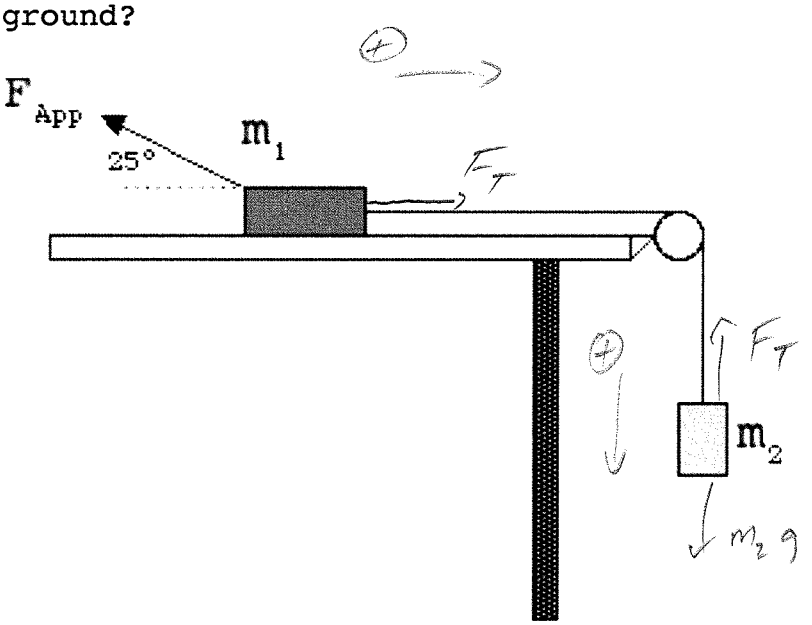
Physics 10154 - Exam #4D

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. Two massses (m_1 = 5.0 kg, m_2 = 7.0 kg) are connected by a massless string over a pulley as shown below. An applied force of 44 N acts on m_1 as shown. If m_2 starts from rest 1.0 meters above the ground, how long (in seconds) does it take to hit the ground?



$\Delta s = 1.0$

$v_0 = 0$

$v = ?$

$a = 2.4\ m/s^2$

$t = ?$

$\Sigma F_1 : F_T - F_{App}\cos 25^\circ = m_1 a$

$\Sigma F_2 : m_2 g - F_T = m_2 a$

$F_T = m_1 a + F_{App}\cos 25^\circ$

$m_2 g - m_1 a - F_{App}\cos 25^\circ = m_2 a$

$m_2 g - F_{App}\cos 25^\circ = (m_1 + m_2)a$

$68.6 - 39.9 = 12a \quad a = 2.4\ m/s^2$

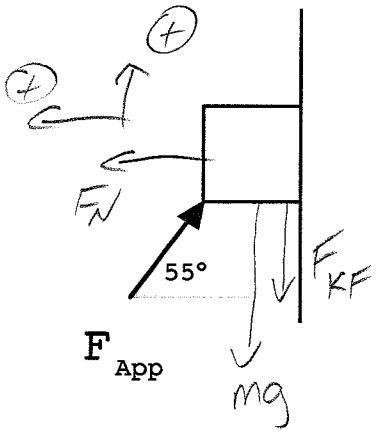
$1.0 = 0t + \frac{1}{2}(2.4)t^2 \Rightarrow 1.0 = 1.2t^2$

$t = 0.91\ s$

2. A 12-kg mass is sliding along a vertical wall with a constant velocity of 3.5 meters/sec upwards. An applied force of 180 N acts on the mass as shown.

What is the coefficient of kinetic friction between the block and the wall?

$a = 0$ due to constant velocity



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

$$\Sigma F_x = F_N - F_{App}\cos 55^\circ = 0$$

$$F_N = 180\cos 55^\circ = 103.2\ N$$

$$180\sin 55 - (12)(9.8) - \mu_k(103.2) = 0$$

$$147.4 - 117.6 = \mu_k(103.2)$$

$$\mu_k = \frac{147.4 - 117.6}{103.2}$$

$$= \boxed{0.29}$$