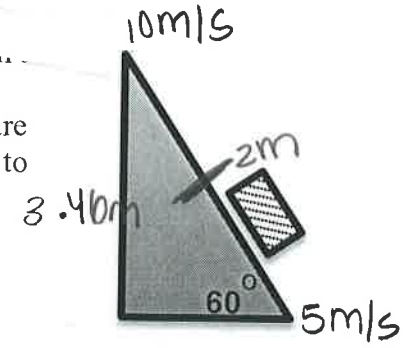
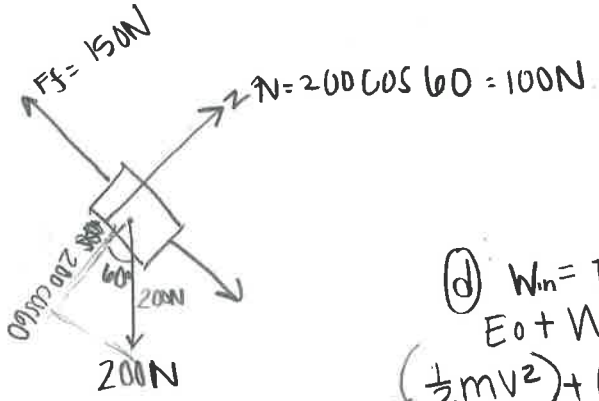
Physics F14 MT2 retake, question #2, Nov. 18, 2014 Nar

3. (15 pts) Your job is to slow boxes down as they move down a 60° incline as shown right. Boxes (m = 20 kg) start at a speed of 10 m/s at the top of a 4m incline. The coefficient of friction of 1.5 between the boxes and ramp help you slow them. You are touching the boxes only for the last 2 m of their trip down the incline and your job is to make sure they are only moving 5 m/s by the time they get to the bottom.



a) Find the force of friction.
b) How much heat is liberated in this process?
c) What is the change of potential energy of the system?
d) How much work should I do on each box?
e) What is the force that I need to push with? Include direction.

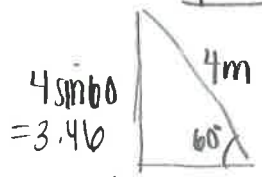
$m = 20\,kg$
$d = 4m$
$V_0 = 10\,m/s$
$\theta = 60°$
$\mu = 1.5$
$V_f = 5\,m/s$



(a) $F_f = \mu N$
$= (1.5)(100N) = \boxed{150N}$ ✓

(b) $Q = W_f = F_f \Delta x$
$= (150N)(2m) = \boxed{300J}$
$(150N)(4m) = \boxed{600J}$ ✓

(c) $\Delta PE = mgh$
$= (20kg)(10m/s^2)(-3.46m)$ ✓
$= \boxed{-692.8J}$



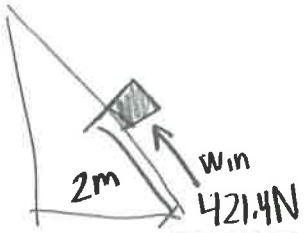
$KE_0 + PE_0 + W_{in} = KE_f + PE_f + W_{out}$
$W_{out} = W_f$

(d) $W_{in} = Fd$
$E_0 + W_{in} = E_F + W_{out}$
$(\frac{1}{2}mv^2) + (mgh) + W_{in} = \frac{1}{2}mv^2 + (mgh) + Q$
Fd
$[(\frac{1}{2}\cdot 20kg)(10m/s)^2] + [(20kg)(10m/s^2)(3.46m)] + Fd =$
$[\frac{1}{2}\,20kg(5m/s)^2] + [600J]$

$1692.8J + W_{in} = 850J$
$\boxed{W_{in} = -842.8J}$

(e) $W_{in} = Fd$
$-842.8J = F(2m)$
$\boxed{F = -421.4N}$

nice!!



Your Statements:

... and have not received any information about