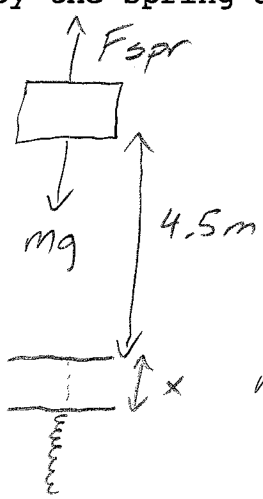
Phys 10154 - Fall 2006 - Exam #5B

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. A 13-kg box (initially at rest) falls from an initial height of 4.5 meters above the equilibrium point of a vertical spring (spring constant 2400 N/m). What is the maximum compression reached by the spring at which point the box comes to rest briefly?



$$W_{grav} = mg(4.5 + x)$$

$$W_{spr} = -\frac{1}{2}kx^2$$

$$mg(4.5 + x) - \frac{1}{2}kx^2 = 0 - 0$$

$$-\frac{1}{2}(2400)x^2 + 127.4x + 573.3 = 0$$

$$x = \frac{-127.4 \pm \sqrt{127.4^2 - 4(-1200)(573.3)}}{1200}$$

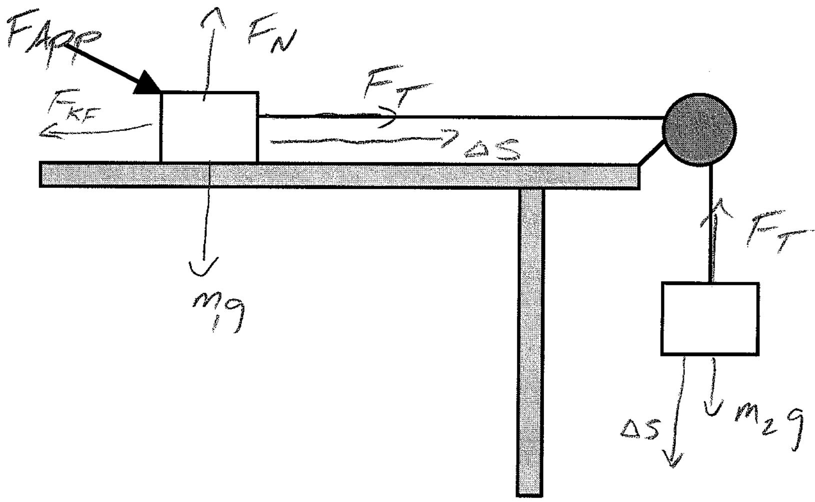
$$= -0.106 \pm 1.386$$

$$\boxed{x = 1.3 \text{ m}}$$

2. A 95-kg box is being pushed across a rough table by a 440-Newton applied force directed 22° below the horizontal. Attached to the mass on the table by a massless string is a 12-kg hanging block. The system moves at a constant velocity for 75 cm (with the mass on the table moving to the right and the hanging mass moving downward).

What is the work done by gravity in this problem?
What is the work done by the applied force?
What is the work done by the force of kinetic friction?

What is the coefficient of kinetic friction between the box and the table?



m_1: $W_N = 0$

$W_T = F_T \Delta S$

$W_g = 0$

$W_{App} = F_{App} \Delta S \cos 22^\circ$

m_2: $W_g = m_2 g \Delta S$

$W_T = -F_T \Delta S$

$W_{grav} = 0 + m_2 g \Delta S$

$= \boxed{88\ J}$

$W_{App} = (440)(.75)\cos 22^\circ$

$= \boxed{310\ J}$

$W_{KF} = -\mu_k(m_1 g + F_{App}\sin 22^\circ)\Delta S$

$= -821.8\,\mu_k$

$\Sigma W_F = 88 + 310 + F_T\Delta S - F_T \Delta S + W_{KF} = 0$ ← v = constant

$W_{KF} = -88 - 310 = \boxed{-400\ J}$

$-400 = -821.8\,\mu_k$ $\boxed{\mu_k = 0.49}$