Practice Problem Solutions

1 .0031 m
.161 m

12.3
12.4641

Not known with certainty

a) SOM = 12.5 m

b) 3

2. $30 \text{ days} * 24 \frac{\text{hr}}{\text{day}} \times 3600 \frac{\text{sec}}{\text{hr}} = 30 \times 24 \times 3600$

$= 2,592,000 \text{ s}$

3. $x = \frac{1}{2}at^2 \quad \frac{H}{2} = \frac{1}{2}at_1^2 \quad H = \frac{1}{2}at_2^2$

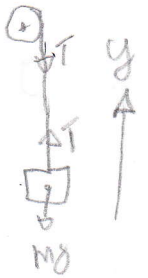
$t_1^2 = \frac{H}{a} \quad t_2^2 = \frac{2H}{a}$

$\frac{t_2}{t_1} = \sqrt{2} = 1.414 \quad t_2 = 1.414 \times 3.1$

$t_2 = 4.384 \text{ s}$

4. $\vec{v} = 5\vec{i} - 4\vec{j} \quad v = \sqrt{25+16} = \sqrt{41} = 6.40$

$\theta = \tan^{-1}\left(\frac{-4}{5}\right) = -38.7^\circ$



5. $\tau = I\alpha = \frac{T}{2} = I\alpha \quad T = 2I\alpha$

$T - mg = ma \quad T = m(g+a)$

$a = r\alpha = \frac{\alpha}{2}$

$\alpha = 2a$

$T = 2I2a = 4Ia$

$T = m(g+a) = 4Ia$

$\Sigma F_y = T - mg = ma$

$a(m+4I) = -mg$

$a = \frac{-mg}{4I+m} = \frac{-450}{80 + \frac{450}{9.8}} = -3.57 \text{ m/s}^2$

$\vec{a} = -3.57\vec{j}$

6. $F_x = T\cos 30^\circ = ma_x$

a) $a_x = \frac{T\cos 30^\circ}{m} = \frac{100\cos 30^\circ}{50} = 1.732\ m/s^2$ $= \sqrt{3}$

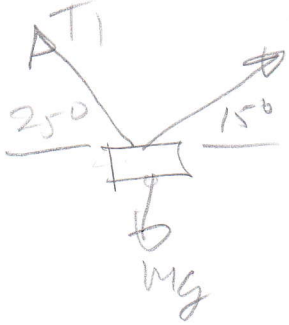
$x = \frac{1}{2} a_x t^2 = \frac{\sqrt{3}}{2} * (0.1)^2$

b) $x = \frac{\sqrt{3}}{2} * .01 = 8.66\ mm$

7. $v = 89.4\ m/s$ $a = \frac{v^2}{R}$ $R = \frac{v^2}{a} = \frac{(89.4)^2}{2.5 \times 9.8}$

$R = 326\ m$

8.



(Eq 1) $\Sigma F_x = T_2\cos 15^\circ - T_1\cos 25^\circ = 0$

(Eq 2) $\Sigma F_y = T_2\sin 15^\circ + T_1\sin 25^\circ = mg$

Eq 1 * $\sin 25^\circ$ $T_2\sin 25^\circ\cos 15^\circ - T_1\cos 25^\circ\sin 25^\circ = 0$

Eq 2 * $\cos 25^\circ$ $T_2\cos 25^\circ\sin 15^\circ + T_1\cos 25^\circ\sin 25^\circ = mg\cos 25^\circ$

Add $T_2(\sin 25^\circ\cos 15^\circ + \cos 25^\circ\sin 15^\circ) = mg$

$T_2 = \frac{mg\cos 25^\circ}{\sin 25^\circ\cos 15^\circ + \cos 25^\circ\sin 15^\circ}$

$= \frac{98\times\cos 25^\circ}{0.4082 + 0.2345697}$

$T_2 = 138\ N$

13 $v_T = r\omega$

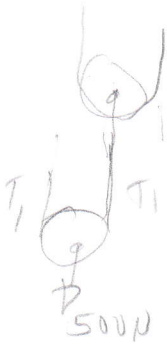
$\omega = 1\frac{rev}{day} * \frac{2\pi\ rad}{rev} * \frac{1\ day}{24\ hrs} * \frac{1\ hr}{3600\ sec} = \frac{2\pi}{24*3600}\ \frac{rad}{s}$

$= 7.2722 \times 10^{-5}$ $= 5$

$v_T = r\omega = 6370\times10^{3} \times 7.2722\times10^{-5}$

$= 63.7 \times 7.2722 =$

$= 463\ m/s$

14. 

$T_1 = \frac{500}{2} = 250N$

$2T_2 = T_1 \quad T_2 = \frac{T_1}{2} = \underline{125N}$

15. $\sum F_y = 2T_1 - 500 = 0$ Pully #1

$\sum F_y = 2T_2 - T_1 = 0$ Pully #2

$T_2 = F$

16. $m_B v_b = (m_2 + m_b) v_f$ $\quad m_b + m_2 = 5.003$

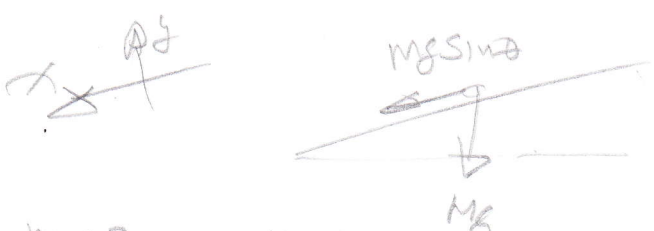
$v_f = \frac{v_b}{5} m_b = \frac{150}{5} * 3\times10^{-3} \quad \approx 5$

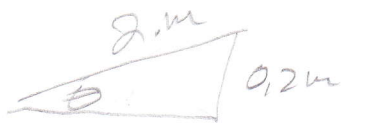
$= 30\times3\times10^{-3} = 90\times10^{-3} = \underline{.09\ m/s}$

$KE = \frac{1}{2}(m_b + m_2) v_f^2 = \frac{1}{2} * 5 \times (0.09)^2 = F_2$

$F = \frac{\frac{5}{2}\times(0.09)^2}{.31} = \underline{0.065\ N}$

9.





$F_x = ma_x = mg\sin\theta = ma_x$

$\sin\theta = \frac{.2}{2} = 0.1$

$a_x = g\sin\theta$

$x = \frac{1}{2}at^2$

$t = \sqrt{\frac{2x}{a}} = \sqrt{\frac{2}{g\sin\theta}} = \sqrt{\frac{2}{9.8/10}} = \sqrt{\frac{20}{9.8}}$

$t = 1.4286$

$\boxed{t = 1.4 \text{ s}}$

10. $W = Fs\cos\theta = 50 * 50 \times \cos 50^\circ$

$W = \underline{1,600 \text{ J}}$

11. $60 \text{ watts} * \frac{1 \text{ KW}}{10^3 \text{ W}} = .06 \text{ KW}$

$30 \text{ days} \times 24 \frac{\text{hr}}{\text{day}} = 720 \text{ hrs}$

$.06 \text{ KW} \times 720 \text{ hrs} = 43.2 \text{ KW.hr}$

$43.2 \text{ KW.hr} * 0.15\text{¢}/\text{KW.hr} = 6.48$

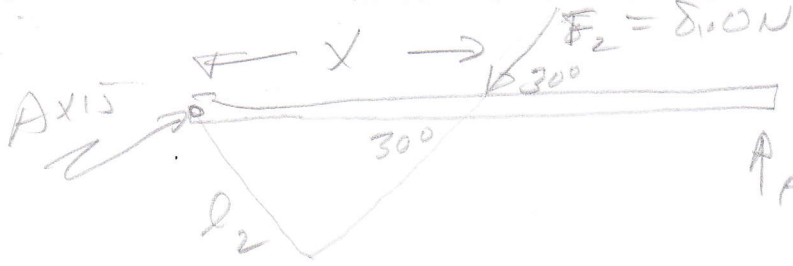
12. $KE \overset{?}{>} PE \qquad KE = \frac{1}{2}mv^2 \qquad PE = mgh$

$v^2 \overset{?}{>} 2gh$

$(20)^2 \overset{?}{>} 2 \times 9.8 \times 15$

$400 \overset{?}{>} 294$ yes He Makes it

17.



$\Sigma \tau = F_1 * 1 - F_2 * l_2$ $\quad l_2 = x \sin 30^\circ = \frac{x}{2}$

$3 - F_2 \frac{x}{2} = 0$ $\quad F_2 = 5$

$3 - 4x = 0$

$x = \frac{3}{4} = 0.75 m$

18. $\tau = \alpha I$ $\quad I = \frac{\tau}{\alpha} = \frac{12}{10} = 1.2 kg \cdot m^2$

19. $y = -\frac{1}{2} g t^2$ $\quad t = \sqrt{\frac{-2y}{g}}$ $\quad y = -400$

$t = \sqrt{\frac{2 \times 400}{9.8}} = 9.04 sec$

$v_y = -at = -9.8t = 88.54 m/s$

$v_x = 125 m/s$ $\quad v = \sqrt{v_x^2 + v_y^2} = \sqrt{(125)^2 + (88.54)^2}$

$v = 153 m/s$

20. $\omega = 2\pi f$

$= 2\pi \times 1.2 \times 10^3$

$\omega = 7.54 \times 10^3$

$\theta = \omega t - kx = 0$

$v = \frac{x}{t} = \frac{\omega}{k}$

$k = \frac{\omega}{v} = \frac{7.54 \times 10^3}{343} = 21.98$

$y = A \sin(\omega t - kx)$

$y = 10 \sin(7.54 \times 10^3 t - 21.98 x)$