ws-9 momentum foundat.

Thask

①

Given

$m = 2\,kg$; velocity = $2\ m/sec$.

momentum $p = m \times v$

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

option :- A

②

$m = 4\ kg$: $u = 4\hat{i} - \cancel{7}\hat{j}\ m/s$: $v = \hat{i} - 3\hat{j}\ m/s$

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

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

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

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

option 'c'.

③

Given mass = M ; initial speed = V

bouncing speed = -V

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

$= m(-v - v)$

$= -2mv$.

C

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

Given $p =$ constant

$\Rightarrow mv =$ constant

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

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

(5)

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

From $p = mv$

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

(6)

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

From $p = mv$

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

(7)

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

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

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

$= 15\ NS. \rightarrow D$

(8)

$m = 250\ gm$

$= 0.25\ kg$

$u = 2\ m/s$

(1)

$V = -2\ m/sec.$

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

$= 0.25\ (-2-2)$

$= 0.25 \times (-4)$

$= -1\ kg\ m/s.$ '-ve' shows

direction of momentum $\hookrightarrow$ A

Advanced

(3)

Since $P =$ momentum $= m\,V.$

when $p =$ constant $m \propto \frac{1}{V}$

So heavier body posess less velocity

(5) (6) (7)

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

$V_1 = 5\ m/s$ $V_2 = 2\ m/s$

Befor collision momentum $= m_1 u_1 + m_2 u_2$

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

~~Accord~~ Given after collision momentum of 1 kg body

is 5 m/s

Total momentum After collision $= m_1 V_1 + m_2 V_2$

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

L Task

Jee mains level

①

Given $m = 6\,kg$; $v = 2\ m/s$

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

②

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

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

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

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

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

$\rightarrow D$

③

Given $m = 3M$; $u = 1.5V$

$v = -1.5V.$

$\therefore$ 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)

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

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 $m = 3\ kg$: ; $V = 6i + 8j\ m/s$.

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

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

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

(8)

Given $m = 500\ gm$; $u = 4\ m/s$

$= 0.5\ kg$ $\quad V = -4\ m/s$.

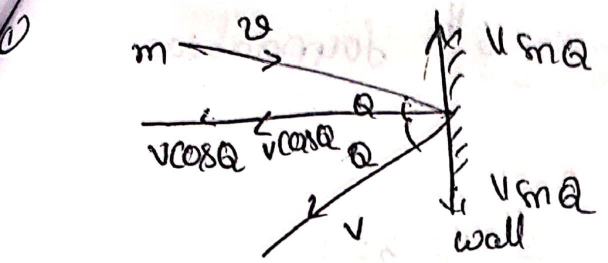
$\therefore$ change in momentum $dp = m(V - u)$

$= 0.5(-4 - 4)$

$= 0.5(-8)$

$= -4\ NS$

(1)



∴ Change in momentum on ball $= m(v-u)$

$= m(-v\cos Q - v\cos Q)$

$= -2mv\cos Q$.

wall remain 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 $= mu = 3\times 0 = 0$.

Final momentum $= mv = 3\times 5 = 15$ kgm/s

change in momentum = Final momentum − Initial momentum

$= 15 - 0 = 15$ kgm/s