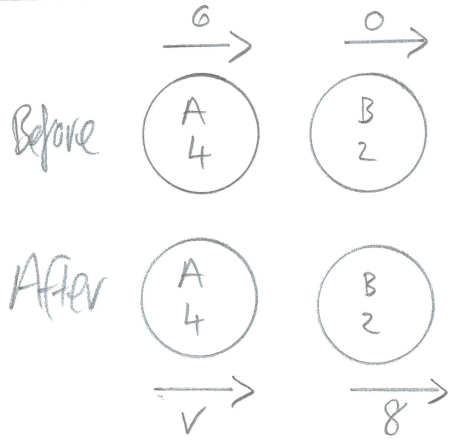
Momentum and Impulse Answers

www.m4ths.com

① @



C.O.L.M

$6(4) + 0(2) = v(4) + 8(2)$

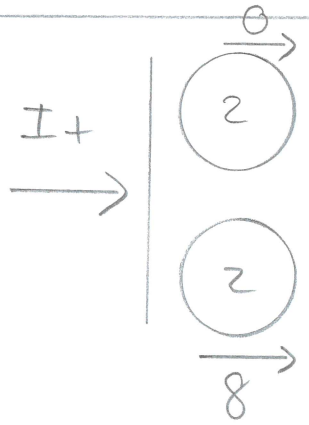
$24 = 4v + 16$

$v = 2$

∴ $2ms^{-1}$ in the direction of original travel.

---

⑥



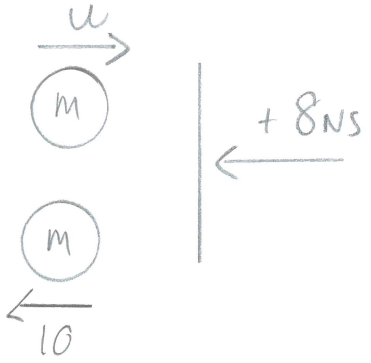
$I = m(v-u)$

$I = 2(8-0)$

$I = 16\ Ns$

---

②



$I = m(v-u)$

$8 = m(10--u)$

$8 = m(10+u)$

$\frac{8}{m} = 10+u$

$\frac{8}{m} - 10 = u$

$u > 0$ for the particle to be moving

∴ $\frac{8}{m} - 10 > 0$

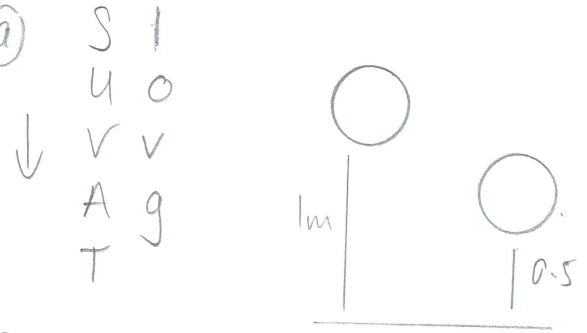
$\frac{8}{m} > 10$

$\frac{8}{10} > m$

$\frac{4}{5} > m$ ✓

---

③ @



$v^2 = u^2 + 2as$

$v^2 = 0 + 2(g)(1)$

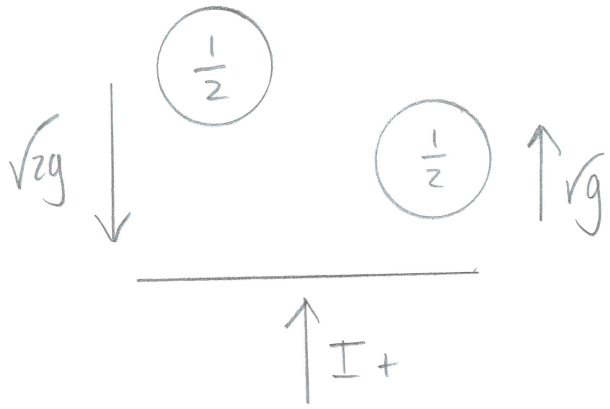
$v^2 = 2g \Rightarrow v = \sqrt{2g}$

$v^2 = u^2 + 2as$

$0 = u^2 + 2(-g)(\frac{1}{2})$

$u^2 = g \Rightarrow u = \sqrt{g}$.

3(a) Continued



$I = m(v-u)$

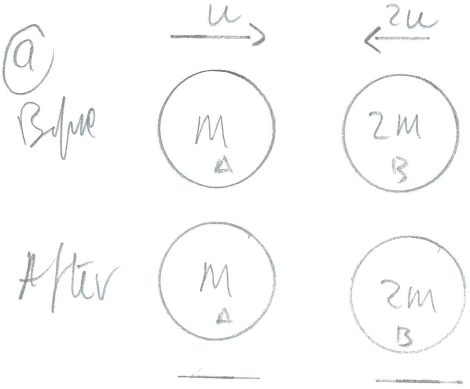
$I = \frac{1}{2}(\sqrt{g} - -\sqrt{2g})$

$I = 3.78\ Ns.$

(b) Decrease as approch speed and rebound speed reduced $e \neq 1$

---

(4) (a)



C.O.L.M

$m(u) - 2m(2u) = -3mu\ Ns$

∴ Total momentum after collision is $-3mu$ Ns (or 3Ns in BA direction).

(i) Not possible as velocity of B would be greater than A

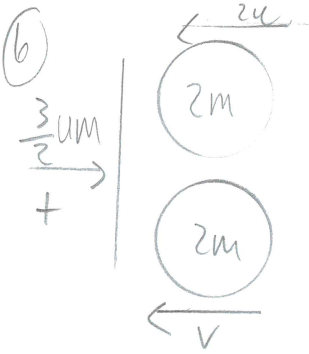
(ii) Not possible as $-3mu$ Ns (or Acting B to A)

(iii) Not possible as $-3mu$ Ns (or Acting B to A)

(iv) Possible $V_1(m) + V_2(2m) = 3mu$, $V_1 > 2V_2$ in the direction BA.

$V_1 + 2V_2 = 3u$

(b)



$I = m(v-u)$

$\frac{3}{2}um = m(-v + 2u)$

$\frac{3}{2}u = -v + 2u$

$v = \frac{1}{2}u$

∴ B has speed $\frac{1}{2}u$ in the same direction.

AND

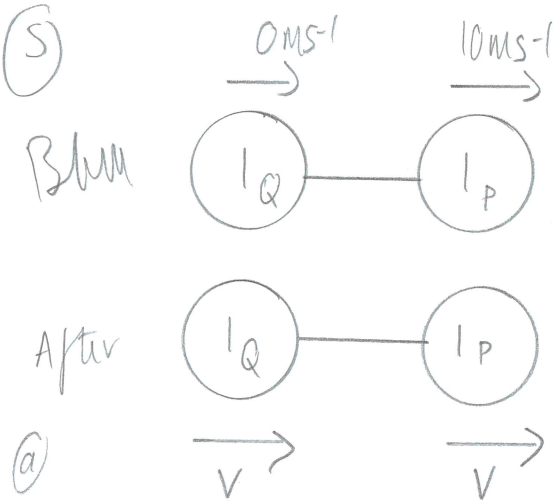
A: $V_2(m) = 2mu$

$V_2 = 2u$

in the opposite direction

As Total momentum = $3mu$ after collision.

(5)



C·O·L·M

$1(0) + 1(10) = 1(v) + 1(v)$

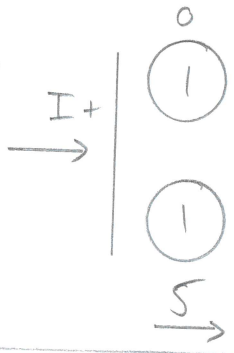
$10 = 2v$

$5 = v$ ✓

(a)

---

(6)



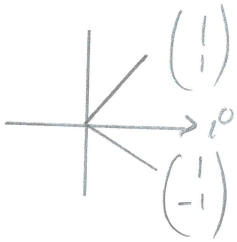
$I = m(v-u)$

$I = 1(5-0)$

$I = 5\,Ns$

---

(6) $\begin{pmatrix}1\\1\end{pmatrix}$ or $\begin{pmatrix}1\\-1\end{pmatrix}$



Both have magnitude $\sqrt{1^2+1^2} = \sqrt{2}$ and make 45° angle with i°.

$I = m(v-u)$

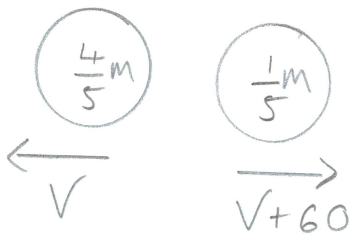
$\begin{pmatrix}1\\\pm1\end{pmatrix} = \frac{1}{2}\left(\begin{pmatrix}x\\y\end{pmatrix} - \begin{pmatrix}-2\\4\end{pmatrix}\right)$

$\begin{pmatrix}2\\\pm2\end{pmatrix} + \begin{pmatrix}-2\\4\end{pmatrix} = \begin{pmatrix}x\\y\end{pmatrix}$

$\therefore \begin{pmatrix}0\\-6\end{pmatrix}$ or $\begin{pmatrix}0\\-2\end{pmatrix}$ ms^{-1} $\quad$ ($-6j°$ or $-2j°$)

---

(7) Before



C·O·L·M

$m(0) = \left(\frac{4}{5}m\right)(-v) + \left(\frac{1}{5}m\right)(v+60)$

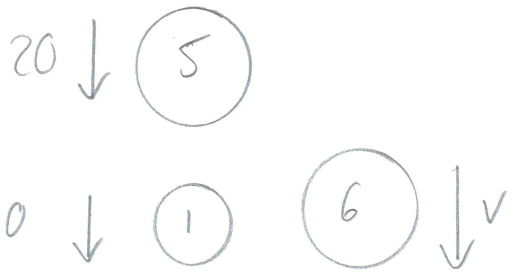
$\frac{4}{5}v = \frac{1}{5}(v+60)$

$4v = v + 60$

$v = 20$

∴ 20 ms^{-1} larger and 80 ms^{-1} smaller.

(8) (a) Bef. Aft.



C.O.L.M

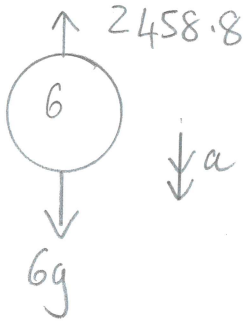
$5(20) + 1(0) = 6(v)$

$100 = 6v$

$\frac{50}{3} = v$ $\left(16.7 ms^{-1}\right)$

---

(6)



$F = ma$

$6g - 2458.8 = 6a$

$a = -400$

	S	X
	u	50/3
↓	v	0
	A	−400
	T	

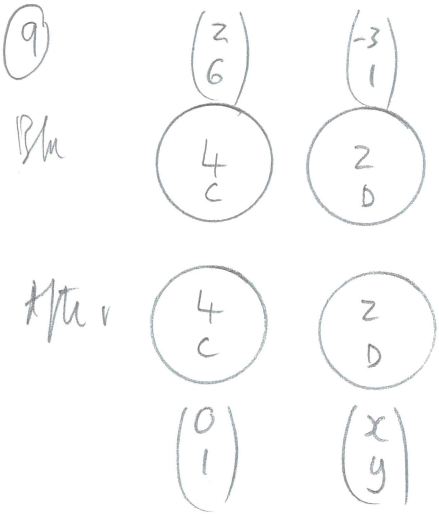
$v^2 = u^2 + 2as$

$0 = \left(\frac{50}{3}\right)^2 + 2(-400)X$

$X = 0.347 m$

---

(9)



C.O.L.M

$4\begin{pmatrix}2\\6\end{pmatrix} + 2\begin{pmatrix}-3\\1\end{pmatrix} = 4\begin{pmatrix}0\\1\end{pmatrix} + 2\begin{pmatrix}x\\y\end{pmatrix}$

$\therefore 8 - 6 = 0 + 2x$ (x's)

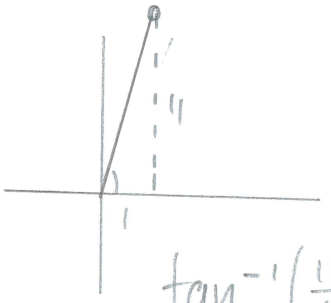
$1 = x$

AND

$24 + 2 = 4 + 2y$ (y's)

$22 = 2y$

$11 = y$



Velocity $= \begin{pmatrix}1\\11\end{pmatrix}$ or $(i + 11j) ms^{-1}$

$\tan^{-1}\left(\frac{11}{1}\right) = 84.8°$