac{W}{t} = \frac{120000}{60} = 2000 W$

$HP = 746 W$

$\frac{2000}{746} = 2.65$ HP