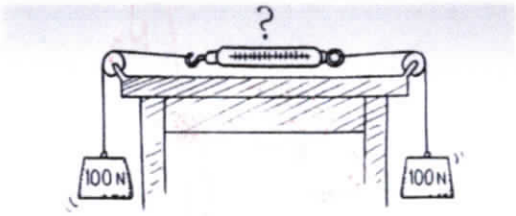
Dynamics

AT Dynamics (20)

Directions: Solve the following problems using "sum of forces". A Free Body diagram and all sum of force equations need to be clear. Do all algebra prior to substituting values. The honor system applies. Your text book and your notes are fair game. Please do not use the assistance of other people, or the internet in any means.

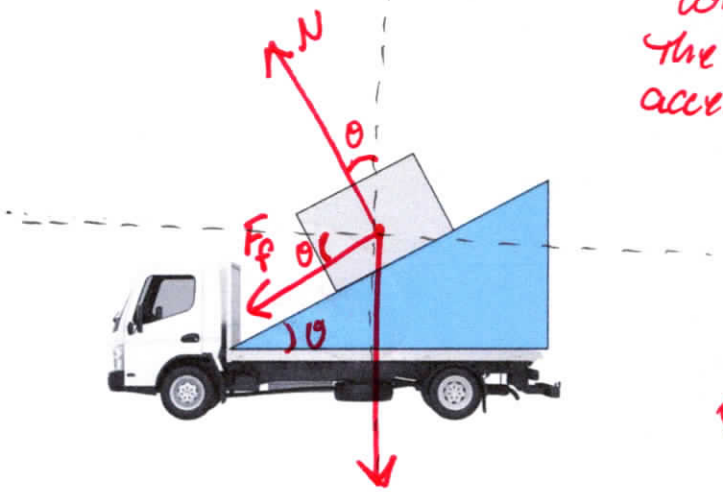
1) Determine the tension in the string (Which will be the same as the reading on the force scale). In event it's hard to read, each mass has a weight of 100N.

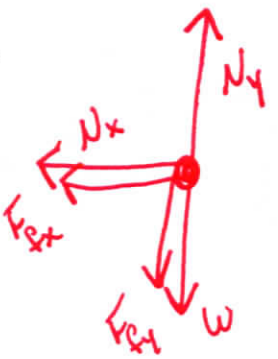


100N

2) Imagine if you would, a box on an incline, that is riding on a flatbed truck. The incline is rigidly attached to the truck and makes an angle of 30 degrees. The box is sitting on the incline. There is a coefficient of friction between the box and the incline of 0.7. Determine the minimum forward acceleration of the truck that will cause the box to slide off the back of the truck.

The acceleration of the Box Will Be Forward With The Truck. The Axis Will Be Drawn So The acceleration Is On An Axis





$\Sigma F_y = N_y - F_{f_y} - W = ma$

$N\cos\theta - F_f \sin\theta - W = 0$

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

$N(\cos\theta - \mu\sin\theta) = mg$

$N = \dfrac{mg}{(\cos\theta - \mu\sin\theta)}$

$\Sigma F_x = -N_x - F_{f_x} = -ma$

$N\sin\theta + F_f\cos\theta = ma$

$N\sin\theta + \mu N\cos\theta = ma$

$N(\sin\theta + \mu\cos\theta) = ma$

$\dfrac{(mg)}{(\cos\theta - \mu\sin\theta)}(\sin\theta + \mu\cos\theta) = ma$

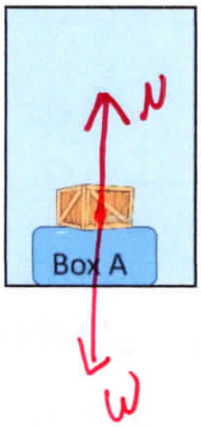
$\dfrac{(g)(\sin\theta + \mu\cos\theta)}{(\cos\theta - \mu\sin\theta)} = a$

$\dfrac{(9.8\,m/s^2)(\sin 30^\circ + (.7)\cos 30^\circ)}{(\cos 30^\circ - (.7)\sin 30^\circ)} = a$

$21\,m/s^2 = a$

$(2.14g)$ ... No Truck will Do that

3) Box A and the crate shown in the diagram are both in an elevator. Box A has a mass of 20kg and the crate has a mass of 32 kg. The elevator is accelerating upward at 1.5 m/s^2. Determine the force exerted on the crate by box A.



The System Is the Crate

$\Sigma F_y = N - W = ma$

$N = ma + W$

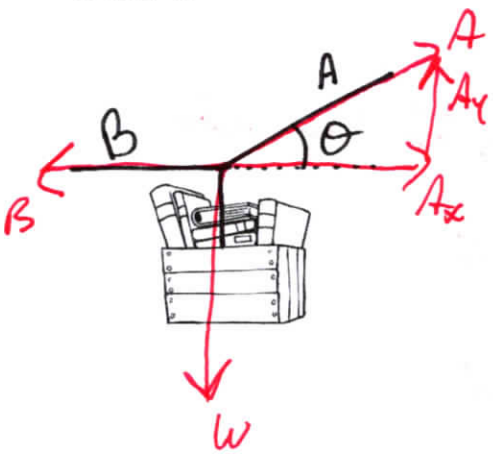
$N = ma + mg$

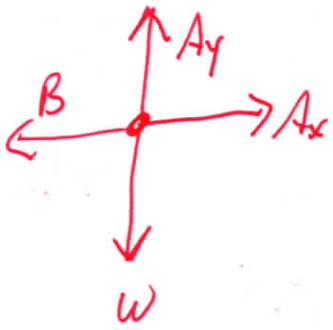
$N = m(a+g)$

$N = (32kg)(1.5 m/s^2 + 9.8 m/s^2)$

$N = 362N$

4) The crate has a mass of 10 kg, and the angle theta is 36 degrees. Determine the tension in ropes "A" and "B."





$\Sigma F_x = A_x - B = ma$

$A\cos\theta = B$

$(167\mathcal{N})\cos(36^\circ) = B$

$134\mathcal{N} = B$

$\Sigma F_y = A_y - w = ma$

$A\sin\theta = w$

$A\sin\theta = mg$

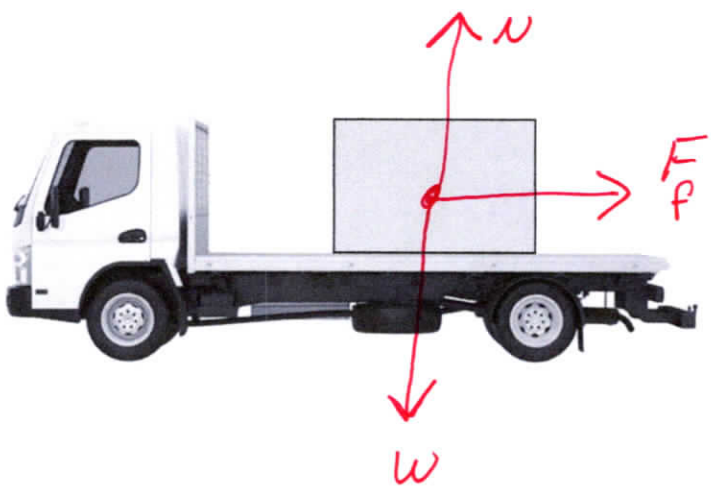
$A = \frac{mg}{\sin\theta}$

$A = \frac{(10kg)(9.8m/s^2)}{\sin(36^\circ)}$

$A = 167\mathcal{N}$

5) The box below has a mass of 250kg and is sitting on the flatbed of the truck as shown. The coefficient of friction between the box and the bed of the truck is 0.75. Determine shortest stopping distance the truck can have from 60mi/hr without the box sliding on the bed of the truck.

$$\left(60\frac{mi}{hr}\right)\left(\frac{1609m}{1mi}\right)\left(\frac{1hr}{3600s}\right) = 26.8\,m/s$$



$$\Sigma F_y = N - w = ma$$
$$N - w = 0$$
$$N = w$$
$$N = mg$$

$$\Sigma F_x = \mu N = ma \quad (F_f = ma)$$
$$\mu mg = ma$$
$$\mu g = a$$

$v_0 = -26.8\,m/s$

$x = ?$

$v = \text{Zero}$

$a = \mu g$

$$v^2 = v_0^2 + 2ax$$
$$0 = v_0^2 + 2\mu g x$$
$$-v_0^2 = 2\mu g x$$
$$\frac{-v_0^2}{2\mu g} = x = \frac{-(-26.8\,m/s)^2}{(2)(.75)(9.8\,m/s^2)} = 48.9\,m$$