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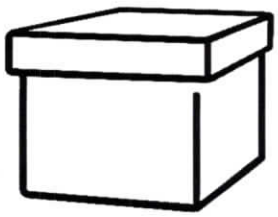
Key

Dynamics Test

FT Dynamics (20)

Directions: Solve the problems below. Each problem is worth 5 points; the test is worth 50 points. Consider each problem to be prompt for an essay. The essay you will write will be with the language of math!!! I need to be able to follow your work.

1) What is the mass of a 15 kg object?



15kg

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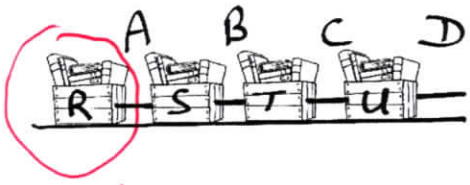
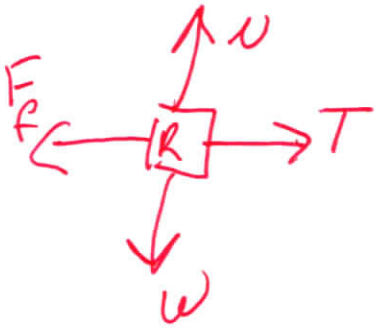
2) The 4 boxes shown are being accelerated to the right at 1.2 m/s^2. Each box has a mass of 8 kg and a coefficient of friction of 0.6. Determine the tension in string "A".





$\Sigma F_y = N - w = ma$

$N - w = 0$

$N = w$

$N = mg$

$\Sigma F_x = T - F_f = ma$

$T = ma + F_f$

$T = ma + \mu N$

$T = ma + \mu mg$

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

$T = (8\,kg)\left[1.2\,m/s^2 + (.6)(9.8\,m/s^2)\right]$

$T = 56.6\,N$

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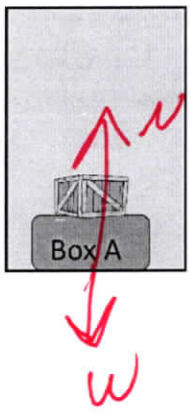
2) The 2 boxes shown (combined mass of 10 kg) are in an elevator accelerating downward at 2 m/s^2. Determine the force exerted on the boxes (at the bottom on Box A) by the floor. (*note* consider what force the floor would exert on the boxes if the elevator were not accelerating. Not a question to answer, just something to think about and to help you ensure your response makes sense)



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

$$N = ma + w$$

$$N = ma + mg$$

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

$$N = (10kg)(-2m/s^2 + 9.8m/s^2)$$

$$N = 78N$$

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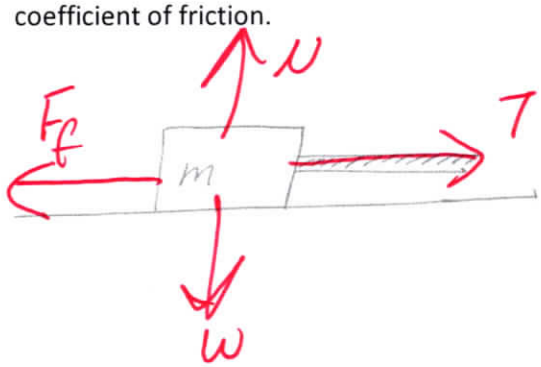
3) A 18kg box is being pulled, accelerating at $2m/s^2$ to the right with a force of 45N. Determine the coefficient of friction.



$\Sigma F_y = N - w = ma$

$N - w = 0$

$N = w$

$N = mg$

$\Sigma F_x = T - F_f = ma$

$T - ma = F_f$

$T - ma = \mu N$

$\frac{T - ma}{N} = \mu$

$\frac{45N - (18kg)(2m/s^2)}{(18kg)(9.8m/s^2)} = .05$

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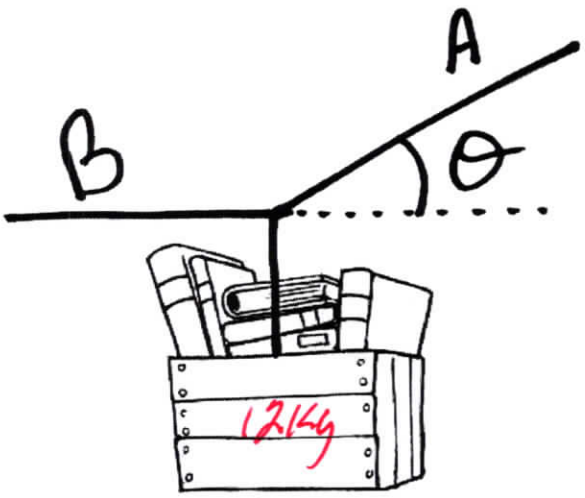
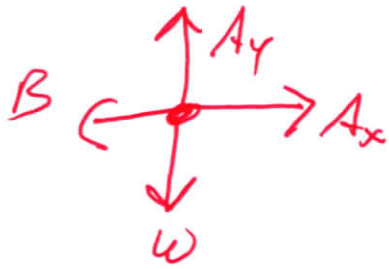
4) The box in the diagram below has a mass of 12 kg. The angle indicated is 45 degrees. Assume string "B" is in the negative x-direction, and the dotted line is in the positive X-direction. Find the tension in both string "A" and string "B".





$\Sigma F_x = A_x - B = 0$

$A_x = B$

$A\cos\theta = B$

$\Sigma F_y = A_y - w = 0$

$A_y = w$

$A_y = mg$

$A\sin\theta = mg$

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

$A = \frac{(12kg)(9.8 m/s^2)}{\sin(45°)}$

$A = 166.3N$

$(166.3N)\cos 45° = B$

$117.6N = B$

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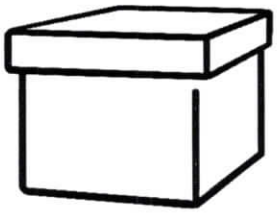
5) Determine the weight of a 2 kg object



$W = mg$

$W = (2\,kg)(9.8\,m/s^2)$

$W = 19.6\,N$

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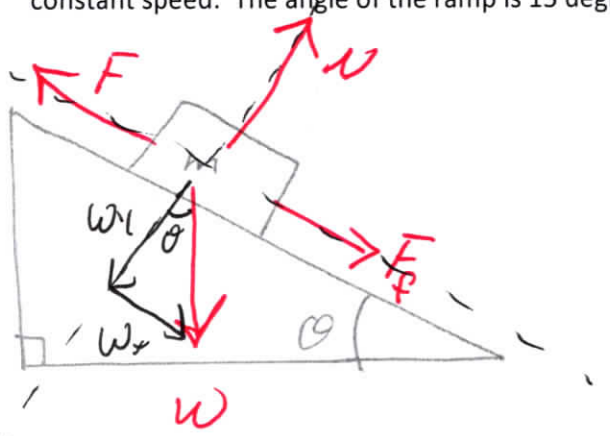
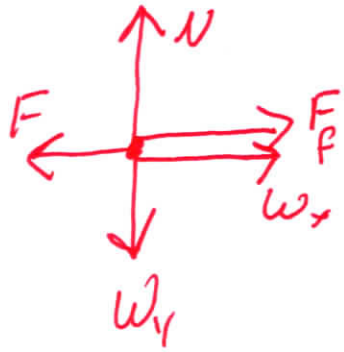
6) The box shown in the diagram has a mass of 12 kg. There is a coefficient of friction between the box and the incline of 0.34. Determine the force required to push the box up the ramp at a constant speed. The angle of the ramp is 15 degrees.





$\Sigma F_y = N - W_y = ma$

$N - W_y = 0$

$N - W\cos\theta = 0$

$N = mg\cos\theta$

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

$F_f + W_x - F = 0$

$\mu N + mg\sin\theta - F$

$\mu mg\cos\theta + mg\sin\theta = F$

$mg(\mu\cos\theta + \sin\theta) = F$

$(12kg)(9.8m/s^2)((.34)\cos(15^\circ) + \sin(15)) = F$

$69N = F$

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