

$$\begin{aligned} \Rightarrow e &= \frac{p - 3r}{2p} \\ &= \frac{p + \frac{3q^2}{p}}{2p} \\ &= \frac{p^2 + 3q^2}{2p^2} \\ &= \frac{1}{2} + \frac{3(q^2)}{2(p^2)} \\ &= \frac{1}{2} + \frac{3(1)}{2(9)} \\ &= \frac{1}{2} + \frac{1}{6} = \frac{2}{3} \end{aligned}$$

(iii) $\text{K.E.}_{\text{before}} = \frac{1}{2}m(0.6)^2 = 0.18m$

$$\begin{aligned} \text{K.E.}_{\text{after}} &= \frac{1}{2}m(0.2)^2 + \frac{1}{2}(2m)t^2 \\ &= 0.02m + mt^2 \end{aligned}$$

$$p = 0.6 \cos \theta = 0.6 \left(\frac{3}{\sqrt{10}} \right) = \frac{1.8}{\sqrt{10}}$$

$$r + 2t = \frac{1.8}{\sqrt{10}} \quad \dots \text{from Equation 1}$$

$$r - t = -\frac{2p}{3} \quad \dots \text{from Equation 2}$$

$$\Rightarrow -r + t = \frac{3.6}{3\sqrt{10}}$$

$$= \frac{1.2}{\sqrt{10}}$$

$$\text{Add } 3t = \frac{3}{\sqrt{10}}$$

$$\Rightarrow t = \frac{1}{\sqrt{10}}$$

$$\Rightarrow \text{K.E.}_{\text{after}} = 0.02m + 0.1m = 0.12m$$

$$\text{Loss} = 0.18m - 0.12m = 0.06m$$

Q. 6. (a) $\frac{b}{a} \times \frac{d}{c} = -1$

$$\Rightarrow \frac{b}{a} = -\frac{c}{d}$$

$$\Rightarrow ac = -bd$$

(b) $\cos \theta = \frac{3}{7}$

$$\Rightarrow \sin \theta = \frac{\sqrt{40}}{7}$$

Before	(Mass)	After
$\frac{3v}{7}\vec{i} + \frac{v\sqrt{40}}{7}\vec{j}$	2m	$p\vec{i} + \frac{v\sqrt{40}}{7}\vec{j}$
$-u\vec{i} + 0\vec{j}$	m	$q\vec{i} + 0\vec{j}$
$\frac{3v}{7}(p) = -\frac{v\sqrt{40}}{7}\left(\frac{v\sqrt{40}}{7}\right)$... from part (a)
$\Rightarrow 3vp = -\frac{40v^2}{7}$		
$\Rightarrow p = -\frac{40v}{21}$		

Momentum in the \vec{i} -direction is conserved

$$\begin{aligned} \Rightarrow 2m\left(\frac{3v}{7}\right) + m(-u) &= 2m\left(\frac{-40v}{21}\right) + m(q) \\ &\dots \text{multiply by } \frac{21}{m} \end{aligned}$$

$$\Rightarrow 18v - 21u = -80v + 21q$$

$$\Rightarrow 98v - 21u = 21q$$

$$\Rightarrow 14v - 3q = 3u \quad \dots \text{Equation 1}$$

N.E.L.

$$\frac{\frac{-40v}{21} - q}{\frac{3v}{7} + u} = -\frac{3}{4}$$

$$\Rightarrow \frac{-40v - 21q}{9v + 21u} = -\frac{3}{4}$$

$$\Rightarrow 160v + 84q = 27v + 63u$$

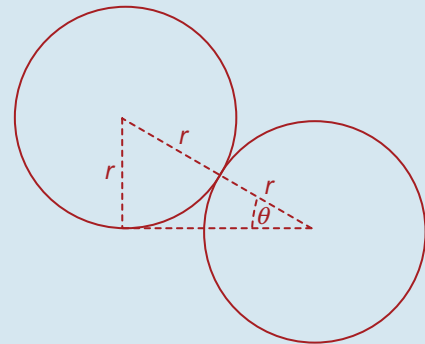
$$\Rightarrow 133v + 84q = 63u \quad \dots \text{Equation 2}$$

$$392v - 84q = 84u \quad \dots \text{from Equation 1}$$

$$\hline 525v = 147u$$

$$v = \frac{147u}{525} = \frac{7u}{25}$$

Q. 7. (i)



$$\sin \theta = \frac{r}{2r} = \frac{1}{2} \Rightarrow \theta = 30^\circ$$