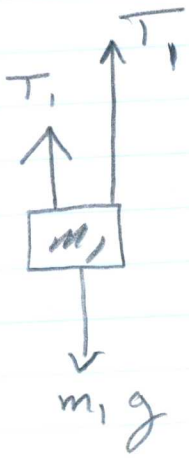
CHAPTER 6 EVEN SOLUTIONS
16, 20, 26, 36

(16)



Block m_1 :

$\Rightarrow \quad \Sigma F = m_1 a$

(1) $T_1 + T_1 - m_1 g = -m_1 a$

Block m_2 : 

$\Sigma F = m_2 a$

(2) $T_1 = m_2 a$

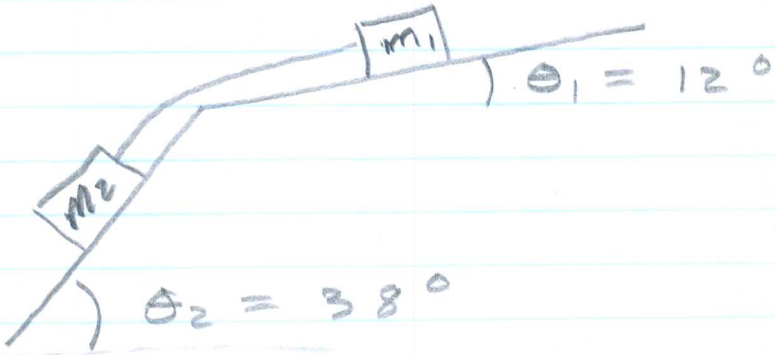
$\Rightarrow$ SUBSTITUTE INTO EQUATION (1):

$m_2 a + m_2 a - m_1 g = -m_1 a$

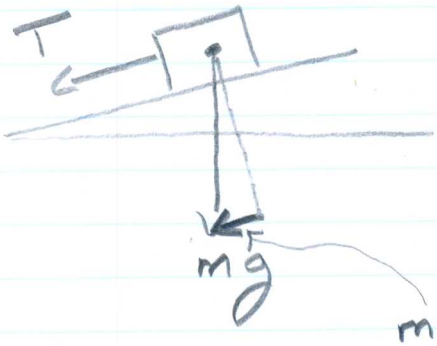
$$a = \frac{m_1 g}{2m_2 + m_1}$$

NOTE: BOTH BLOCKS EXPERIENCE SAME ACCELERATION

(20)



m_1 :

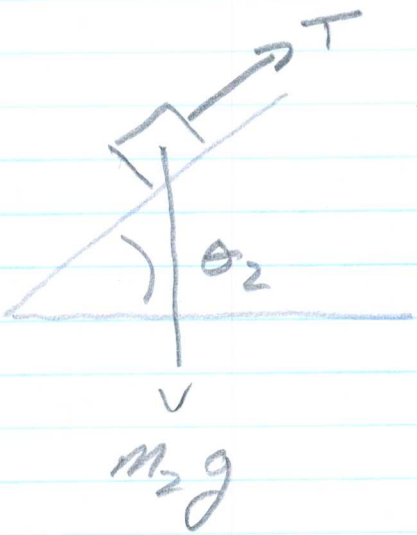


let positive direction be down along incline

$mg \sin\theta_1$

(1) $\Sigma F = \quad T + m_1 g \sin\theta_1 = m_1 a$

m_2 :



(2) $\Sigma F = \quad m_2 g \sin\theta_2 - T = m_2 a$

Now eliminate T:

$$T = m_2 g \sin\theta_2 - m_2 a$$

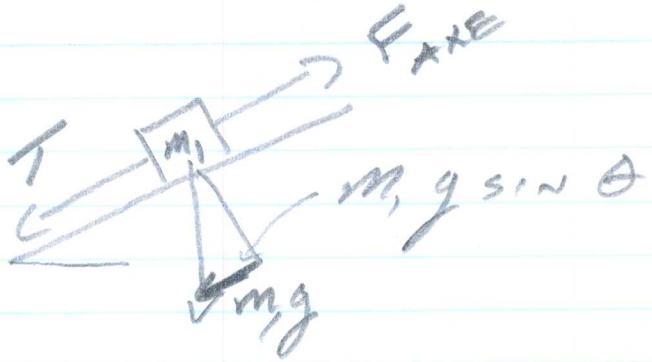
$$\Rightarrow m_2 g \sin\theta_2 - m_2 a + m_1 g \sin\theta_1 = m_1 a$$

$$\Rightarrow a = g\,\frac{(m_2 \sin\theta_2 + m_1 \sin\theta_1)}{m_1 + m_2}$$

$$= 9.8\,\frac{(63 \sin 38^\circ + 75 \sin 12^\circ)}{63 + 75}$$

$$= 3.86\ \frac{m}{s^2}$$

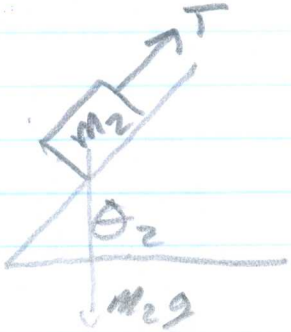
(b)



m_1: $\Sigma F = ma = 0$

$$F_{AXE} - T - m_1 g \sin\theta$$

m_2:



$$\Sigma F = m_2 a = 0$$

$$T - m_2 g \sin\theta_2 = 0$$

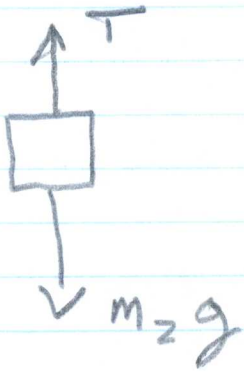
$\Rightarrow$ Solve for F_{AXE}

$$\Rightarrow F_{AXE} - m_2 g \sin\theta_2 - m_1 g \sin\theta_1 = 0$$

$$\Rightarrow F_{AXE} = g(m_1 \sin\theta_1 + m_2 \sin\theta_2)$$

$$\boxed{F_{AXE} = 532.9 \text{ N}}$$

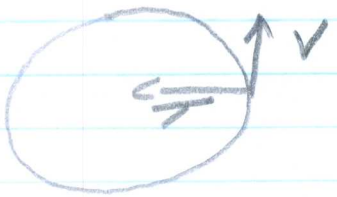
(26) m_2:



$$\Rightarrow T - m_2 g = m_2 a = 0$$

$$\Rightarrow \boxed{T = m_2 g}$$

m_1:



$$\Rightarrow \Sigma F = ma$$

$$\Rightarrow T = \frac{mv^2}{R}$$

$$\Rightarrow \quad m_2 g = \frac{m_1 v^2}{R}$$

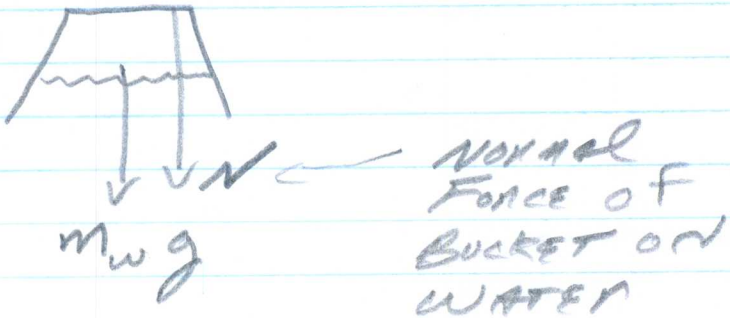
$$\Rightarrow \quad v = \sqrt{\frac{m_2}{m_1} g R}$$

$$\Rightarrow \quad t_{period} = \frac{2\pi R}{v}$$

$$= \frac{2\pi R}{\sqrt{\frac{m_2}{m_1} g R}}$$

$$\boxed{t_{period} = 2\pi \sqrt{\frac{m_1}{m_2 g R}}}$$

(36) Forces on water



- Looking for minimum v so that Normal Force, N -> 0 at top of circle.

$$\Sigma F = m_w a$$

$$\Rightarrow \cancel{N}^{0} + m_w g = m_w a = \frac{m_w v^2}{r}$$

$$\Rightarrow \frac{v^2}{r} = g \Rightarrow v = \sqrt{\frac{9.8}{.85}}$$

$$\boxed{v = 3.4 \frac{m}{s}}$$