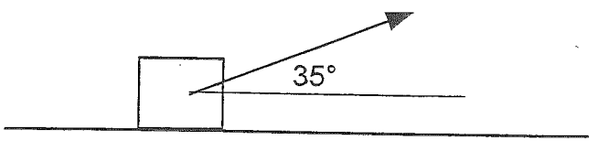
Phys 12 : Practice : Ch 4

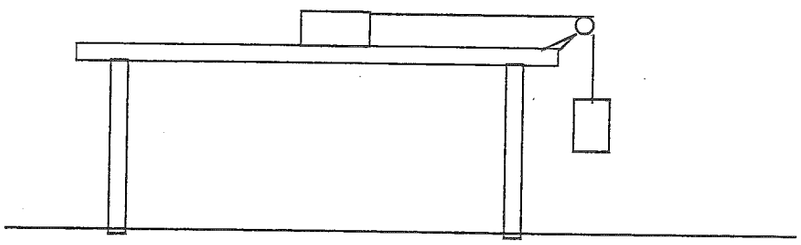
KEY

1 ✍ The diagram below shows a box of mass 4.6 kg being pulled along a horizontal sidewalk by a force of 51 N as shown. The coefficient of friction between the box and the sidewalk is 0.70.

a. What is the magnitude of the normal force exerted by the sidewalk on the box?
b. What is the magnitude of the net force on the box?



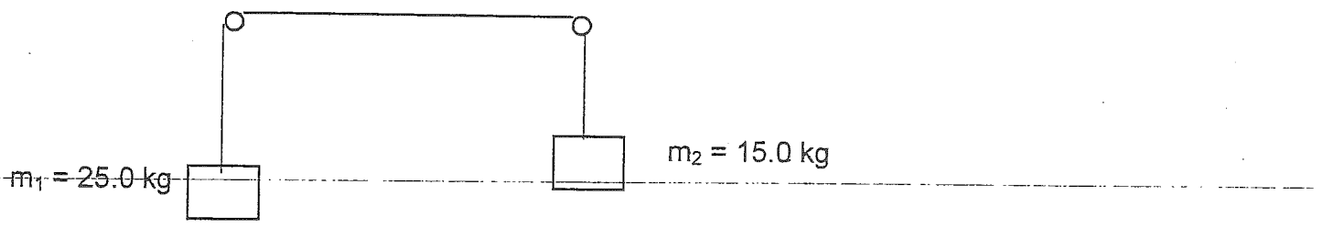
2. ✍ A 10.0 kg block hangs by a string connected to a 7.0 kg block on a table.



(a) What is the minimum coefficient of static friction needed to keep the system at rest?
(b) If the true coefficient of friction is 0.35, what is the acceleration of the system?
(c) For the situation in (b), what is the tension in the string?

3. ✍ For the diagram shown:

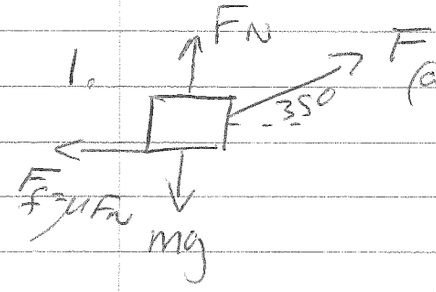
a. What is the acceleration of the system if friction may be ignored?
b. What is the tension on the string?



4. ✍ The coefficient of static friction between your physics text (m=0.450 kg) and the desk is 0.30. If you tilt your desk, at what angle to the horizontal will your book start to slide?

5. ✍ A car is traveling at a constant speed of 50.0 km/h up a slope that is 9.0° to the horizontal.

a. Draw the free body diagram for the car.
b. What is the horizontal component of the car's velocity?
c. What is the net force on the car?

1. 

(a) $\Sigma F_y = 0 = F_N + F\sin 35^\circ - mg$

$\therefore F_N = mg - F\sin 35^\circ$

$F_N = (4.6)(9.8) - (51)\sin 35^\circ$

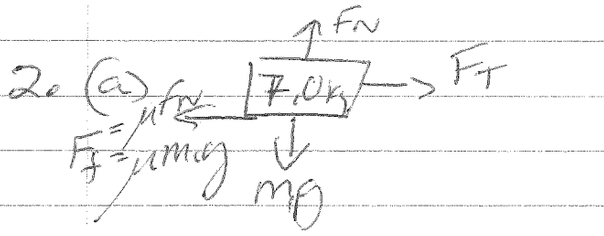
$\boxed{F_N = 16\,N}$ (15.8276)

(b) $\Sigma F_x = F\cos 35^\circ - F_f$

$= F\cos 35^\circ - \mu(15.8276)$

$= 51\cos 35^\circ - (0.7)(15.8276)$

$\boxed{\Sigma F = 31\,N \text{ (right)}}$

2. (a) 

$\Sigma F = (m_1 + m_2)a = m_2 g - \mu m_1 g$

$0 = m_2 - \mu m_1$

$\therefore \mu = \frac{m_2}{m_1} = \frac{10}{7}$

$\boxed{\mu = 1.4}$

(b) $a = \frac{g(m_2 - \mu m_1)}{m_1 + m_2} = \frac{(9.8)(10 - (0.35)(7))}{17}$

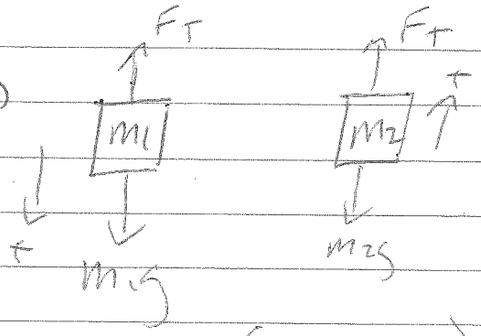
$\boxed{a = 4.4\,m/s^2}$ (4.35235)

(c) $m_2 a = m_2 g - F_T$

$F_T = m_2(g - a) = (10)(9.8 - 4.35235)$

$\boxed{F_T = 54\,N}$

3. (a)



$$\Sigma F = (m_1 + m_2)a = m_1 g - m_2 g$$

$$a = \frac{g(m_1 - m_2)}{m_1 + m_2} = \frac{(9.8)(25 - 15)}{25 + 15}$$

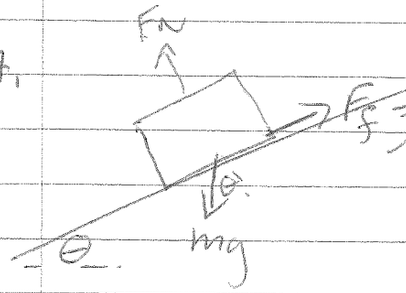
$$\boxed{a = +2.45\ m/s^2}$$

(b) $m_1 a = m_1 g - F_T$

$$\therefore F_T = m_1(g - a) = (25)(9.8 - 2.45)$$

$$\boxed{F_T = 184\ N}$$

4.



$\Sigma F_y = 0$ $F_N - mg\cos\theta$

$\therefore F_N = mg\cos\theta$

$\Sigma F_x = ma_x = mg\sin\theta - \mu mg\cos\theta$

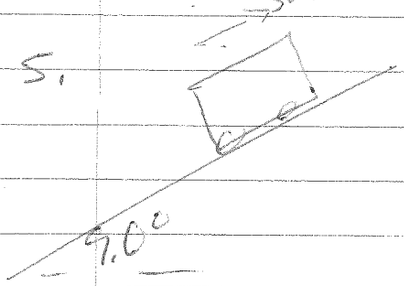
$a_x = 0$ $\quad 0 = mg\sin\theta - \mu mg\cos\theta$

$\therefore \mu = \tan\theta$

$\therefore \theta = \tan^{-1}(0.3)$

$$\boxed{\theta = 17^\circ}$$

5.



(a)

(b) $v_x = (50\ km/h)\cos 9.0^\circ = \boxed{49\ km/h}$

(c) ($\Sigma F = 0$ (const $\vec{v}$ $\therefore \vec{a} = 0$))