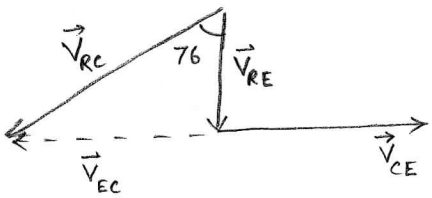
Solutions

PHYS-205A-001 (Midterm Exam 02) Spring 2018

Prob. 1

R - Rain
E - Earth
C - Car



$V_{EC} = 40 \frac{km}{h}$.

(a) $|\vec{V}_{RE}| = \dfrac{|\vec{V}_{EC}|}{\tan 76}$

$= \dfrac{40.0 \text{ km/h}}{\tan 76} = 10.0 \frac{km}{h}$

(b) $|\vec{V}_{RC}| = \dfrac{|\vec{V}_{EC}|}{\sin 76} = \dfrac{40.0}{\sin 76} = 41.2 \frac{km}{h}$

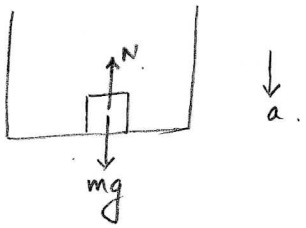
Prob. 2

$$m\vec{a} = m\vec{g} + \vec{N}$$

$$-ma = -mg + N$$

$$N = mg - ma$$

$$= 75(9.8 - 2.0) = 585 \text{ Newton}.$$



Prob. 3

(a) gravity, normal force, tension

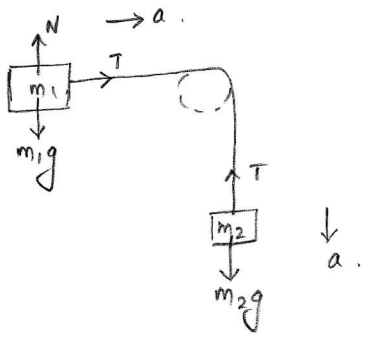
(b) gravity, tension

(c) m_1: $T = m_1 a$

m_2: $m_2 g - T = m_2 a$.

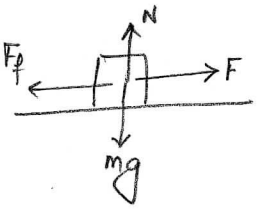
$m_2 g = (m_1 + m_2) a$.

$$a = \frac{m_2}{m_1 + m_2} g = \frac{2.0}{2.0 + 1.0} \times 9.8 = 6.5 \frac{m}{s^2}$$



Prob. 4

(a) gravity, normal force, friction, horizontal force.



$N = mg$

(b) $ma = F - F_f$ (F_f: maximum value.)

$ma = 0$

$F = \mu_s N = \mu_s mg$

$75.0 = \mu_s (25.0)(9.8)$

$\mu_s = \dfrac{75.0}{(25.0)(9.8)} = 0.31$

(c) $ma = F - F_f$.

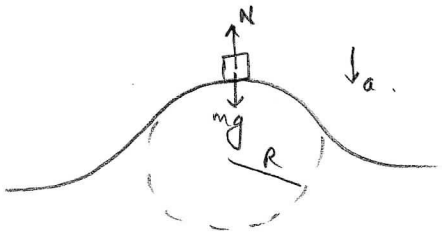
$ma = 0$

$F = \mu_k N = \mu_k mg$

$50.0 = \mu_k (25.0)(9.8)$

$\mu_k = \dfrac{50.0}{(25.0)(9.8)} = 0.20$

Prob. 5



$m\vec{g} + \vec{N} = m\vec{a}$

$mg - N = m\dfrac{v^2}{R}$

$N = 0$ (threshold)

$v = \sqrt{gR} = \sqrt{(9.8)(150)} = 38 \dfrac{m}{s}$

Prob. 6

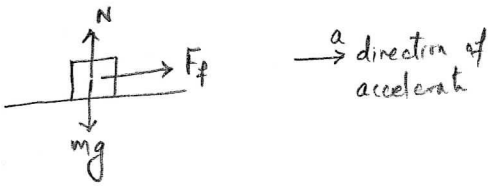
for terminal velocity $\frac{dv}{dt} = 0$

$$0 = mg - bv_T$$

$$v_T = \frac{mg}{b}$$

Prob. 7

(a) gravity, normal force, friction



(b) Friction is in the direction of acceleration, which is given to be in the direction of velocity.

(c) $$ma = F_f \leq \mu_s N = \mu_s mg$$

$$a \leq \mu_s g = (0.40)(9.8) = 3.9 \frac{m}{s^2}$$