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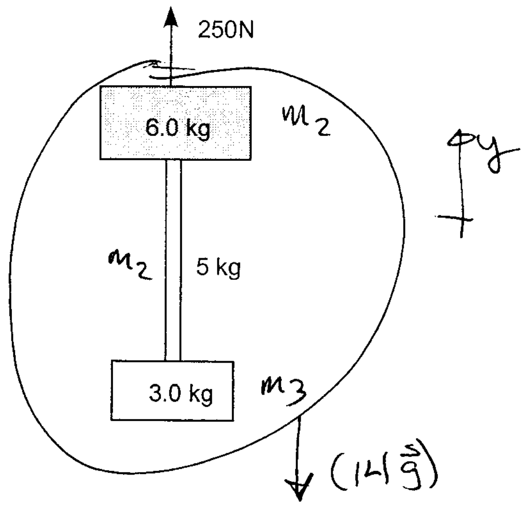
NAME: KEY

PHYSICS 4A
WINTER 2013
EXAM 2

PARTIAL CREDIT will be given so do what you can and make sure that you show all work for each problem. **No credit will be given if no work is shown**. The point value of each question is indicated. Express all answers in SI units.

1. The two blocks shown below are connected by a heavy uniform rope with a mass of 5.0 kg. An upward force of 250 N is applied as shown. (15 pts)



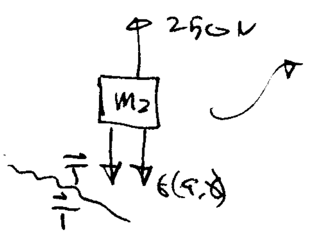
a) Find the acceleration of the masses.
b) Calculate the tension at the top of the rope.
c) Calculate the tension at the midpoint of the rope.

a) $m_1+m_2+m_3$

$\Sigma F_y = 250 - 14(9.8) = 14a$

$a = 8.1 \frac{m}{s^2}$

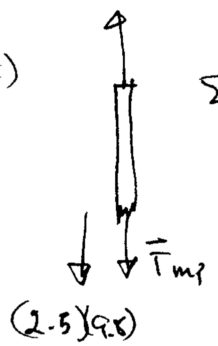
b) m_2



$\Sigma F_y = 250 - T - 6(9.8) = 6(8.1)$

$T = 143 N$

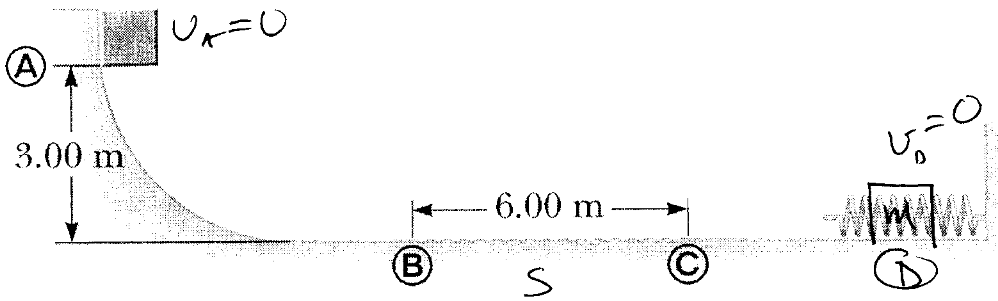
c)



$\Sigma F_y = T - T_{mp} - (2.5)(9.8) = (2.5)(8.1)$

$T_{mp} = 98.3 N$

2. A 10 kg block is released from rest at point A as shown below. The track is frictionless except for the portion between points B and C. The block travels down the track, hits a spring with spring constant 2275 N/m and compresses the spring 35 cm from equilibrium before coming to stop. **Use Work-Energy Methods** to calculate the coefficient of kinetic friction between the block and the rough surface between points B and C. **NO CREDIT** will be given if problem is solved any other method not discussed in class. (15 pts)



A → D

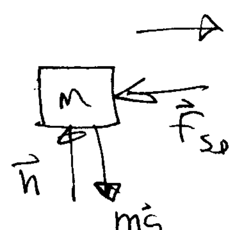
$\Delta K = -f_k S + W_{other}$

$0 = -\mu_k mgS + W_s + W_g$

$0 = -\mu_k mgS + \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2 + mgy_i - mgy_f$

$\mu_k mgS = mgy_i - \frac{1}{2}kx_f^2$

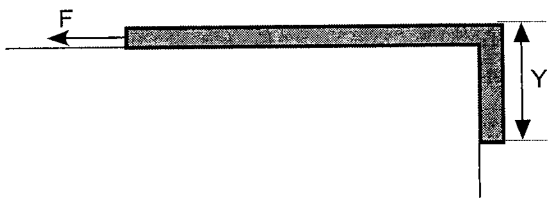
$$\mu_k = \frac{mgy_i - \frac{1}{2}kx_f^2}{mgS} = \boxed{0.26}$$



$W_g = \vec{F}_g \cdot \vec{S} = F_g S \cos\theta$

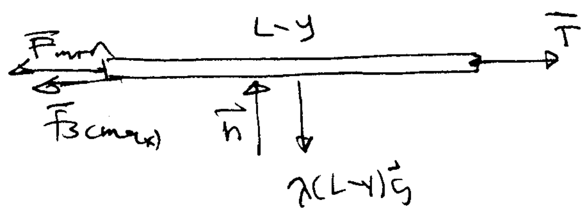
$= mgy_i - mgy_f$

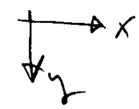
3. A uniform noodle with linear mass density $\lambda = \frac{M}{L}$ has an amount 'y' dangling over a table with coefficient of kinetic and static friction μ_k and μ_s respectively. (15 pts)



a) Assuming the noodle slides off the table-top if released from rest, find the minimum force F_{min} to keep noodle from sliding off the table.
b) If noodle is now released from rest, find the acceleration of the noodle.
c) If $\mu_k = 0$, find the work required to pull the hanging part back onto the table-top.

a)





$\Sigma F_x = T - F_{min} - f_{s(max)} = 0$

$F_{min} = T - f_{s(max)}$

$\Sigma F_y = \lambda y g - T = 0$

$T = \lambda y g$

$F_{min} = \lambda y g - \mu_s \lambda (L-y) g$

$$\boxed{F_{min} = \lambda g [y - \mu_s (L-y)]}$$

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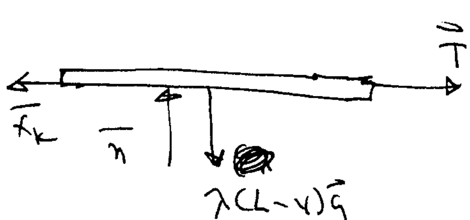
b) $F_{min} = 0$

$f_{s(max)} = f_k$



same.

$\Sigma F_y = \lambda y g - T = \lambda y a$

$\Sigma F_x = T - f_k = \lambda (L-y) a = \lambda L a - \lambda y a$

$\Sigma F_y = \lambda y g - T = \lambda y a$

$$\boxed{\lambda y g - \mu_k \lambda (L-y) g = \lambda L a}$$

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c) $w = \int \vec{F} \cdot d\vec{s} = \int \vec{T} \cdot d\vec{s} = \int_0^y \lambda y g \, dy$

$= \boxed{\frac{1}{2} \lambda g y^2} \Big|_0^y$

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