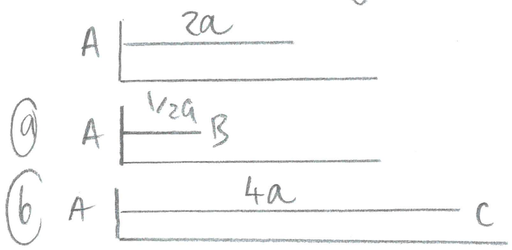
(1)



(a) $T_1 = \frac{\lambda x_1}{l}$

$P = \frac{\lambda\left(\frac{3}{2}a\right)}{2a}$

$P = \frac{3}{4}\lambda$

(b) $T_2 = \frac{\lambda x_2}{l}$

$Q = \frac{\lambda(2a)}{2a}$

$Q = \lambda$

$\therefore P = \frac{3}{4}Q$

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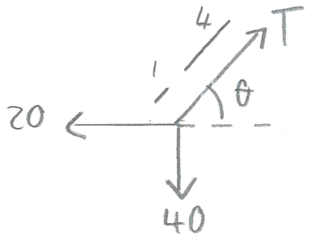
(2)



$\cos^2\theta + \sin^2\theta = 1$

$F=ma \uparrow: T\sin\theta = 40$

$\rightarrow: T\cos\theta = 20$

$T^2(1) = 40^2 + 20^2$

$T^2 = 2000$

$T = \pm 20\sqrt{5}$

$T = 20\sqrt{5}$

H.L

$T = \frac{\lambda(x)}{l}$

$20\sqrt{5} = \frac{\lambda(1)}{4}$

$80\sqrt{5} = \lambda$

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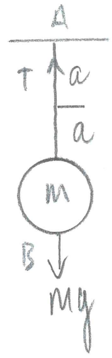
(3)



$\uparrow: F=ma$

$T = mg$

H.L
1st diagram

$T = \frac{\lambda x}{l}$

$mg = \frac{\lambda(a)}{a}$

$\lambda = mg$

H.L (Enegry)
2nd Diagram

	Start C	End A
K.E	0	$\frac{1}{2}mv^2$
G.P.E	0	$5amg$
E.P.E	$\frac{mg(4a)^2}{2a}$	0

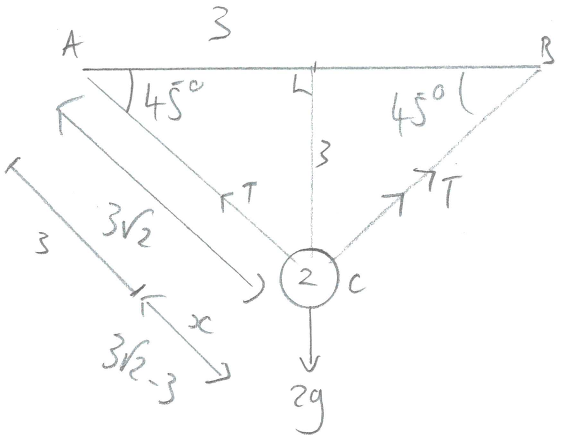
$\frac{\cancel{m}g(16a^2)}{2a} = 5a\cancel{m}g + \frac{1}{2}\cancel{m}v^2$

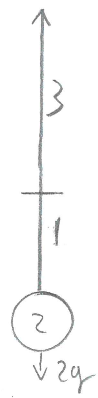
$8ag - 5ag = \frac{1}{2}v^2$

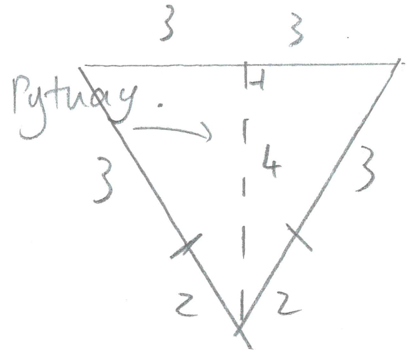
$6ag = v^2$

$\sqrt{6ag} = v$

4







H.L in equilibrium

$\uparrow$: $2T\sin 45 = 2g$

$T\left(\frac{1}{\sqrt{2}}\right) = g$

$T = \sqrt{2}g$

$\therefore \sqrt{2}g = \frac{\lambda(2)(3\sqrt{2}-3)}{6}$

$\lambda = \frac{\sqrt{2}g}{\sqrt{2}-1}$

$(\lambda \approx 33.459..)$

W.E.P

	Start @ C	End @ Point h above C
K.E	0	0
G.P.E	0	$h(2g)$
E.P.E	$\frac{\sqrt{2}g}{\sqrt{2}-1} \times \frac{(4)^2}{2(6)}$	0

$\frac{16\sqrt{2}g}{12(\sqrt{2}-1)} = 2hg$

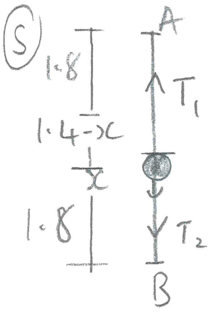
$44.612 = 2hg$

$2.276.. = h$

$h < 4 \therefore$ doesn't reach AB

A few possible ways to show this

5



F=ma

$\uparrow$: $T_1 = T_2 + g$

H.L top

$T = \frac{\lambda x}{l}$

$T_1 = \frac{40(1.4-x)}{1.8}$

H.L bottom

$T = \frac{\lambda x}{l}$

$T_2 = \frac{40(x)}{1.8}$

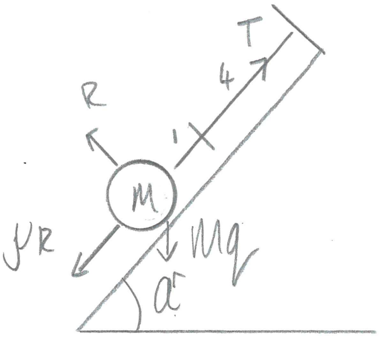
$\therefore \frac{40(1.4-x)}{1.8} = \frac{40x}{1.8} + g$

$1.4 - x = x + 0.441$

$0.959 = 2x$

$x = 0.4795 \quad \therefore 1.8 + 0.4795 = 2.28\text{m}$

(6)



$\tan\alpha = \frac{4}{3}$

$\cos\alpha = \frac{3}{5}$

$\sin\alpha = \frac{4}{5}$

	At B	At A
K.E	0	0
G.P.E	0	$(5\sin\alpha)(mg) = 4mg$
E.P.E	$\frac{\lambda(1)^2}{2(4)} = \frac{\lambda}{8}$	
Work out		Friction × d $\mu R(5) =$ $\mu(mg)(\cos\alpha)(5)$ $\mu(mg)(\frac{3}{5})(5)$ $3\mu mg$

$$\frac{\lambda}{8} = 4mg + 3\mu mg$$

$$\frac{\lambda}{8} - 4mg = 3\mu mg$$

$$\frac{\lambda - 32mg}{8} = 3\mu mg$$

$$\frac{\lambda - 32mg}{24mg} = \mu$$

$0 < \mu \leq 1$ as plane is rough

$$\therefore \quad 0 < \frac{\lambda - 32mg}{24mg} \leq 1$$

$=$

$$0 < \lambda - 32mg \leq 24mg$$

$$32mg < \lambda \leq 56mg$$