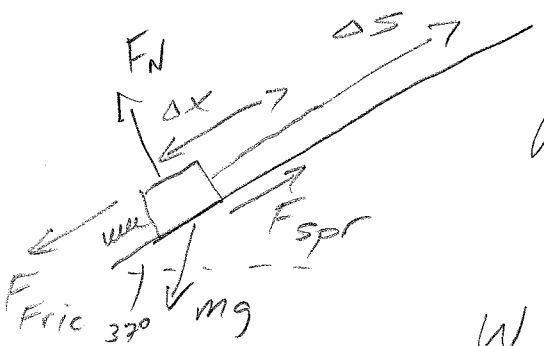
Physics 10154 - Exam #5C

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. A 4.5-kg mass is resting against a compressed spring with a spring constant of 1200 N/m. The spring is compressed by a length of 45 cm. The apparatus is at rest on a long wooden board inclined at 37° above the horizontal.

The spring is released, propelling the mass up the ramp. If the coefficient of kinetic friction between block and ramp is 0.33, how far up the ramp does the block travel before stopping? Keep in mind that friction also acts on the block while it is on the spring.



$W_N = 0$

$W_{spr} = \frac{1}{2} k \Delta x^2$

$= \frac{1}{2}(1200)(.45)^2 = 121.5\,J$

$W_{grav} = mg\,\Delta s \cos 127°$

$= -26.5\,\Delta s$

$W_{Fric} = -\mu_k F_N \Delta s$

$= -(.33)(mg \cos 37°)\Delta s$

$= -11.6\,\Delta s$

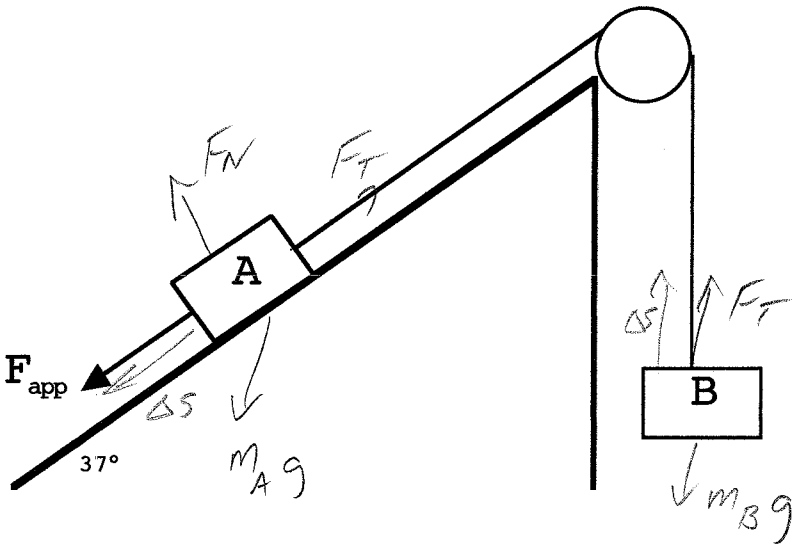
$121.5 - 26.5\Delta s - 11.6\Delta s = 0 - 0$

$121.5 = 38.1\Delta s$

$\boxed{\Delta s = 3.2\,m \text{ total}}$

(2.7 m from end of spring)

2. Two masses are connected by a massless, frictionless pulley and string as shown below. Mass A is 35 kg. Mass B is 55 kg. An applied force of 750 Newtons is pulling mass A down the frictionless ramp. After mass A has moved, starting from rest, a distance of 1.2 meters, what is its speed?



M_A : $W_N = 0$

$W_{App} = (750)(1.2)\cos 0° = 900\ J$

$W_{grav} = (35)(9.8)(1.2)\cos 53° = 248\ J$

$W_T = -F_T \Delta s$

M_B : $W_{grav} = (55)(9.8)(1.2)\cos 180° = -647\ J$

$W_T = F_T \Delta s$

$0 + 900 + 248 - F_T \Delta s - 647 + F_T \Delta s = \frac{1}{2}(M_A + M_B)v^2 - 0$

$501 = \frac{1}{2}(90)v^2$

$v = 3.3\ m/s$