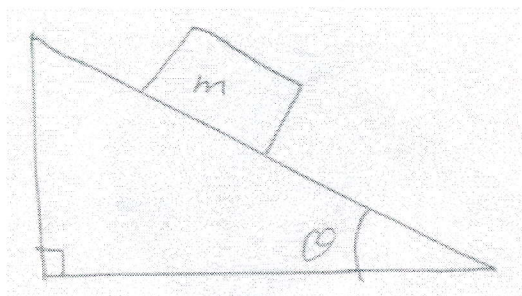


Dynamics

AT Dynamics(15).doc

Directions: Solve the following problems. Each is worth 5 points. Show all work for full credit.

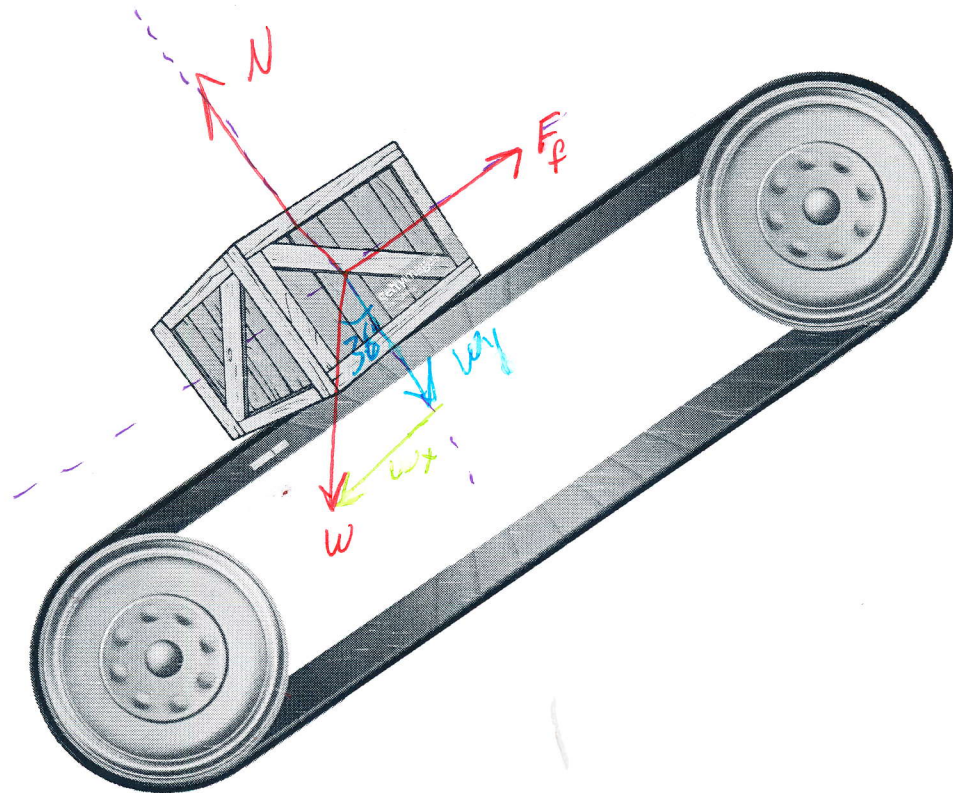
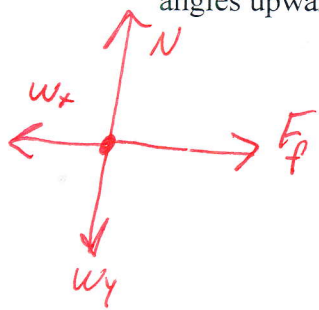
1) Draw a free body diagram for the box as shown.



* Note *

I Drew Forces On Body & Free Body

2) Determine the minimum coefficient of friction between the 22 kg box and the conveyor belt so that the conveyor belt starts at rest (with the box on it) and accelerates at 3.2 ms^{-2} . The belt angles upward at 36 degrees above the horizontal.



$$\Sigma F_y = N - W_y = 0$$

$$N = W \cos \theta$$

$$N = mg \cos \theta$$

$$\Sigma F_x = F_f - W_x = ma$$

$$\mu N - W_x = ma$$

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

$$g(\mu \cos \theta - \sin \theta) = a \quad \text{opposite looking force}$$

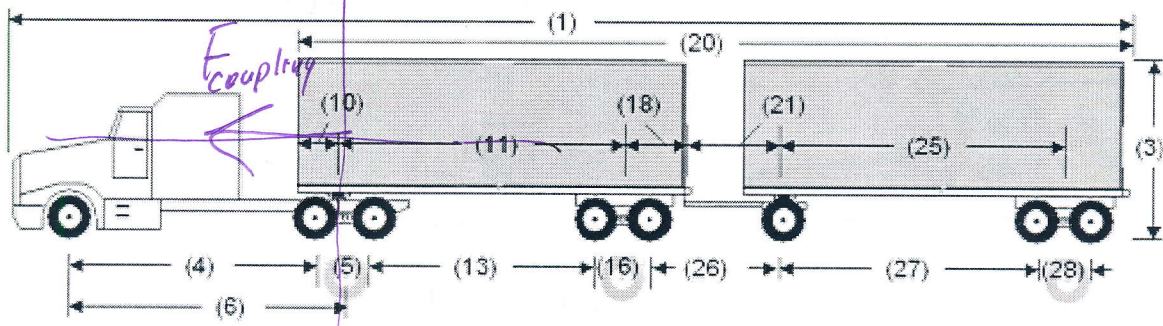
$$\mu g \cos \theta - g \sin \theta = a$$

$$\mu g \cos \theta = a + g \sin \theta$$

$$\mu = \frac{a + g \sin \theta}{g \cos \theta} = \frac{(3.2 \text{ m/s}^2) + (9.8 \text{ m/s}^2) \sin 36^\circ}{(9.8 \text{ m/s}^2) \cos 36^\circ}$$

$$\mu = 1.13$$

3) The double tractor trailer show here consists of the tractor with a mass of 10,000 kg and each trailer has a mass of 50,000 kg. Determine the force acting on the trailer at the coupling when the truck accelerates from rest to 40 mi/hr (17.9 m/s) in a distance of a quarter mile.



$$x = \frac{1}{4} \text{ mile} = 400 \text{ m}$$

$$v_0 = \text{Zero}$$

$$v = 17.9 \text{ m/s}$$

$$a = ?$$

$$v^2 = v_0^2 + 2ax$$

$$v^2 = 2ax$$

$$\frac{v^2}{2x} = a$$

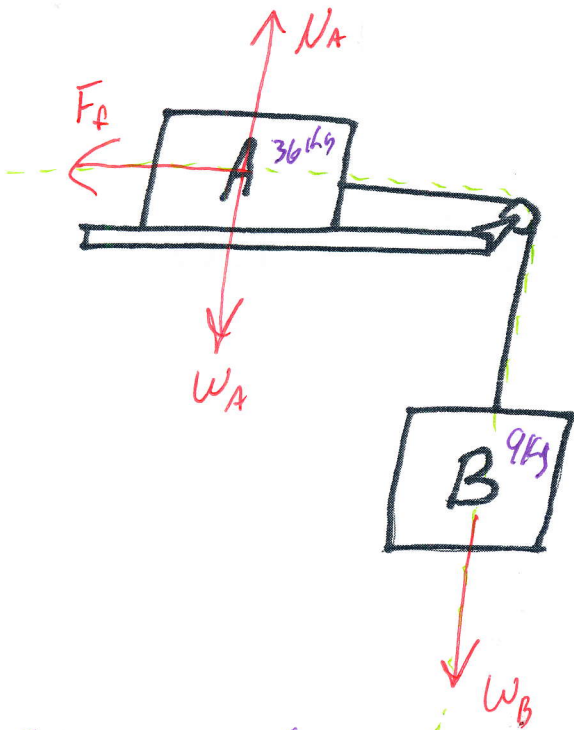
System Is Both Trailers

$$\Sigma F_x = F_{\text{coupling}} = m(-a)$$

$$F_{\text{coupling}} = ma$$

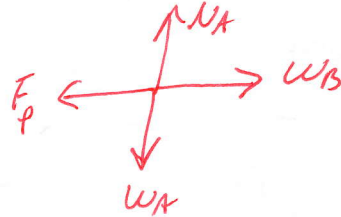
$$F_{\text{coupling}} = \frac{mv^2}{2x} = \frac{(100,000 \text{ kg})(17.9 \text{ m/s})^2}{(2)(400 \text{ m})} = 40,051 \text{ N}$$

4) Two boxes are as pictured below. Box "A" has a mass of 36 kg and a coefficient of friction with the table of 0.24. Box B has a mass 9kg



Find a

The System Is A-B



$$\Sigma F_y = N_A - W_A = ma$$

$$N_A - W_A = 0$$

$$N_A - m_A g = 0$$

$$N_A = m_A g$$

$$\Sigma F_x = W_B - F_f = (m_A + m_B)a$$

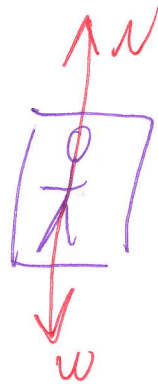
$$m_B g - \mu N = (m_A + m_B)a$$

$$m_B g - m_A g \mu = (m_A + m_B)a$$

$$\frac{g(m_B - m_A \mu)}{(m_A + m_B)} = a$$

$$\frac{(9.8 \text{ m/s}^2)(9 \text{ kg} - (36 \text{ kg})(.24))}{(9 \text{ kg} + 36 \text{ kg})} = \mathbf{.0784 \text{ m/s}^2}$$

5) You have a mass of 60kg. The elevator you are standing in is accelerating upward at 2.3 m/s^2 . How heavy do you feel?



$$\Sigma F_y = N - w = ma$$

$$N - mg = ma$$

$$N = ma + mg$$

$$N = m(a + g)$$

$$N = (60 \text{ kg})(2.3 \text{ m/s}^2 + 9.8 \text{ m/s}^2)$$

$$N = 726 \text{ N}$$

6) Determine the weight of a 10 kg object.

$$W = mg$$

$$98\text{ N}$$