

EXAM 2

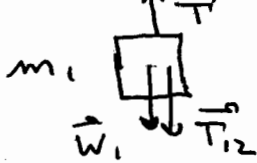
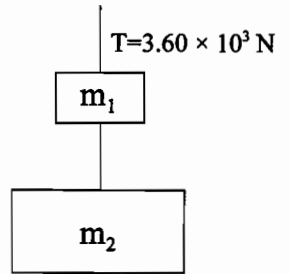
Name: _____

Student ID #: _____

TA (circle one): Akiko Golda Josh Mahamadou Matt Victoria

A. [20 pts.] Two large crates ($m_1 = 120$ kg, $m_2 = 180$ kg) are hung by strong massless cables as shown in the drawing. A tension applied to the upper cable of $T = 3.60 \times 10^3$ N accelerates this load upward. Find (1) the upward acceleration of the two-crate load, and (2) the tension in the cable between the upper and lower crates.

$W_1 = m_1 g = 1176 \text{ N}$
 $W_2 = m_2 g = 1764 \text{ N}$



FOR m_1

$$T - W_1 - T_{12} = m_1 a \quad (1)$$

FOR m_2

$$T_{12} - W_2 = m_2 a \quad (2)$$

ADD EQUATIONS

$$T - (W_1 + W_2) = (m_1 + m_2) a$$

$$a = \frac{3.6 \times 10^3 \text{ N} - (1176 \text{ N} + 1764 \text{ N})}{300 \text{ kg}}$$

$a = 2.20 \text{ m/s}^2$

USE EQ. (2)

$$T_{12} = m_2 a + W_2$$

$$= (180 \text{ kg})(2.2 \text{ m/s}^2) + 1764 \text{ N}$$

$T_{12} = 2160 \text{ N}$

B. A youngster is twirling a 0.110 kg ball on a string in a horizontal circle of radius 0.360 m. The ball travels once around the circle in 1.24 s.

1. [6 pts.] What is the constant speed of the ball as it travels around the circle?

$$v = \frac{2\pi R}{T} = \frac{(2\pi)(0.36 \text{ m})}{1.24 \text{ s}} = \boxed{1.82 \text{ m/s}}$$

2. [6 pts.] Find the centripetal force on the ball.

$$F_c = \frac{mv^2}{R} = \frac{(0.11 \text{ kg})(1.82 \text{ m/s})^2}{0.36 \text{ m}} = \boxed{1.02 \text{ N}}$$

3. [10 pts.] What is the tension on the string? COULD DO THIS

$T \cos \theta = mg$
 $T \sin \theta = F_c$
 $\tan \theta = \frac{F_c}{mg} = \frac{1.02 \text{ N}}{(0.11 \text{ kg})(9.8 \text{ m/s}^2)}$
 $\theta = \tan^{-1}(0.946) = 43.4^\circ$

$T = F_c / \sin 43.4^\circ$

$T = 1.48 \text{ N}$

OR
 $T = \sqrt{(mg)^2 + F_c^2}$

$T = 1.48 \text{ N}$