7th foundation +
WS-10 · Thank

①

$F = 100\,N$; $m = 2\,kg$; $t = 10\,sec$

From Newton's IInd law $F = \frac{dp}{dt}$

$\Rightarrow F \cdot dt = dp$

$\Rightarrow dp = 100 \times 10 = 1000\,Ns$

②

$a_1 = 0.5\,m/s^2 \rightarrow m_1 = 3\,kg$

$a_2 = ?$ $\quad m_2 = 1.5\,kg$

For same force acting on the body

$m_1 a_1 = m_2 a_2$

$\Rightarrow a_2 = \frac{m_1 a_1}{m_2} = \frac{3 \times 0.5}{1.5} = 1\,m/s^2$

③

$m_1 = 2\,kg$; $a_1 = 1\,m/s^2$

After a kg is gently glued over moving block.

The mass $m_2 = 2 + 2 = 4\,kg$: $a_2 = ?$

In both cases same force is acting.

$\therefore$ $F = constant$ $\quad m \propto \frac{1}{a}$

$\Rightarrow \frac{m_1}{m_2} = \frac{a_2}{a_1} \Rightarrow a_2 = \frac{m_1}{m_2} \times a_1 = \frac{2}{4} \times 1 = 0.5\,m/s^2$

(10)

$V = 10$ m/s. $\quad \frac{dm}{dt} = 5$ kg/s.

The additional force required to maintain same velocity $F = \frac{dp}{dt} = V\frac{dm}{dt} = 10 \times 5 = 50$ N.

Thask advanced

(8), (9), (10)

$m = 10$ kg ; $F = 20$ N. ; $u = 0$: $V = 30$ m/s.

(8) Initial momentum of the body $P_I = m \times u = 10 \times 0 = 0$

(9) Final momentum of the body $P_F = m \times V = 10 \times 30$
$= 300$ kgm/s

(10) Acceleration $a = \frac{F}{m} = \frac{20}{10} = 2$ m/s^2.

(4)

$m = 2\ kg$; $t = 2\ sec$ $dv = 3\ m/s$

From IInd law $F = \frac{dp}{dt}$

$\Rightarrow F = m\frac{dv}{dt} = 2 \times \frac{3}{2}$

$\Rightarrow F = 3\ N.$

(5)

$F = 15\ N$; $m = 20\ kg$; $t = 8\ sec$ $u = 0$; $v = ?$

From $v = u + at$ we know $a = \frac{F}{m}$

$\Rightarrow v = 0 + \frac{F}{m} \times t$

$\Rightarrow v = \frac{15}{20} \times 8^2 \Rightarrow v = 3 \times 2 = 6\ m/s$

(6)

$m = 2\ kg$; $s = 1m$; $u = 0$; $v = 3\ m/s$

From $v^2 - u^2 = 2as$

$\Rightarrow 3^2 - 0^2 = 2 \times a \times 1$

$\Rightarrow 9 = 2a \Rightarrow a = \frac{9}{2}\ m/s^2$

$F = ma$

$= 2 \times \frac{9}{2}$

$F = 9\ N.$

(7)

$m_{air} = 8\ gm$ $\left(\frac{dv}{dt}\right)_{air} = 7\ cm/s$; $dt = 5 \cdot 6\ sec$

From Newton's IInd law $F = \frac{dp}{dt} = m\frac{dv}{dt}$

$\Rightarrow F = 8 \times \frac{7}{5 \cdot 6} = \frac{56}{5 \cdot 6} = 10\ dynes = 10 \times 10^{-5}\ N = 10^{-4}\ N$

(8)

$m_{bullet} = 0.03\ kg = 3\times10^{-2}\ kg$

$\left(\frac{n}{t}\right)_{bullets} = 200 \qquad v_{bullet} = 30\ m/s.$

$\therefore$ From IInd law $\quad F = \frac{dp}{dt}$

$\Rightarrow F = \frac{n m_{bullet} \times v_{bullet}}{t} = 200\times3\times10^{-2}\times30$

$\Rightarrow F = 180\ N.$

(9)

$m_{bullet} = 40\times10^{-3}\ kg \quad \therefore v_{bullet} = 1200\ m/s.$

$F_{man} = 144\ N. \qquad \frac{n}{t} = ?$

According to newton's IInd law $\quad F = n\frac{dp}{dt}$

$\Rightarrow 144 = \frac{n}{t}(mv)_{bullet}$

$\Rightarrow 144 = \frac{n}{t}[40\times10^{-3}\times1200]$

$\Rightarrow 144 = \frac{n}{t}\times48 \Rightarrow \frac{n}{t} = 3$

(10)

$v = 5\ m/s \qquad \frac{dm}{dt} = 5\ kg/sec.$

$F = \frac{dp}{dt} = v\frac{dm}{dt} = 5\times5 = 25\ N$

7th foundation +

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L-task

(1)

$m = 10$ kg ; $V = 50$ cm/s $= 50 \times 10^{-2}$ m/s

momentum $= m \times v = 10 \times 50 \times 10^{-2} \Rightarrow 5$ kgm/s.

(2)

$F = 100N$: $m = 20$ kg

From $F = ma$ $\Rightarrow a = \frac{F}{m} = \frac{100}{20} = 5$ m/s^2

(3)

Here the body is moving with uniform velocity

so no force is required

$F = 0$

(4)

$a = 2$ m/s^2 ; $m = 1.5$ kg.

$F = ma = 1.5 \times 2 = 3$ N.

(5)

$a = 5$ cm/s^2 ; $m = 20 \times 10^{-3}$ kg $= 20$ gm

$F = ma = 20 \times 5 = 100$ dyne

$= 100 \times 10^{-5}$ N

$= 10^{-3}$ N

$= 1.0 \times 10^{-3}$ N

(6)

$a = 3\ cm/s^2$; $m = 250\ gm$

∴ Force $F = ma = 250 \times 3 = 750\ gm\ cm/s^2$

$= 750 \times 10^{-5}$

$\Rightarrow 75 \times 10^{-4}\ N$

(7)

Given $m_1 = 2\ kg$; $m_2 = 3\ kg$. For same force

$m \propto \frac{1}{a}$ $\Rightarrow$ $\frac{a_1}{a_2} = \frac{m_2}{m_1} = \frac{3}{2}$.

(8)

$m = 200\ gm$; $s = 400\ cm$; $t = 2\ sec$. ; $u = 0$.

From $s = ut + \frac{1}{2}at^2$

$\Rightarrow 400 = 0 \times t + \frac{1}{2} \times a \times (2)^2$

$\Rightarrow 400 = 2a \Rightarrow a = 200\ cm/s^2$

From $F = ma = 200 \times 200 = 40000 \times 10^{-5}\ N$

$= 4 \times 10^{-1}\ N = 0.4\ N.$

(9)

$m = 2\ kg$; $\frac{dm}{dt} = 1\ kg/s$; $v = 5\ m/s$.

From $F = \frac{dp}{dt}$

$\Rightarrow Ma = v\frac{dm}{dt}$

$\Rightarrow 2a = 5 \times 1$ $\Rightarrow a = \frac{5}{2} = 2.5\ m/s^2$