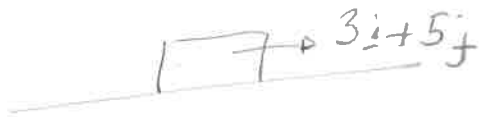


Homework 18

①

1)



$$\Sigma F = ma$$

$$ma = 3\hat{i} + 5\hat{j}$$

$$m = 3 \text{ kg}$$

$$\underline{a} = \hat{i} + \frac{5}{3}\hat{j}$$

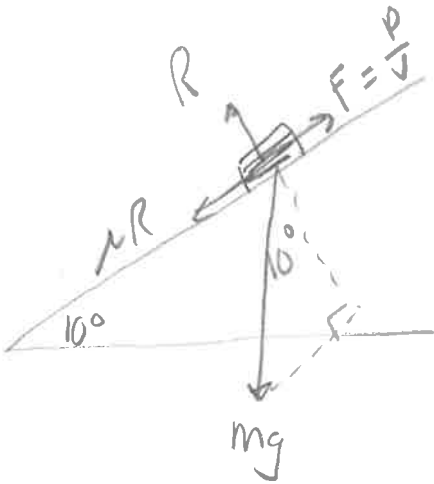
$$\underline{v} = t\hat{i} + \frac{5}{3}t\hat{j} + C \quad C = 0 \text{ since } v = 0 \text{ at } t = 0$$

$$\underline{v} = t\hat{i} + \frac{5}{3}t\hat{j}$$

at $t = 6$

$$\underline{v} = (6\hat{i} + 10\hat{j}) \text{ ms}^{-1}$$

2)



$$ma = \frac{P}{v} - \mu R - mg \sin 10^\circ$$

$$ma = \frac{P}{v} - \mu mg \cos 10^\circ - mg \sin 10^\circ$$

$$7a = \frac{50}{2} - 0.1 \times 7g \cos 10^\circ - 7g \sin 10^\circ$$

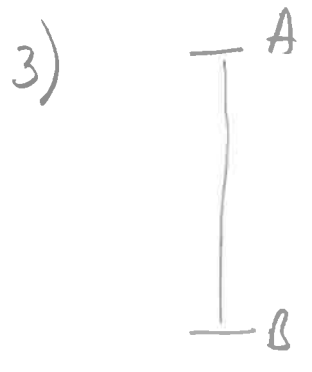
$$\underline{a = 0.905 \text{ ms}^{-2}}$$

b) at constant speed $a = 0$

$$0 = \frac{P}{v} - \mu mg \cos 10^\circ - mg \sin 10^\circ$$

$$0 = \frac{P}{2} - 0.1 \times 7g \cos 10^\circ - 7g \sin 10^\circ$$

$$\underline{P = 37.3 \text{ W}}$$

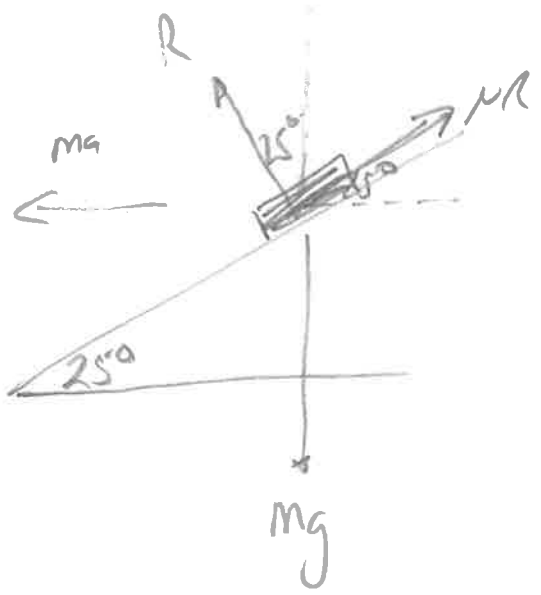


at A $PE = mgh$
 $= 0.4 \times 9.8 \times 3$
 $= \underline{11.76 J}$

75% of 11.76 = 8.82 J
 75% of 8.82 = 6.62 J

6.62 = mgh
 6.62 = 0.4g \times h
h = 1.69 m

4)



$\Sigma F = ma$

$$\frac{R \sin 25^\circ - \mu R \cos 25^\circ}{R \cos 25^\circ + \mu R \sin 25^\circ} = \frac{Ma}{Mg}$$

\div

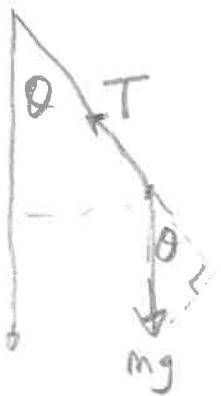
$$\frac{\sin 25^\circ - \mu \cos 25^\circ}{\cos 25^\circ + \mu \sin 25^\circ} = \frac{v^2}{gr}$$

(3)

$$v = \sqrt{gr \left(\frac{\sin 25 - \mu \cos 25}{\cos 25 + \mu \sin 25} \right)}$$

$$\underline{v = 12.9 \text{ ms}^{-1}}$$

5)



$$\sum F = ma$$

$$ma = T - mg \cos \theta$$

goes slack $\Rightarrow T = 0$

$$ma = -mg \cos \theta$$

$$\frac{v^2}{r} = -g \cos \theta$$

$$\underline{v^2 = -gr \cos \theta}$$

Conservation of energy

$$\frac{1}{2} m u^2 = \frac{1}{2} m v^2 + m g r (1 - \cos \theta)$$

$$u^2 = v^2 + 2gr(1 - \cos \theta)$$

$$u^2 = -gr \cos \theta + 2gr(1 - \cos \theta)$$

$$u^2 = -3gr \cos \theta + 2gr$$

$$u = 3.5 \text{ ms}^{-1}$$

$$r = 0.5 \text{ m}$$

$$3.5^2 = -3g \times 0.5 \cos \theta + 2g \times 0.5$$

$$\underline{\theta = 99.6^\circ}$$

$$v^2 = -gr \cos \theta$$

$$v = \sqrt{-gr \cos \theta}$$

$$\underline{v = 0.904 \text{ ms}^{-1}}$$

b) at $t = 1$ $x = 0.6m$

at $t = 2$ $x = 0.4m$

$$x = a \sin \omega t$$

$$0.6 = a \sin \omega$$

$$0.4 = a \sin 2\omega$$

$$\sin 2\omega = 2 \sin \omega \cos \omega$$

$$\frac{0.4}{0.6} = \frac{2 \cancel{a \sin \omega} \cos \omega}{\cancel{a \sin \omega}}$$

$$0.6 = \cancel{a \sin \omega}$$

$$\frac{2}{3} = 2 \cos \omega$$

$$\cos \omega = \frac{1}{3}$$

$$\underline{\omega = 1.23}$$

$$x = a \sin 1.23t$$

$$0.6 = a \sin 1.23$$

$$\underline{\underline{a = 0.636m}}$$

b) $V_{max} = \omega a$

$$= \underline{\underline{0.78ms^{-1}}}$$