Tkasle

①

Given $m = 2kg$; velocity = 2 m/sec.

momentum $p = m \times v$

$= 2 \times 2 = 4$ kg m/sec

option :- A

②

$m = 4kg$: $u = 4\hat{i} - 3\hat{j}$ m/s. : $v = \hat{i} - 3\hat{j}$ m/s

change in momentum $= d\vec{p} = m(v-u)$

$= 4(\hat{i} - 3\hat{j} - 4\hat{i} + 7\hat{j})$

$= 4[-3\hat{i} + 4\hat{j}]$

$|d\vec{p}| = 4\sqrt{(-3)^2+4^2} = 4\sqrt{9+16} = 4 \times 5 = 20$ kgm/

option 'c'.

③

Given mass = M ; initial speed = V

bouncing speed = -V

∴ change in momentum = $dp = m(v-u)$

$= m(-v-v)$

$= -2mv$.

C

(4)

$m_1 = 2\ kg$; $m_2 = 4\ kg$

Given $p =$ constant

$\Rightarrow mv =$ constant

$\Rightarrow m \propto \frac{1}{v}$

$\Rightarrow \frac{v_1}{v_2} = \frac{m_2}{m_1} = \frac{4}{2} = \frac{2}{1}$ → B

(5)

Given $p = 8\ NS$; $v = 4\ m/s$; mass = ?

From $p = mv$

$\Rightarrow m = \frac{p}{v} = \frac{8}{4} = 2\ kg$ → A

(6)

Given $m = 8\ kg$; $p = 24\ NS.$

From $p = mv$

$\Rightarrow v = \frac{p}{m} = \frac{24}{8} = 3\ m/sec$ → B

(7)

$m = 3kg$; $v = 3\hat{i} + 4\hat{j}\ m/sec$

∴ From $\vec{p} = mv = 3(3\hat{i} + 4\hat{j}) =$

$|\vec{p}| = 3\sqrt{3^2 + 4^2} = 3\sqrt{9+16} = 3 \times \sqrt{25} = 3 \times 5$

$= 15\ NS.$ → D

(8)

$m = 250\ gm$ $\quad u = 2\ m/s$

$= 0.25\ kg$ $\quad v = -2\ m/sec.$

change in momentum $= m(v-u)$

$= 0.25(-2-2)$

$= 0.25 \times (-4)$

$= -1\ kg\ m/s.$ -ve shows ↳ A

direction of momentum

Advanced

(3)

Since P = momentum $= mv$.

when P = constant $\quad m \propto \frac{1}{v}$

So heavier body possess less velocity

(5) (6) (7)

$m_1 = 1\ kg$: $m_2 = 3\ kg$ $\quad u_1 = 9\ m/s$; $u_2 = 3\ m/s$

$v_1 = 5\ m/s$ $\quad v_2 = 2\ m/s$

Befor collision momentum $= m_1u_1 + m_2u_2$

$= 1 \times 9 + 3 \times 3 = 9 + 9 = 18\ Ns$

Accord Given after collision momentum of 1 kg body is 5 m/s

Total momentum After collision: $m_1v_1 + m_2v_2$

$= 1 \times 5 + 3 \times 2 = 5 + 6 = 11\ Ns$

L Task

Jee mains level

① Given $m = 6\,kg$; $v = 2\ m/s$

∴ momentum $p = mv = 6 \times 2 = 12\ kgm/sec. \rightarrow D$

② Given $m = 2kg$; $u = -2\hat{i} - \hat{j}\ m/s$ ∴ $v = 4\hat{i} + 7\hat{j}\ m/s.$

∴ change in momentum $= d\vec{p} = m(v-u)$

$= 2[4\hat{i} + 7\hat{j} + 2\hat{i} + \hat{j}]$

$= 2[6\hat{i} + 8\hat{j}]$

$|d\vec{p}| = 2\sqrt{6^2 + 8^2} = 2\sqrt{36+64} = 2\sqrt{100} = 2 \times 10 = 20\ NS$ $\rightarrow D$

③ Given $m = 3M$

$u = 1.5V$

$v = -1.5V.$

∴ change in momentum $= dp = m(v-u)$

$= 3M(-1.5V - 1.5V)$

$= 3M(-3V)$

$\Rightarrow -9MV$

④ Given $m_1 = 5kg$; $m_2 = 25\ kg$ $p = constant$

$\Rightarrow mv = constant \Rightarrow m \propto \frac{1}{v}$

$\Rightarrow \frac{v_1}{v_2} = \frac{m_2}{m_1} = \frac{25}{5} = \frac{5}{1} \rightarrow C$

(5)

$P = 18$ NS $\therefore$ $V = 3$ m/s $\therefore$ mass $= ?$

From $P = mV$

$\Rightarrow m = \frac{P}{V} = \frac{18}{3} = 6$ kg. $\rightarrow$ D

(6)

Given mass $= 11$ kg ; $P = 44$ NS.

From $P = mV \Rightarrow V = \frac{P}{m} = \frac{44}{11} = 4$ m/s $\rightarrow$ A

(7)

Given $m = 3$ kg $\therefore$ $V = 6i + 8j$ m/s.

Then momentum $\vec{P} = mV = 3(6\vec{i} + 8\vec{j})$

$|\vec{P}| = 3\sqrt{6^2 + 8^2} = 3\sqrt{36+64}$

$= 3\sqrt{100} = 30$ NS

(8)

Given $m = 500$ gm $= 0.5$ kg ; $U = 4$ m/s, $V = -4$ m/s.

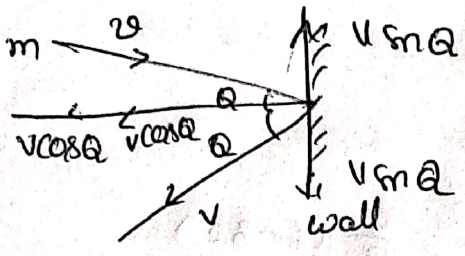
$\therefore$ change in momentum $dp = m(V-U)$

$= 0.5(-4-4)$

$= 0.5(-8)$

$= -4$ NS

(i)



∴ change in momentum on ball = m (V-U)

= m (-vcosθ - vcosθ)

= -2mv cosθ.

wall remains at rest after collision. so there is no change in momentum of wall.

According to Newton's third law ⇒ the direction of force on wall and ball are equal and opposite. So the change in momentum of wall equal and opposite to that of ball

(6), (7), (8)

Given m = 3kg; u = 0, v = 5 m/s

Initial momentum = mu = 3×0 = 0.

Final momentum = mv = 3×5 = 15 kgm/s

change in momentum = Final momentum - Initial momentum

= 15 - 0 = 15 kgm/s