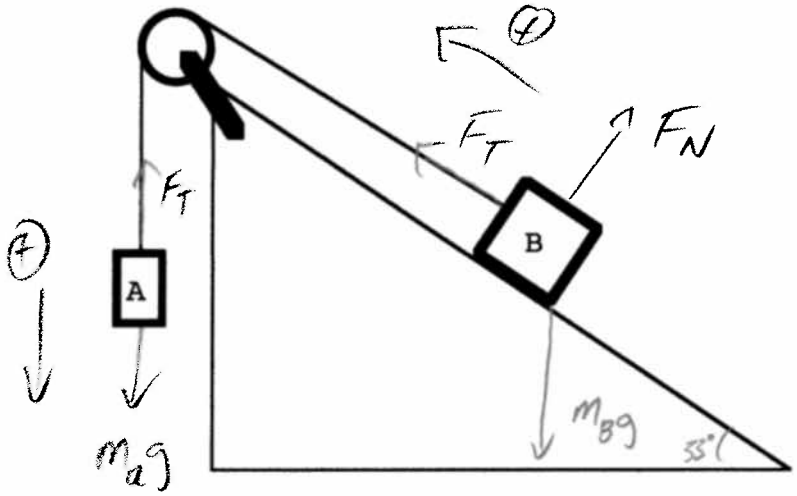
Physics 10154 - Exam #2c

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. (40 pts) A 15.0 kg mass A hangs vertically while a 13 kg attached mass B slides up a frictionless ramp inclined 33 degrees with respect to the horizontal as shown below. What is the tension in the string connecting the masses?



$\Sigma F_A : m_a g - F_T = m_a a$

$\Sigma F_{\parallel,B} : F_T - m_B g \sin 33^\circ = m_B a$

$F_T = m_a g - m_a a$

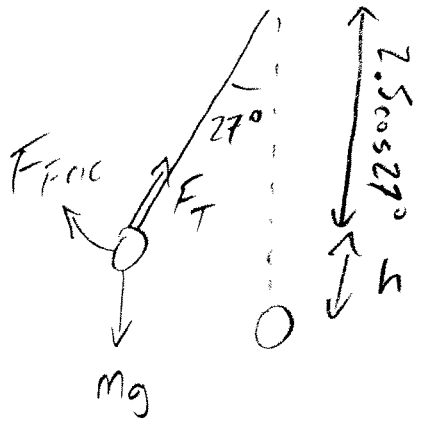
$m_a g - m_a a - m_B g \sin 33^\circ = m_B a$

$m_a g - m_B g \sin 33^\circ = (m_a + m_B) a$

$a = \frac{147 - 69.4}{28} = 2.77 \text{ m/s}^2$

$F_T = 147 - (15)(2.77) = 105.4$ or $\boxed{110 \text{ N}}$

2. (30 pts) A 7.0 kg pendulum bob is initially held at rest at an angle of 27° with respect to the vertical. The pendulum string is 2.5 meters long. As the pendulum bob passes through the lowest point in its motion, its speed is measured to be 3.8 m/s, how much energy was lost due to frictional forces during the motion?



$h = 2.5 - 2.5\cos 27°$

$= 0.2725$

should be 1.8

$\Sigma W_F = W_{grav} + W_T + W_{Fric} = \frac{1}{2}mv^2 - 0$

$W_{grav} = mgh = 18.7\ J$

$W_T = 0$

$W_{Fric} = ?$

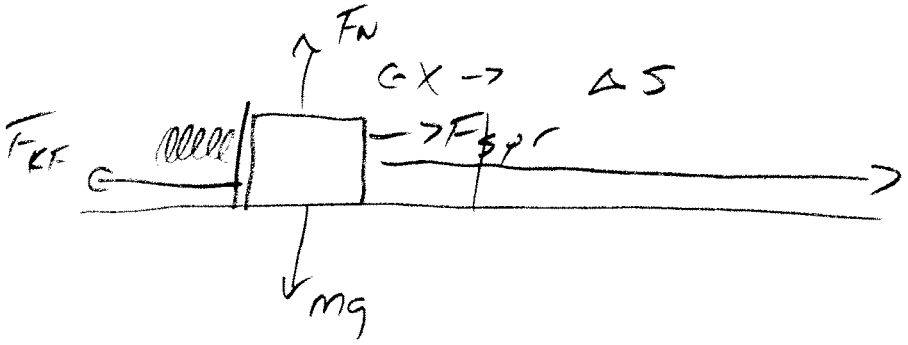
$\frac{1}{2}mv^2 = 50.54\ J$

so W_{Fric} is positive, which doesn't make sense

For $v = 1.8$, $\frac{1}{2}mv^2 = 11.3$

So $W_{Fric} = 11.3 - 18.7 = -7.4\ J$

3. (30 pts) A 3.0 kg block is initially at rest on a rough horizontal surface (coefficient of kinetic friction is 0.33). The block is pushed by a spring (k = 1500 N/m) that is initially compressed by 25 cm. Measured from the point of release, how far does the block slide across the surface before coming to rest?



$$\Sigma W_F = W_N + W_{grav} + W_{KF} + W_{spr} = \Delta K$$

$$0 \qquad 0$$

$$W_{KF} = -\mu_K F_N \Delta s = -\mu_k mg \Delta s$$

$$= -9.7 \Delta s$$

$$W_{spr} = \frac{1}{2} k x^2 = 46.88 \text{ J}$$

$$\Delta K = 0 - 0$$

$$-9.7 \Delta s + 46.88 = 0$$

$$\boxed{\Delta s = 4.8 \text{ m}}$$