WS-14 → Newton's 2nd law   6th foundation + Thank   (1)

(1)

Given force = 100 N   m = 2 kg ; t = 10 sec.

According to Newton's IInd law

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

$$\Rightarrow dp = F \times dt$$

$$= 100 \times 10$$

$$= 1000 \text{ Ns} \rightarrow D$$

(2)

Given mass m = 2 kg : time = 4 sec.

Initial velocity u = 0   a = 1.5 m/s²

According to Newton's 2nd law

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

$$\Rightarrow dp = F \times dt = ma \times dt$$

$$= 2 \times 4 \times 1.5$$

$$= 12 \text{ kg m/s} \Rightarrow C$$

(3)

Initially the body is at rest u = 0.

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

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

$$\Rightarrow s \propto t^2.$$

(4)

Given $m_1 = 3$ kg ; $a_1 = 0.5$ m/s²

$m_2 = 1.5$ kg ; $a_2 = ?$ For same force acting

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

B

(5)

$a_A = 2\ m/s^2$; $a_B = 5\ m/s^2$

For same force acting on the body $m \propto \frac{1}{a}$.

$\Rightarrow \frac{m_A}{m_B} = \frac{a_B}{a_A} = \frac{5}{2} \rightarrow A$

(6)

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

when a block of mass 2 kg is gently glued over the moving block then the mass $m_2 = 4\ kg$

under constant force $a \propto \frac{1}{m}$

$\Rightarrow \frac{a_2}{a_1} = \frac{m_1}{m_2} \Rightarrow a_2 = \frac{m_1}{m_2} \times a_1$

$\Rightarrow a_2 = \frac{2}{4} \times 1 = 0.5\ m/s^2 \rightarrow C$

(7)

Given mass $m = 2\ kg$: time $t = 2\ sec$, $dv = 3\ m/s$

According to Newton's 2nd law $F = m\frac{dv}{dt}$

$\Rightarrow F = 2 \times \frac{3}{2} = 3N \rightarrow C$

(8)

Given force $F = 15N$ mass = 20 kg ; time = 8 sec

According to Newton's 2nd law $F = m\frac{dv}{dt}$

$\Rightarrow \cancel{15}^{3} = \cancel{20}^{5} \frac{dv}{\cancel{8}\ 2}$

$\Rightarrow 3 = \frac{dv}{2}$

$\Rightarrow dv = 3 \times 2 = 6\ m/s \rightarrow D$

(9)

$m_{bullet} = 0.03$ kg $\quad \frac{n}{t} = 200 \quad$; velocity = 30 m/s

$= 3\times10^{-2}$ kg

Force $= n\, m \frac{dv}{dt}$

$\Rightarrow 200 \times 3\times10^{-2} \times 30 = 180$ N

(10)

$m_{bullet} = 40$ gm $\quad$; velocity = 1200 m/s.

$= 40\times10^{-3}$ kg $\quad$ Force = 144 N

According to newton's 2nd law.

$$F = n\, m \frac{dv}{dt}$$

$$\Rightarrow 144 = \frac{n}{t}\, 40\times10^{-3} \times 1200$$

$$\Rightarrow \frac{n}{t} = 3 \rightarrow B.$$

(11)

According to Newton's 2nd law $\quad F = ma$

when m = constant $\quad F \propto a$

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

(12)

1 gm weight $\Rightarrow$ mass = 1 gm

$g = 980$ cm/s²

$\therefore$ 1gm weight = 1×980 gcm/s² = 980 gmcm/s²

(14)

since acceleration is $= \frac{dv}{dt}$

when velocity = constant

Acceleration is zero.

(18), (19), (20)

Given $m = 10$ kg ; Initial velocity $u = 0$.

Force $F = 20N$. ; Final velocity $V = 30$ m/s.

∴ Final momentum = m x Final velocity

= 10 x 30

= 300 kg m/s.

Initial momentum = m x Initial velocity

= 10 x 0

= 0.

Acceleration $= \frac{F}{m} = \frac{20}{10} = 2 \ m/s^2$

L Task

CUQ's

(2)

when F = constant

⇒ ma = constant

⇒ a = constant

(3)

A car accelerates on a horizontal road solely due to the force exerted by the road on the car.

The tyres of the car accelerate on the road as the road try to push back the tires.

According to 3rd law, as the car pushes the ground in backward direction, and the ground's reaction force pushes in the forward direction simultaneously acts on the car.

(4)

As the horse goes forward, the force pulls the cart. so the movement of the horse is due to the force exerted by the ground. This force is known as friction force.

(5)

when we jump out of a boat standing in water, it moves backwards because the feet applies a force on boat in back ward direction.

(6)

The frictional force acting on the man along the surface will be in the west to east direction. As we know the motion of body and the friction are opposite in direction.

(7)

Given $m = 1\,kg$;

weight $w = mg = 1 \times 9.8 = 9.8\,N$.

(10)

Given $m = 1\,gm$; $F = 1$ dyne

From $F = ma$

$\Rightarrow a = \frac{F}{m} = \frac{1}{1} = 1\,cm/s^2$

(1)

Given

$m = 10\ kg$; $V = 50\ cm/s$

$= 50 \times 10^{-2}\ m/s$

momentum $P = m \times V$

$= 10 \times 50 \times 10^{-2}$

$\Rightarrow 500 \times 10^{-2} = 5\ kg\,m/s \rightarrow A$

(2)

Given

$F = 100\ N$; $m = 20\ kg$

$\therefore$ Acceleration $a = \frac{F}{m} = \frac{100}{20} = 5\ m/s^2 \rightarrow C$

(3)

Given

$m = 50\ kg$; $a = 15\ m/s^2$

$\therefore$ Force $F = ma = 50 \times 15 = 750\ N. \rightarrow A$

(4)

Given $m = 2\ kg$; $V = 4\ m/s$

In order to move the body with uniform velocity

acceleration is zero

Since $F = ma = m(0) = 0 \rightarrow A$

$\therefore$ No force is required

⑤

Given acceleration $a = 2\ m/s^2$

mass $m = 1.5\ kg$.

$\therefore$ Force $= ma = 1.5 \times 2 = 3\ N \rightarrow c$

⑥

Given Acceleration $a = 1\ m/s^2$

mass $m = 500\ gm = 0.5\ kg$.

$\therefore$ Force $= ma = 1 \times 0.5 = 0.5\ N. \rightarrow D$

⑦

Given acceleration $a = 5\ cm/s^2$

mass $m = 20\ gm$

$\therefore$ Force $= ma = 20 \times 5 = 100\ gm\ cm/s^2$

$= 100$ dynes

$= 100 \times 10^{-5}\ N = 10^{-3}\ N \rightarrow C$

⑧

Given Acceleration $a = 3\ cm/s^2$

mass $m = 250\ gm$

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

$= 750 \times 10^{-5}\ N \Rightarrow 75 \times 10^{-4}\ N. \rightarrow A$

⑨

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

$$\frac{a_1}{a_2} = \frac{m_2}{m_1} = \frac{3}{2} \Rightarrow a_1 : a_2 = 3 : 2. \rightarrow B.$$

(10)

Given $m = 200\ gm = 2\times10^{-1}\ kg$

$u = 15\ m/s$; $v = 25\ m/s$; $t = 2.5\ sec.$

∴ According to Newton's 2nd law

$$F = m\frac{dv}{dt}$$

$$= 2\times10^{-1}\times\frac{(25-15)}{2.5}$$

$$= 2\times10^{-1}\times\frac{10}{2.5} = \frac{20}{2.5} = \frac{4}{5} = 0.8\,N \rightarrow C$$

(19)

Given $m = 2\ kg$; Initial velocity $u = 5\ m/s$

$t = 0.1\ sec.$ Final velocity $v = 6\ m/s$

(i) Initial momentum $P_I = mu = 2\times5 = 10\ kg\,m/s$

(ii) Final momentum $P_F = mv = 2\times6 = 12\ kg\,m/s$

(iii) Change in momentum $dp = P_F - P_I$

$= 12 - 10 = 2\ kg\,m/s$

(iv) Force $= \frac{dp}{dt} = \frac{2}{0.1} = 20\,N$

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