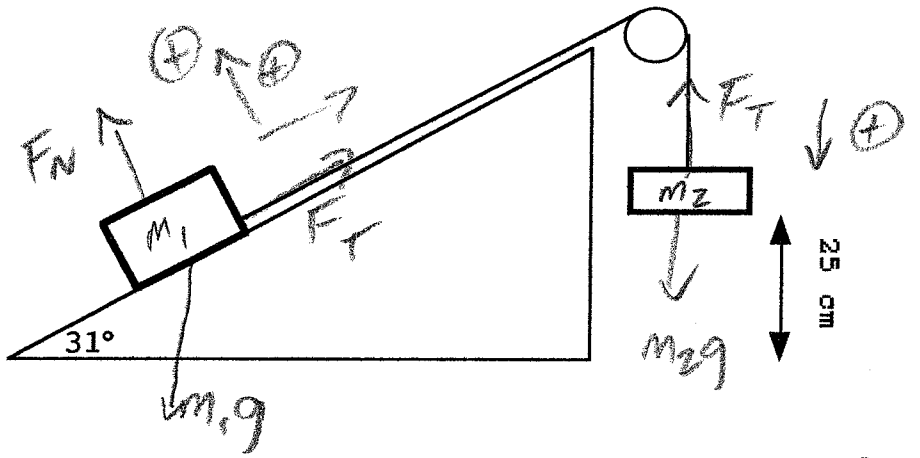
Phys 10154 - Fall 2006 - Exam #4B

Be sure to answer with the proper units and significant figures. 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. Two masses are connected by a frictionless pulley. The first mass (11 kg) is on a frictionless inclined plane as shown below. The second mass (6.5 kg) is hanging from the massless string that connects the two blocks. Assuming the system starts at rest with the second mass 25 cm above the floor...

What is the tension in the string?
How much time does it take for the 2nd mass to reach the floor?



$\Delta s = 0.25\,m$
$v_0 = 0$
$v = ?$
$a = 0.467$
$t = ?$

$0.25 = 0 + \frac{1}{2}(.467)t^2$

$t = \sqrt{\frac{.25}{.2335}} = \boxed{1.05}$

$m_1: \Sigma F_{\parallel} = F_T - m_1 g \sin 31^\circ = m_1 a$

$m_2: \Sigma F_y = m_2 g - F_T = m_2 a$

$F_T = m_2 g - m_2 a$

$m_2 g - m_2 a - m_1 g \sin 31^\circ = m_1 a$

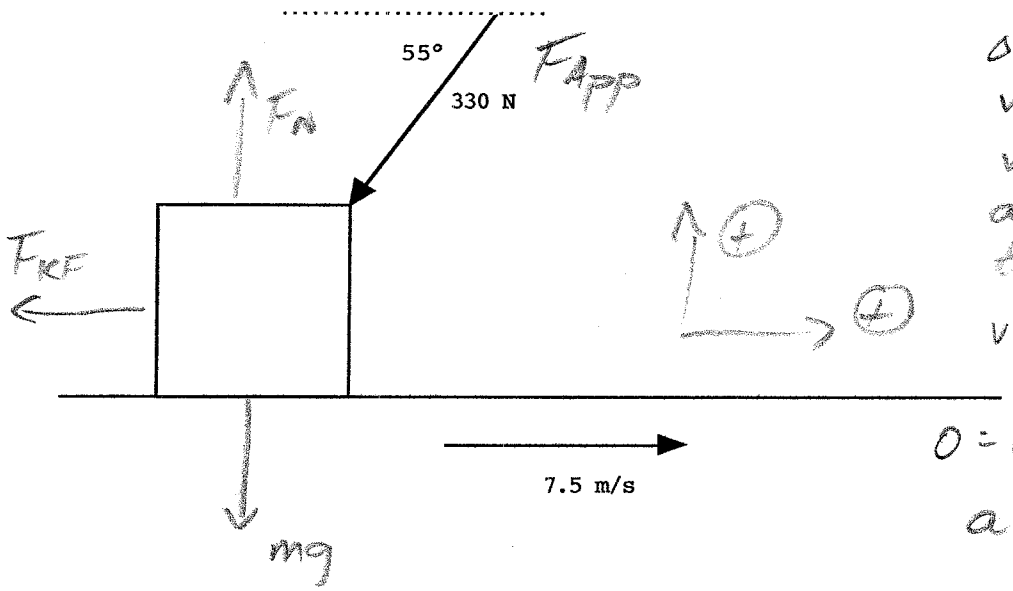
$m_2 g - m_1 g \sin 31^\circ = (m_1 + m_2) a$

$a = \frac{m_2 g - m_1 g \sin 31^\circ}{m_1 + m_2}$

$= \frac{63.7 - 55.5}{17.5} = 0.467\ m/s^2$

$F_T = m_2 g - m_2 a = 6.5(9.8 - 0.467) = \boxed{61\ N}$

2. A 450-N block is sliding across a rough floor with an initial speed of 7.5 m/s. In order to stop the block, an applied force of 330 N is directed at an angle of 55° below the horizontal as shown below. The block comes to rest after moving 4.5 meters. Calculate the coefficient of kinetic friction between the block and the floor.



$\Delta s = 4.5m$
$v_0 = 7.5$
$v = 0$
$a = ?$
$t = ?$

$v^2 = v_0^2 + 2a\Delta s$

$0 = (7.5)^2 + 2a(4.5)$

$a = \frac{-7.5^2}{9}$

$= -6.25\ m/s^2$

$\Sigma F_x = -F_{App}\cos 55^\circ - \mu_k F_N = ma$

$\Sigma F_y = F_N - F_{App}\sin 55^\circ - mg = 0$

$-F_{App}\cos 55^\circ - \mu_k (F_{App}\sin 55^\circ + mg) = ma$

$-189.3 - \mu_k (270.3 + 450) = 45.9a$

$-189.3 - \mu_k (720.3) = -286.9$

$\mu_k = \frac{286.9 - 189.3}{720.3}$

$= \boxed{0.14}$