

# Solutions

## Problem 1



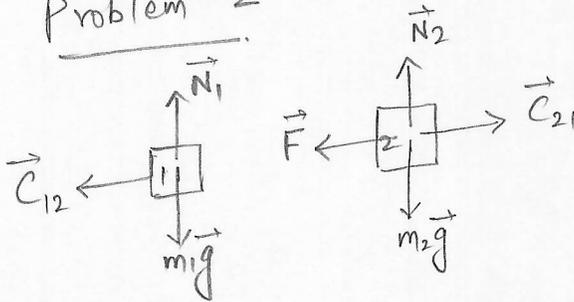
$$ma = N - mg$$

$$N = mg + ma$$

$a > 0$  : speeding while moving up  
 $a < 0$  : slowing while moving up

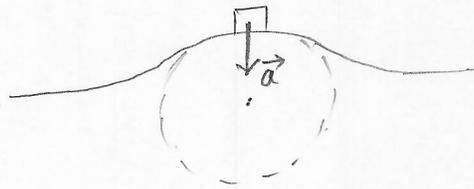
It will weigh heavier when speeding moving upwards. That is, while moving upwards.

## Problem 2



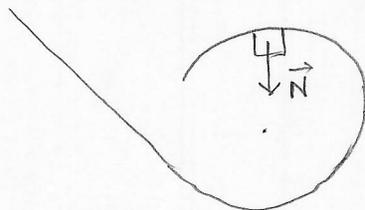
$\vec{C}_{12}$  and  $\vec{C}_{21}$  are action-reaction pair.

## Problem 3



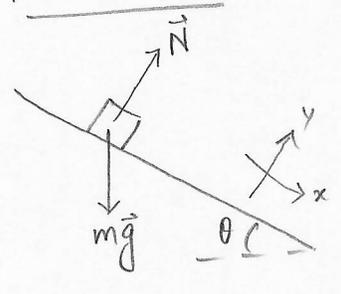
towards the center of circle.

## Problem 4



$\vec{N}$  is downward.

Problem 5



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

$$x: ma = mg \sin \theta + 0$$

$$a = g \sin \theta$$

$$= 9.8 \sin 30$$

$$= 4.9 \text{ m/s}^2$$

$$y: 0 = -mg \cos \theta + N$$

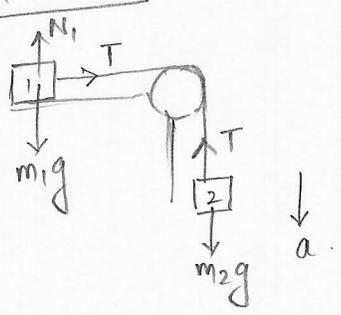
$$N = mg \cos \theta$$

$$v_f = \sqrt{v_i^2 + 2a\Delta x}$$

$$= \sqrt{0^2 + 2(4.9)(20.0)}$$

$$= 14 \frac{\text{m}}{\text{s}}$$

Problem 6



$$m_1: x: m_1 a = T$$

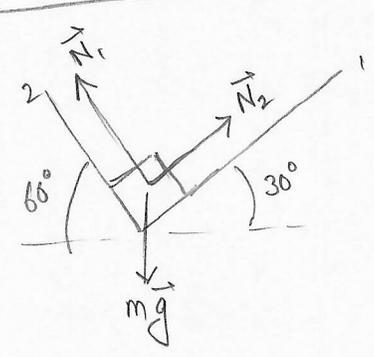
$$m_2: y: m_2 a = m_2 g - T$$

$$y: 0 = -m_1 g + N_1$$

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

$$a = \left( \frac{m_2}{m_1 + m_2} \right) g = \left( \frac{2.0}{1.0 + 2.0} \right) 9.8 = 6.5 \frac{\text{m}}{\text{s}^2}$$

Problem 7



$$m\vec{a} = m_1\vec{g} + \vec{N}_1 + \vec{N}_2$$

$$0 = m_1\vec{g} + \vec{N}_1 + \vec{N}_2$$

$$x: 0 = 0 - N_1 \cos 60 + N_2 \cos 30$$

$$N_1 \cdot 0.50 = N_2 \cdot 0.87 \Rightarrow N_1 = 1.74 N_2$$

$$y: 0 = -m_1 g + N_1 \sin 60 + N_2 \sin 30$$

$$196 = N_1 \cdot 0.87 + 0.50 N_2$$

$$= (1.74) N_2 (0.87) + (0.50) N_2$$

$$\Rightarrow N_2 = 97 \text{ Newtons}$$

$$N_1 = 170 \text{ Newtons}$$

- $m_1 \vec{g}$ : 196 N, vertically down
- $\vec{N}_1$ : 170 N, 60° cw w.r.t.  $-\hat{i}$
- $\vec{N}_2$ : 97 N, 30° ccw w.r.t.  $+\hat{i}$