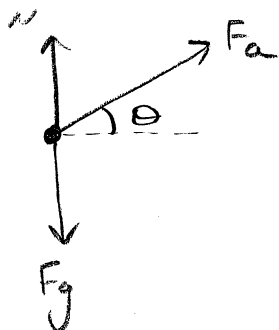


Dynamics Worksheet #3

①



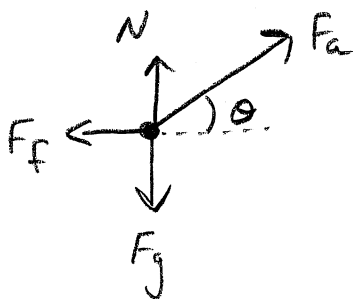
$$\Sigma F = ma$$

$$F_a \cos \theta = ma$$

$$a = \frac{F_a \cos \theta}{m} = \frac{100 \cos 37}{40}$$

$$a = \underline{2.00 \text{ m/s}^2}$$

②



(a)

$$\Sigma F = ma$$

$$-f_f + F_a \cos \theta = ma$$

$$F_f = F_a \cos \theta = 30 \cos 20$$

$$F_f = 28 \text{ N} = \underline{30 \text{ N}}$$

(b)

$$\Sigma F = ma$$

$$N + F_a \sin \theta - F_g = ma$$

$$N = mg - F_a \sin \theta$$

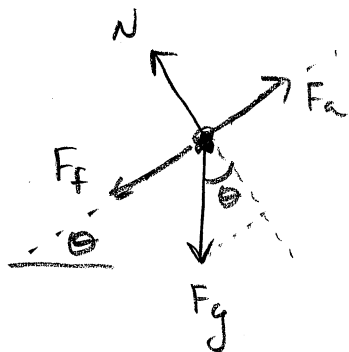
$$= 20(10) - 30 \sin 20$$

$$N = 189.7 \text{ N}$$

$$\mu = \frac{F_f}{N} = \frac{28}{189.7} =$$

$$\mu = \underline{0.15}$$

③



$$\sum F = ma$$

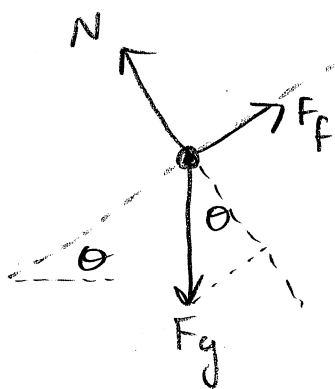
$$-F_f - F_g \sin \theta + F_a = ma$$

$$F_a = F_f + F_g \sin \theta$$

$$= 3 + 10 \sin 30$$

$$F_a = \underline{8 \text{ N}}$$

④



$$\sum F = ma$$

$$-F_g \sin \theta + F_f = ma$$

$$a = \frac{F_f - F_g \sin \theta}{m}$$

$$\sum F = ma$$

$$N - F_g \cos \theta = ma$$

$$N = F_g \cos \theta$$

$$F_f = \mu N$$

$$a = \frac{\mu m g \cos \theta - m g \sin \theta}{m}$$

$$a = g (\mu \cos \theta - \sin \theta)$$

$$= 10 (0.4 \cos 60 - \sin 60)$$

$$a = -6.7 = -7 \text{ m/s}^2$$

(7 m/s² down the ramp)

5



(a) Block B



$$\Sigma F = ma$$

$$T = m_B a$$

$$= 4(0.5)$$

$$T = \underline{2 \text{ m/s}^2}$$

(b) Blocks A + B



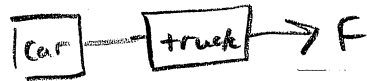
$$\Sigma F = ma$$

$$P = (m_A + m_B) a$$

$$= (6 + 4)(0.5)$$

$$P = \underline{5 \text{ m/s}^2}$$

⑥



(a)

car

$$\Sigma F = ma$$



$$T = m_{\text{car}} a$$

$$= 750(4)$$

$$T = 3000 \text{ N}$$

(b)

car + truck

$$\Sigma F = ma$$

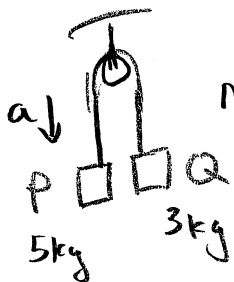


$$F = (m_{\text{car}} + m_{\text{truck}}) a$$

$$= (750 + 1500)(4)$$

$$\underline{F = 9000 \text{ N}}$$

⑦



$$\Sigma F = ma$$

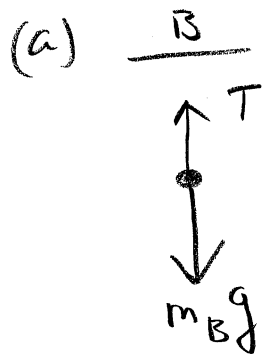
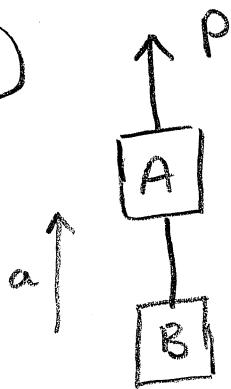
$$-m_p g + m_q g = (-m_p + m_q)(-a)$$

$$a = \frac{-(-m_p + m_q)g}{m_p + m_q}$$

$$= \frac{(m_p - m_q)g}{m_p + m_q} = \frac{(5 - 3)10}{(5 + 3)}$$

$$\underline{a = 2.5 \text{ m/s}^2}$$

(8)



$$\Sigma F = ma$$

$$T - m_B g = m_B a$$

$$T = m_B (a + g)$$

$$= 3(2.2 + 10)$$

$$T = 36.6 = \underline{37 N}$$

$$(T = 36 \text{ if } g = 9.8)$$

(b) A+B



$$\Sigma F = ma$$

$$P - F_g = (m_A + m_B) a$$

$$P - (m_A + m_B) g = (m_A + m_B) a$$

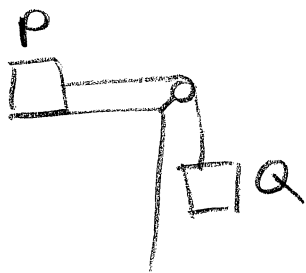
$$P = (m_A + m_B)(g + a)$$

$$= (2 + 3)(10 + 2.2)$$

$$P = \underline{61 N}$$

$$(P = 60 N \text{ if } g = 9.8)$$

9



(a) P+Q

$$F_{fp} \leftarrow \bullet \rightarrow m_a g$$

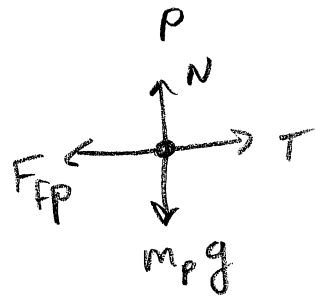
$$\Sigma F = ma$$

$$-F_{fp} + m_a g = ma$$

$$-\mu m_p g + m_a g = (m_p + m_a) a$$

$$a = \frac{m_a g - \mu m_p g}{m_p + m_a} = \frac{3(10) - .2(5)10}{(5+3)}$$

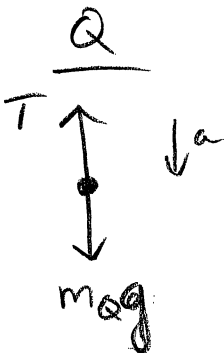
$$a = \underline{2.5 \text{ m/s}^2}$$



$$N = m_p g$$

$$F_f = \mu m_p g$$

(b)



$$\Sigma F = ma$$

$$T - m_a g = -m_a a$$

$$T = m_a g - m_a a$$

$$= m_a (g - a)$$

$$T = 3(10 - 2.5)$$

$$T = 22.5 = \underline{23 \text{ N}}$$

$$(T = 22 \text{ N if } g = 9.8)$$