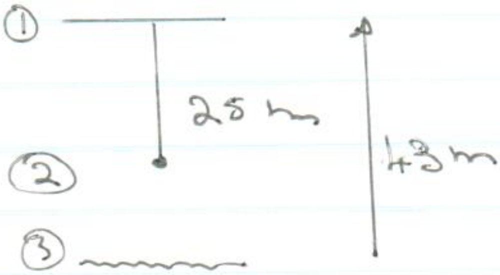
Exercise 5 B

2. $m = 65\,kg$
$\lambda = 25\,m$



Use $T_1 + V_1 = T_2 + V_2$

$V_1 = mgh_1 = 65(10)43 = 27950\,J$
$T_1 = 0$

$V_2 = mgh_2 = 65(10)(43-25) = 11700\,J$
$T_2 = \frac{1}{2}mv^2 = \frac{1}{2}65\,v_2^2$

$\therefore\ T_1 + V_1 = T_2 + V_2$
$0 + 27950 = \frac{1}{2}65\,v_2^2 + 11700$

$\therefore\ v_2 = 22.4\ m\,s^{-1}$

$T_1 + V_1 = T_3 + V_3$

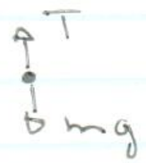
$0 + 27950 = 0 + V_3$

$\therefore\ V_3 = 27950\ J$

Miscellaneous exercise 5

(1) $l = 0,2\text{ m}$ $\qquad \lambda = 400\text{ N}$

$m = 5,5\text{ kg}$



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

$$\therefore 5,5(10) = \frac{400}{0,2} x \Rightarrow x = 0,0275\text{ m}$$

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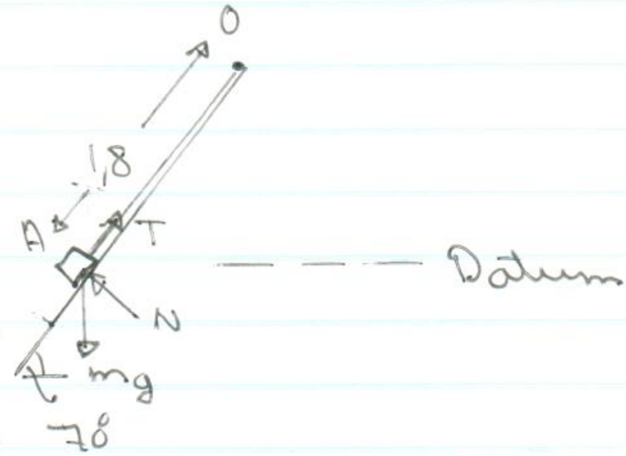
(7) $l = 1,8\text{ m}$

$\lambda = 1,2\text{ N}$

$m = 0,05\text{ kg}$



For energy conservation the plane must be smooth (No friction)

(a) $T_1 + V_1 = T_2 + V_2$

$$0 + 0 = \frac{1}{2} 0,05\, v_2^2 + \frac{1}{2}\frac{1,2}{1,8} 0,5^2 - 0,05(10)0,5 \sin 70^\circ$$

$\therefore v_2 = 2,46\ \text{m.s}^{-1}$

(b) $T_1 + V_1 = T_3 + V_3$

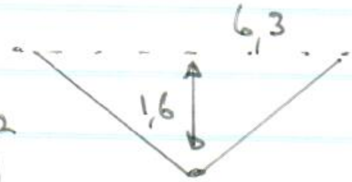
$$\therefore 0 + 0 = 0 + \frac{1}{2}\frac{1,2}{1,8} x^2 - 0,05(10) x \sin 70^\circ$$

$\therefore x = 1,41\text{ m}$

(13) $l = 10\ m$

$\lambda = 130\ N$

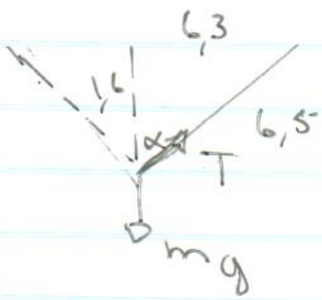
$$T = \frac{\lambda}{l} x = \frac{130}{10} 2{,}6 = 33{,}8\ N$$



(a) $V_1 = \frac{1}{2} \frac{\lambda}{l} x^2$

$$= \frac{1}{2} \frac{130}{10} \left(2\sqrt{6{,}3^2 + 1{,}6^2} - 5\right)^2$$

$$= 58{,}5\ J$$



(b) At) $\Sigma F = 0$

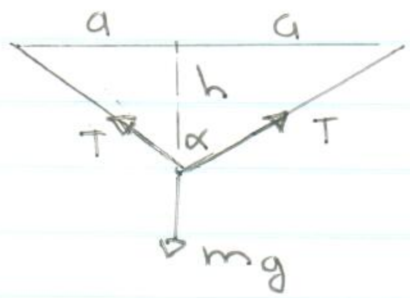
$$-mg + 2T' \cos\alpha = 0 \quad -①$$

$$\cos\alpha = 1{,}6/6{,}5 \quad -②$$

$$T' = \frac{\lambda}{l} x' = \frac{130}{5} (6{,}5 - 5) = 39\ N$$

$$\therefore \quad W = 2(39) \frac{1{,}6}{6{,}5} = 19{,}2\ N$$

17) $T = \frac{\lambda}{a}\sqrt{a^2+h^2}$



+↑) $\Sigma F_y = 0$

$2T\cos\alpha - mg = 0$

$\therefore 2\frac{\lambda}{a}\sqrt{a^2+h^2} \cdot \frac{h}{\sqrt{a^2+h^2}} - mg = 0$

$\therefore h = \frac{mga}{2\lambda}$ — 1

(a) $V_1 = \left[\frac{1}{2}\frac{\lambda}{a}\cdot a^2\right] \times 2 = \lambda a$

(b) $T_1 = 0 \qquad V_1 = \lambda a$
$T_2 = 0$

$V_2 = -mg\,\overline{OP} + 2\left[\frac{1}{2}\frac{\lambda}{a}\left(\sqrt{a^2+\overline{OP}^2}\right)^2\right]$

$\therefore \lambda a + mg\,\overline{OP} = \frac{\lambda}{a}\left(a^2+\overline{OP}^2\right)$

$\therefore a^2 + \frac{mga}{\lambda}\overline{OP} = a^2 + \overline{OP}^2$

$\frac{mga}{\lambda} = \overline{OP}$ → 2

Sub 1 into 2: $2h = \overline{OP}$

(c) $T_1 + V_1 = T_2 + V^2$
$0 + \lambda a = \frac{1}{2}mv^2 - mgh + 2\left[\frac{1}{2}\frac{\lambda}{a}(a^2+h^2)\right]$

$\therefore a^2 + mg\left(\frac{mga}{2\lambda}\right)\frac{a}{\lambda} - a^2 - \left(\frac{mga}{2\lambda}\right)^2 = \frac{1}{2}mv^2\frac{a}{\lambda}$

P.T.O.

$$\therefore \frac{mg^2 a}{\lambda} - \frac{mg^2 a}{2\lambda} = v^2$$

$$\therefore v^2 = \frac{g^2 m a}{2\lambda}$$

$$\therefore v = g\sqrt{\frac{ma}{2\lambda}}$$