Level I Answer Key Pd 3

Dynamics

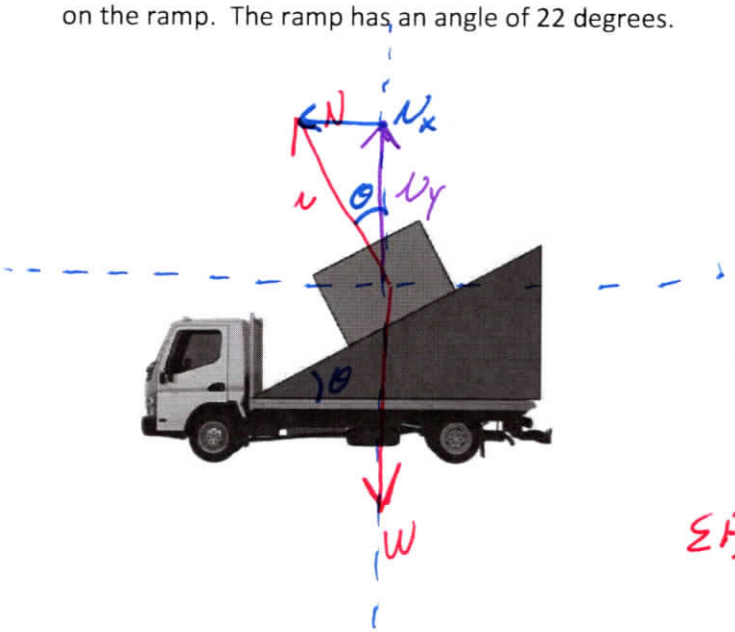
AT Dynamics (21)

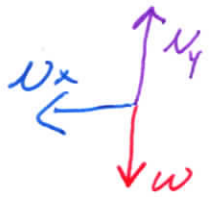
Directions: Solve the following problems. Your work will be graded, not just the answer. Each problem is worth 5 points. The test is worth 50 points. Think like you start with a 5/50 and everything you do from here on is adding to your score!

1. What is the mass of a 25 kg object?

23 kg

2. Consider that the contact between the box and the incline on the truck is frictionless. Determine the acceleration of the truck that would prevent the box from sliding on the ramp. The ramp has an angle of 22 degrees.





$\Sigma F_y = N_y - w = 0$

$N\cos\theta - w =$

$N\cos\theta = mg \Rightarrow N = \frac{mg}{\cos\theta}$

$\Sigma F_x = N_x = ma$

$N\sin\theta = ma$

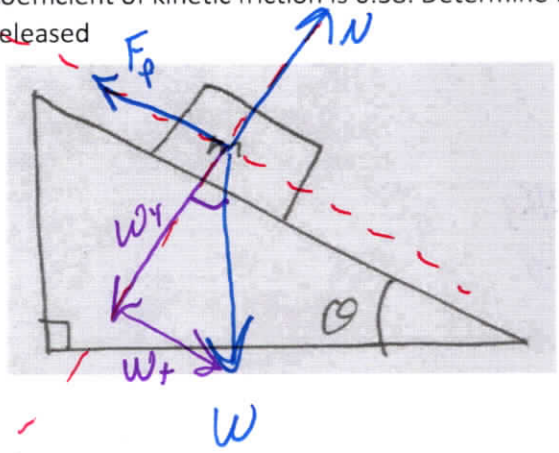
$\frac{mg}{\cos\theta}\sin\theta = ma$

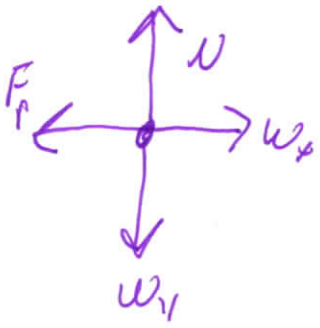
$g\tan\theta = a$

$g\tan(22) =$

$(9.8\ m/s^2)\tan(22) = 3.96\ m/s^2$

3. A box is initially at rest and being held on a ramp that makes an angle of 22 degrees above the horizontal. The box is then released. The coefficient of static friction is 0.42, and the coefficient of kinetic friction is 0.38. Determine the speed of the box 5 seconds after the box is released





$\Sigma F_y = N - W_y = ma$

$N - W\cos\theta = ma$

$N - mg\cos\theta = 0$

$N = mg\cos\theta$

$\Sigma F_x = W_x - F_f = ma$

$W\sin\theta - \mu N = ma$

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

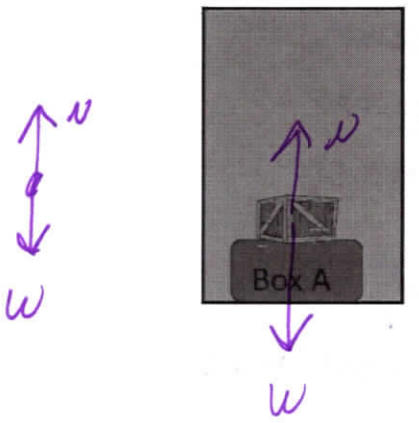
$g\sin\theta - \mu g\cos\theta = a$

$(9.8\,m/s^2)\sin(22^\circ) - (.42)(9.8\,m/s^2)(\cos 22) = a$

$-.145\,m/s^2 = a$

Box won't slide up due to friction... so $v = 0$

4. The 2 boxes shown below are in an elevator. "Box A" has a mass of 150Kg, and the wooden crate has a mass of 72kg. Determine the force exerted by "Box A" on to the wooden crate when the elevator accelerates upward at 1.3 m/s^2.



Crate => 72Kg
Box A = 150Kg

$\Sigma F_y = N - W = ma$

$N = ma + W$

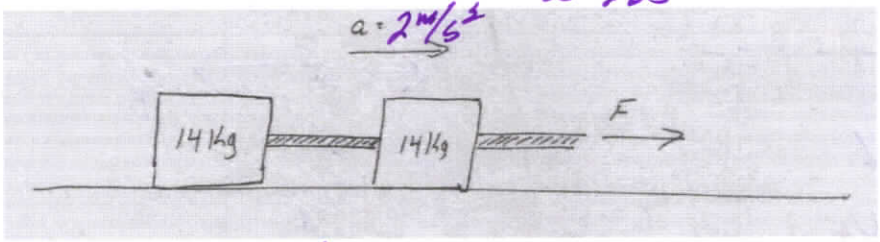
$N = ma + mg$

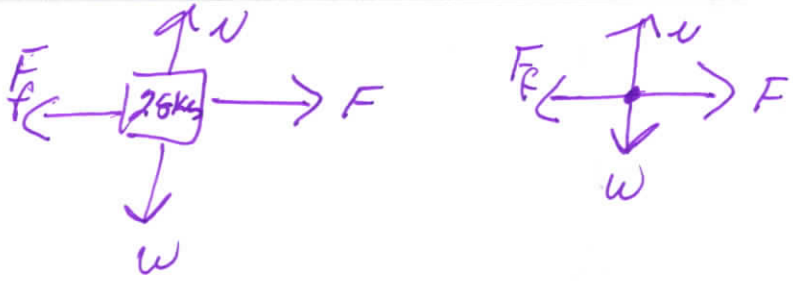
$N = m(a+g)$

$N = (72Kg)(1.3 m/s^2 + 9.8 m/s^2)$

$N = 799N$

5. Determine the force acting to the right (according to the diagram) if the boxes are accelerating at $2m/s^2$ to the right. The boxes have a coefficient of friction of 0.65 with the surface.





$\Sigma F_y = N - w = ma$

$N - w = 0$

$N = w$

$N = mg$

$\Sigma F_x = F - F_f = ma$

$F = ma + F_f$

$F = ma + \mu N$

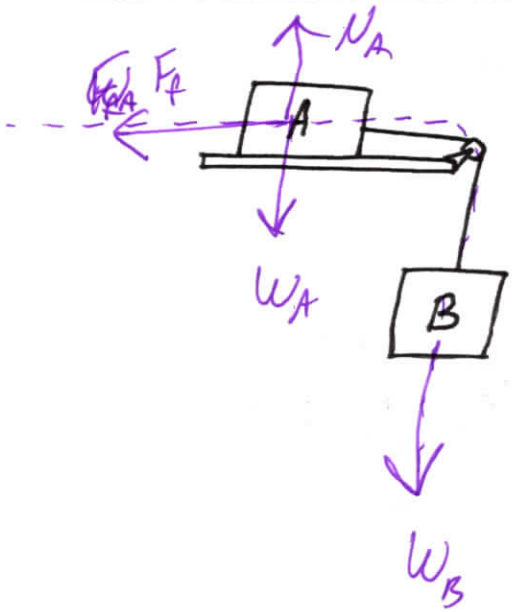
$F = ma + \mu mg$

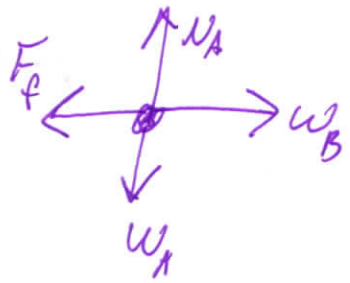
$F = m(a + \mu g)$

$F = (28kg)(2 m/s^2 + (.65)(9.8 m/s^2)$

$F = 234 N$

6. Determine the acceleration of the box on the table knowing both boxes have the same mass. The coefficient of friction between the table and the box on the table is 0.85.





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

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

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

$\Sigma F_y = N_A - W_A = 0$

$N_A = W_A$

$N_A = m_A g$

$m_A = m_B = m$

$mg - \mu mg = 2ma$

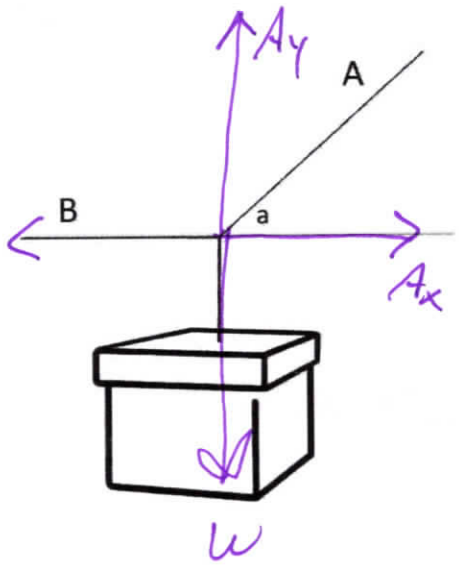
$g - \mu g = 2a$

$\frac{g - \mu g}{2} = a$

$\frac{g(1-\mu)}{2} = a$

$\frac{(9.8\ m/s^2)(1-.85)}{2} = a = .735\ m/s^2$

7. Determine the tension in both strings knowing the angle "a" is 40 degrees and the weight of the box is 225 N.



$\Sigma F_y : A_y - W = ma$

$A_y - W = 0$

$A\sin(a) = \cancel{mg}\, W$

$A = \frac{\cancel{mg}\, W}{\sin(a)} = \frac{225\,W}{\sin 40^\circ}$

$A: 350\,W$

$\Sigma F_x = A_x - B = 0$

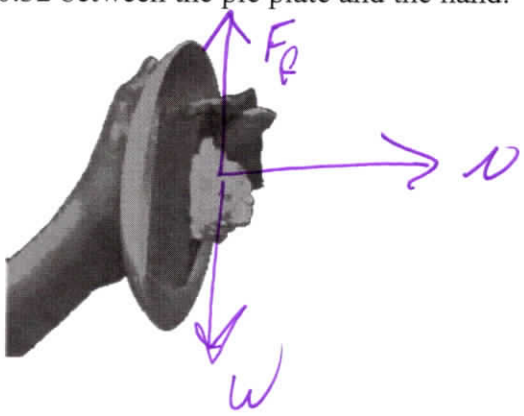
$A_x = B$

$A\cos(a) = B$

$(350\,W)\cos(40^\circ) = B$

$268\,W = B$

8. Determine the minimum acceleration (Think like the pie is being smashed in someone's face) for the pie to stay in the hand knowing there is a coefficient of friction of 0.32 between the pie plate and the hand.



$\Sigma F_y = F_f - W = ma$

$F_f - W = 0$

$\mu N - W = 0$

$\mu ma - W = 0$

$a = \frac{W}{\mu m} = \frac{mg}{\mu m} = \frac{g}{\mu} = \frac{9.8\ m/s^2}{.32} = 30.65\ m/s^2$

$\Sigma F_x = N = ma$

11:15 – 11:37

9. Determine the weight of a 12kg object.

$W = mg = (12\text{kg})(9.8\text{m/s}^2) = 117.6\text{N}$

Celebrate the test is done! Waffle time!