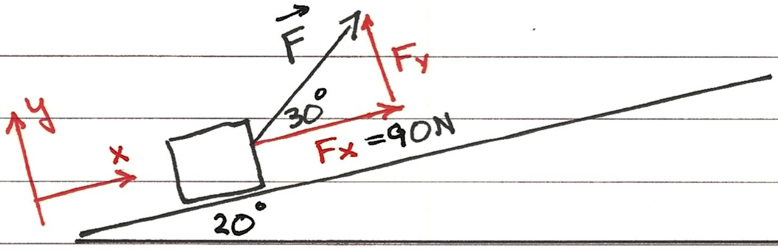
Chapter 4 In-Class Homework Problems

Ex.4 A man is dragging a trunk up the loading ramp...

a.) $|\vec{F}| = ?$

$\cos(30°) = \frac{F_x}{|\vec{F}|}$



$$|\vec{F}| = \frac{F_x}{\cos(30°)} = \frac{90\ N}{\cos 30°} = \boxed{103\ N}$$

b.) $F_y = ?$ $\tan 30° = \frac{F_y}{F_x}$ $F_y = F_x \tan 30° = 90N \tan 30°$

$$\boxed{F_y = 52.0\ N}$$

Ex.7 A 68.5 kg skater moving initially at 2.40 m/s on rough....

$V_o = 2.40\ m/s$
$V = 0.00\ m/s$
$t = 3.52\ s$
$a = ?$

Eq.1 $\Rightarrow V = V_o + at$ $a = \frac{V - V_o}{t}$

$a = \frac{(0.00 - 2.40)\ m/s}{3.52\ s}$ $a = \underline{\underline{-0.68\ m/s^2}}$

$\Sigma F = ma$ $\Sigma F = (68.5\ kg)(-0.68\ m/s^2)$ $\boxed{\Sigma F = -46.7\ N}$

Ex.12 A crate with mass 32.5 kg initially at rest on a....

$\Sigma F_x = 14.0\ N$

a.) acceleration $= ?$ $a = \Sigma F / m = 14.0\ N / 32.5\ kg = 0.431 \frac{m}{s^2}$

$\boxed{a = 0.431\ m/s^2}$

b.) $X = V_o t + \frac{1}{2} a t^2 = 0 + \frac{1}{2}(0.431\ m/s^2)(10.0 s)^2 = \boxed{21.5\ m}$

c.) $V = V_o + at = 0 + (0.431\ m/s^2)(10.0\ s) = \boxed{4.31\ m/s}$

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Chapter 4 In-Class Homework Problems

Ex. 17 Superman throws a 2400-N boulder at an adversary. ...

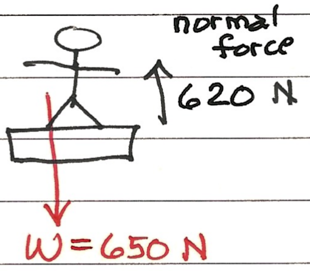
$$\Sigma F_x = ma_x = \left(\frac{2400\text{ N}}{9.8\text{ m/s}^2}\right) 12.0\text{ m/s}^2 = \boxed{2939\text{ N}}$$

Ex. 24 The upward normal force exerted by the floor is 620 N...

1.) What are the reaction forces to these 2 forces.

a.) $F_{\text{floor on passenger}} = -F_{\text{passenger on floor}}$

b.) $F_{\text{Earth on the passenger}} = -F_{\text{passenger on the Earth}}$



2.) Yes. The passenger is accelerating because the $\Sigma F_y \neq 0$.

3.) What are the magnitude and direction of the acceleration?

Free-Body Diagram

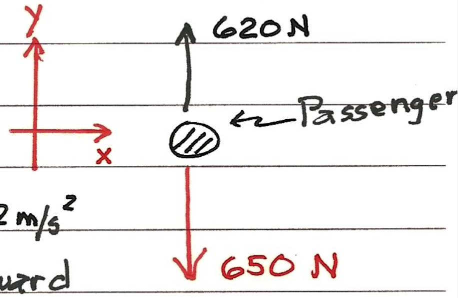
$$\Sigma F_y = ma_y$$

$$a_y = \frac{\Sigma F_y}{m} = \frac{(620-650)\text{ N}}{(650/9.8)\text{ kg}}$$

$$\boxed{a_y = -0.452\text{ m/s}^2}$$

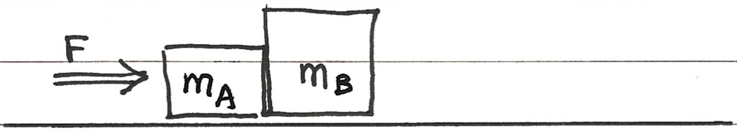
magnitude = 0.452 m/s^2

direction = downward



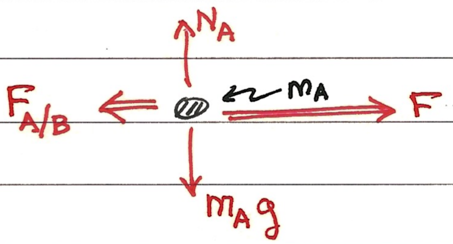
Chapter 4 In-Class Homework Problems

Ex.27 Two crates, A and B, sit at rest side-by-side



a.) Free-body Diagrams

m_A :



m_B :

The only pair of forces that are third-law action-reaction forces in these 2 diagrams are: $\vec{F}_{A/B} = -\vec{F}_{B/A}$

b.) If $|\vec{F}| < (m_A g + m_B g)$, "Yes" the will move.

In fact, the two masses will accelerate $a_x = \frac{\sum F_x}{m_A + m_B}$

$$\boxed{a_x = \frac{\overset{|\vec{F}|}{\sum F_x}}{m_A + m_B}}$$ as long as $|\vec{F}| > 0$

Prob. 28 A .22 rifle bullet, traveling at 350 m/s . . . .

a.)

$V_o = 350 \text{ m/s}$
$V = 0.00 \text{ m/s}$
$X = 0.130 \text{ m}$
$t = ??$

Eq. 2 $\Rightarrow$ $x = \frac{1}{2}(V_o + V)t$

$$t = \frac{2x}{V_o + V} = \frac{2(0.130\text{m})}{(350+0)\text{m/s}} = \boxed{7.43 \times 10^{-4} \text{ s}}$$

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Prob. 28 cont'd

b.) Force = ? First, find the acceleration.

$X = 0.130\,m$

$V_o = 350\,m/s$

$V = 0.00\,m/s$

$a = ?$

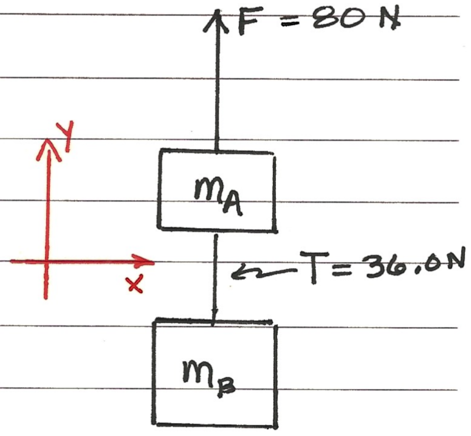
Eq. 4 $\Rightarrow$ $V^2 = V_o^2 + 2aX$

$$a = \frac{V^2 - V_o^2}{2X} = \frac{(0)^2 - (350\,m/s)^2}{2(0.130\,m)} = \underline{\underline{-4.71 \times 10^{+5}\,\frac{m}{s^2}}}$$

b.) $F = ma = (1.80 \times 10^{-3}\,kg)(-4.71 \times 10^{5}\,m/s^2) = \boxed{-848\,N}$

mass of the bullet

Prob. 45 Boxes A and B are connected to each end of a light vertical rope.



First, find the acceleration, $a_y = ?$

$y = -12.0\,m$

$t = 4.00\,s$

$V_{oy} = 0.00\,m/s$

$a_y = ??$

Eq. 3

$V_{oy} = 0.00\,m/s$

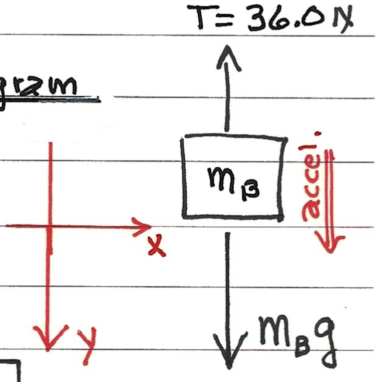
$y = V_{oy}t + \frac{1}{2}a_y t^2$

$y = \frac{1}{2}a_y t^2$

$$a_y = \frac{2y}{t^2} = \frac{(-24.0\,m)}{16.0\,s^2}$$

$\boxed{a_y = -1.50\,m/s^2}$ or $1.50\,m/s^2$ "downward"

Free-Body Diagram



a.) Let $m_B \Rightarrow$ the system

$\Sigma F_y = ma_y$ $a_y = +1.50\,m/s^2$

$+ \; m_B g - T = m_B a_y$

$m_B(g - a) = T$

m_B

$$m_B = \frac{T}{g - a} = \frac{36.0\,N}{(9.8 - 1.50)\,m/s^2} = \boxed{4.34\,kg}$$

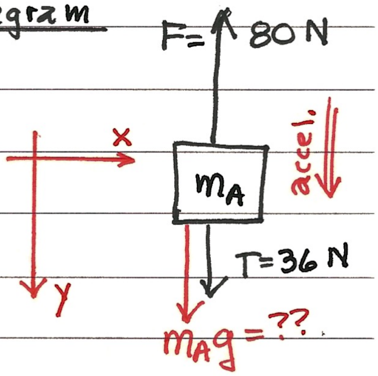
Chapter 4 In-Class Homework Problems

Prob. 45 cont'd

b.) $m_A = ?$

Let $m_A \Rightarrow$ the system

Free-Body Diagram



$\sum F_y = m_A \, a_y$ $a_y = +1.50 \text{ m/s}^2$

$m_A g + T - F = m_A a_y$

$m_A (g - a_y) = F - T$

$m_A = \dfrac{F - T}{g - a_y} = \dfrac{(80 - 36)\text{ N}}{(9.8 - 1.5)\text{ m/s}^2} = \underline{5.30 \text{ kg}}$

$$\boxed{m_A = 5.30 \text{ kg}}$$

End of Chapter 4