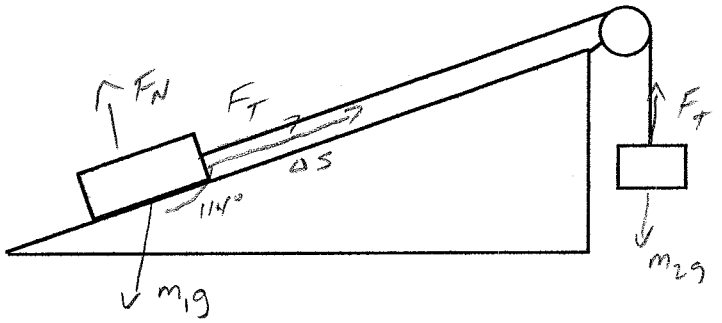
Phys 10154 - Fall 2006 - Exam #5A

Be sure to answer with the proper <u>units</u> and <u>significant figures</u>. Indicate your answers clearly with boxes. SHOW ALL WORK. Even if your answer is correct, I will deduct points if I can't see how you solved the problem. Both problems are worth 50 points.

1. A 12-kg mass is initially at rest on a 24° frictionless incline as shown below. It is connected by a massless string over a frictionless, massless pulley to a 6.5-kg hanging mass. The masses each move a distance of 1.5 meters (the 12-kg mass moves 1.5 meters up the ramp, and the 6.5-kg mass falls 1.5 meters).

What is the final speed of the 12-kg mass?



m_1: $W_N = 0$

$W_T = F_T \Delta s$

$W_g = m_1 g \Delta s \cos 114°$

m_2: $W_T = -F_T \Delta s$

$W_g = m_2 g \Delta s$

$\Sigma W = 0 + F_T \Delta s + m_1 g \Delta s \cos 114° - F_T \Delta s + m_2 g \Delta s = \Delta K$

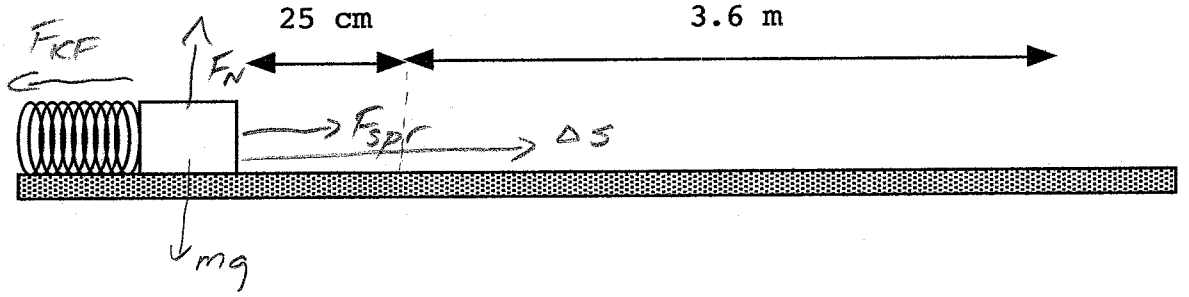
$-71.75 + 95.55 = \frac{1}{2}(m_1 + m_2)v^2 - 0$

$\frac{23.8}{\frac{1}{2}(12+6.5)} = v^2$

$v^2 = 2.57$ $\boxed{v = 1.6\ m/s}$

2. A 4.0-kg mass is held initially at rest on a spring compressed by 25 cm from its equilibrium position. The spring constant is 1200 N/m. After the block leaves the spring, it travels another 3.6 meters before coming to rest. All of the motion takes place on a rough tabletop.

Find the coefficient of kinetic friction of the tabletop.



$W_N = 0$

$W_g = 0$

$W_{spr} = \frac{1}{2}kx^2 = \frac{1}{2}(1200)(.25)^2 = 37.5\ J$

$W_{KF} = \mu_K F_N \Delta s \cos 180^\circ$

$= -\mu_K mg \Delta s = -\mu_K (4)(9.8)(3.85)$

$= -150.9\,\mu_K$

$0 + 0 + 37.5 - 150.9\,\mu_K = 0 - 0$

$37.5 = 150.9\,\mu_K$

$\mu_K = \frac{37.5}{150.9} = \boxed{0.25}$