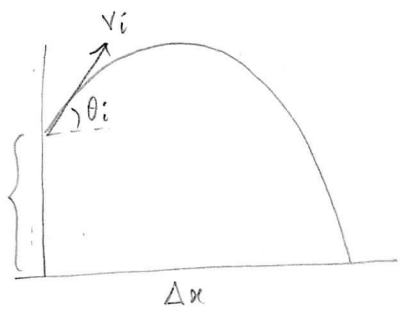


Solutions (PHYS-205A-002) (Midterm Exam 02) (Fall 2017)

Prob. 1

$\Delta x =$
 $\Delta t = 3.00 \text{ s}$
 $v_{ix} = 9.00 \cos 25$
 $= 8.16 \frac{\text{m}}{\text{s}}$

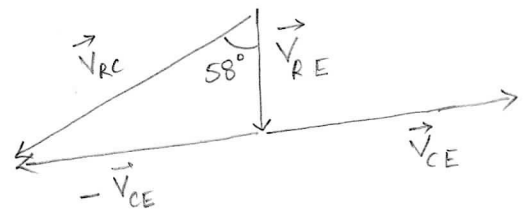
$\Delta y = ?$
 $\Delta t = 3.00 \text{ s}$
 $v_{iy} = +9.00 \sin 25$
 $= +3.80 \frac{\text{m}}{\text{s}}$
 $v_{fy} =$
 $a = -9.8 \frac{\text{m}}{\text{s}^2}$



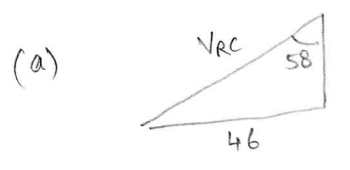
$\Delta y = v_{iy} \Delta t + \frac{1}{2} a \Delta t^2$
 $= (3.80)(3.00) + \frac{1}{2} (-9.8)(3.00)^2$
 $= 11.4 - 44.1 = -32.7 \text{ m}$

height = 32.7 m

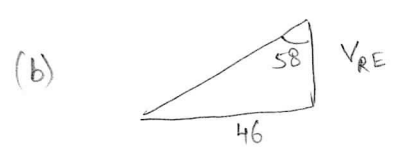
Prob. 2



$\vec{V}_{RC} = \vec{V}_{RE} + \vec{V}_{EC}$
 $= \vec{V}_{RE} - \vec{V}_{CE}$
 R-Rain
 C-Car
 E-Earth



$V_{RC} = \frac{46}{\sin 58} = 54 \frac{\text{km}}{\text{h}}$
 direction: 58° West of Vertical down.



$V_{RE} = \frac{46}{\tan 58} = 29 \frac{\text{km}}{\text{h}}$
 direction: vertically down.

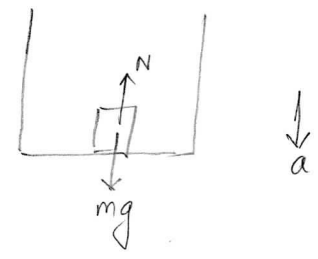
Prob. 3

$$N - mg = -ma$$

$$N = mg - ma$$

$$= 95(9.8) - 95(1.0)$$

$$= 836 \text{ Newtons}$$



Prob. 4

$$y: N = mg \cos \theta$$

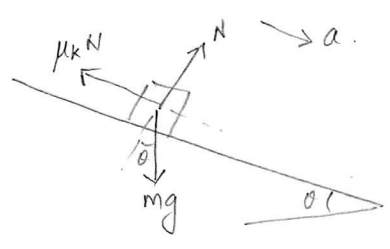
$$x: mg \sin \theta - \mu_k N = ma$$

$$mg \sin \theta - \mu_k mg \cos \theta = ma$$

$$a = g \sin \theta - \mu_k g \cos \theta$$

$$= 9.8 \sin(30) - (0.30)(9.8) \cos 30$$

$$= 2.35 \frac{m}{s^2}$$



Prob. 5

$$T_3 = mg = 500.0 \text{ N}$$

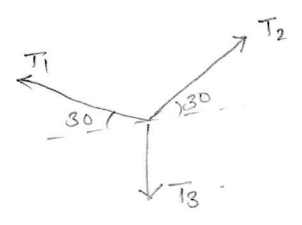
$$\vec{T}_1 + \vec{T}_2 + \vec{T}_3 = m\vec{a} = 0$$

$$x: T_1 \cos 30 = T_2 \cos 30 \Rightarrow T_1 = T_2$$

$$y: T_1 \sin 30 + T_2 \sin 30 = T_3$$

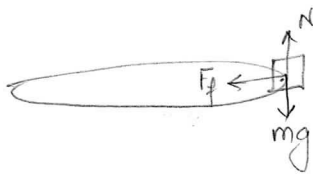
$$2 T_1 \sin 30 = T_3 \Rightarrow T_1 = T_3$$

$$\text{Thus, } T_1 = T_2 = T_3 = 500.0 \text{ N}$$



Prob. 6

(a)



Gravity, Normal force, Friction

(b)

$$\vec{F}_{\text{tot}} = m \vec{a}$$

$$= -\hat{r} \frac{m v^2}{R}$$

$$= -\hat{r} \frac{2500 (14)^2}{250} = -\hat{r} 1960 \text{ N}$$

magnitude = 1960 N
 direction: radially inward.

Prob. 7

$$y: N = mg \cos \theta$$

$$x: mg \sin \theta - b v = m a$$

for terminal velocity $a = 0$.

$$mg \sin \theta - b v_T = 0$$

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

