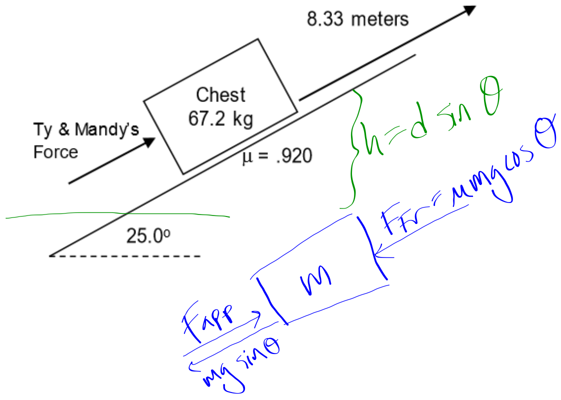
1. Mandy Lifeboats and Ty Dalwaive are walking on a beach when they see a treasure chest. They push the 67.2-kg chest up the beach (which makes an angle of 25.0° with the horizontal). The coefficient of kinetic friction between the beach sand and the chest is .920. If they push the treasure chest at a constant velocity for 8.33 meters,
   a) What work do Mandy and Ty do on the chest? $h_0 = \emptyset$
   b) Why is it important that they push *parallel* to the surface of the beach (the incline)?



$$ⓐ\ \cancel{\tfrac{1}{2}mv_0^2} + \cancel{mgh_0} + \cancel{\tfrac{1}{2}kx_0^2} + W_{NC} = \cancel{\tfrac{1}{2}mv^2} + mgh + \cancel{\tfrac{1}{2}kx^2}$$

not $\emptyset$ ... but equal!
(constant v)

$$W_{NC} = mgh$$

$$W_{app} + W_{Fr} = mgh$$

+ (increasing KE)

− (decreasing KE)

Don't need W_g; it's built in to CLEE

$$W_{app} = mgh + W_{Fr} = mgh + \overbrace{\mu mg\cos\theta}^{F_{Fr}} \cdot d$$

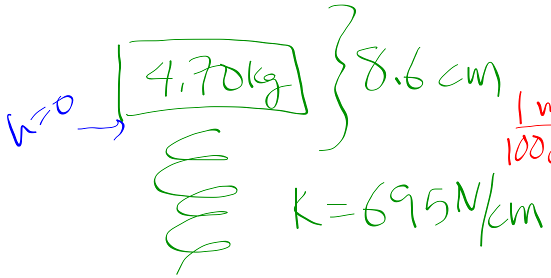
$$= (67.2)(9.8)(8.33\sin 25) + (0.920)(67.2)(9.8)(\cos 25)(8.33)$$

$$W_{app} = 2318.4 + 4574.08$$
$$= 6892.5\text{ J}$$

2. Suddenly the chest pops open. Inside is a spring (k= 695 N/cm) that is compressed by 8.60 cm with a 4.70-kg book resting on it. Mandy accidentally triggers the spring's release mechanism.

a) How high (above the book's original position) will the text go after the spring is released? $v=0$; $h=55.8\,m$

b) What will the book's maximum upward speed be? $h=8.6\,cm = 0.086\,m$



$$\frac{1}{2}kx_0^2 = \frac{1}{2}mv^2 + mgh$$

$$\frac{1\,m}{100\,cm} \cdot \quad \frac{1}{2}(695)(8.6)^2 = (4.7)(9.8)h$$

$$2570\,J = (4.7)(9.8)h$$

$$h = 55.8\,m$$

$$2570\,J = \frac{1}{2}(4.7)v^2 + (4.7)(9.8)(0.086)$$

$$v = 33.05\,m/s$$

EPE of spring

$$695\,N/cm \cdot \frac{100\,cm}{m} = 695000\,N/m$$

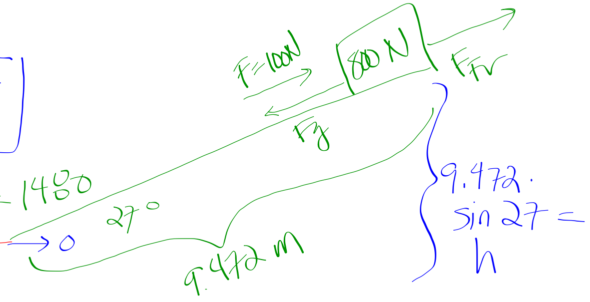
$$8.6\,cm \cdot \frac{1\,m}{100\,cm} = 0.086\,m$$

$$\frac{1}{2}kx^2 = \frac{1}{2}(695000)(0.086)^2 = 2570\,J$$

3. You are sitting upon a 27° incline that is 9.472 meters long and you weigh 800 N. Because it is a very slippery surface, the coefficient of kinetic friction is a mere 0.15. There is a flat surface at the bottom of the incline that also has a coefficient of kinetic friction of 0.15. Your friend is pushing you with a constant 100 N force that is parallel to both surfaces the entire way. How far do you travel along the flat surface?

$$mgh + \underbrace{W_F + W_{Fr}}_{\text{on ramp}} = \boxed{\tfrac{1}{2}mv^2}$$

$$-947.2 \quad -1012.8 \quad = 1480 \rightarrow 0$$



$$\tfrac{1}{2}mv_0^2 + \underbrace{W_F + W_{Fr}}_{\text{on flat}} = 0$$

So...

$$mgh + \underbrace{W_F + W_{Fr}}_{\text{on ramp}} + \underbrace{W_F + W_{Fr}}_{\text{on flat}} = 0$$

$(800)(9.472)(\sin 27)$ +	GPE (initial)	
$-(100)(9.472)$ +	Work done by friend	on ramp
$-(800)(9.472)(\cos 27)(0.15)$ +	Work done by friction	on ramp
$-(100)d$ +	Work done by friend	on flat
$-(800)(d)(0.15)$	Work done by friction	on flat

$$3440 + -947.2 + -1012.8 + -100d + -120d = 0$$

$$-220d = -1480; \quad d = 6.73\,\text{m}$$