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Date: _____

Section _____

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The Masters School
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Physics

Mechanical Energy and Friction

1. A skier starts from rest at the top of a hill that is inclined at 10.5° with the horizontal. The hillside is 200 m long, and the coefficient of friction between the snow and the skis is .0750. At the bottom of the hill, the snow is level and the coefficient of friction is unchanged. How far does the skier move along the horizontal portion of the snow before coming to rest?

$ME_i - W_{\text{friction}} = ME_f$
 $PE_{\text{grav},i} + KE_i - W_{\text{friction}} = PE_f + KE_f$
 $PE_{\text{grav},i} - W_{\text{friction}} = 0$
 $PE_{\text{grav},i} = W_{\text{friction}}$

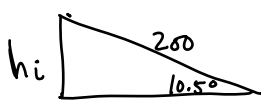
(but $W_{\text{friction}1} \neq W_{\text{friction}2}$, so)

$PE_{\text{grav},i} = W_{\text{friction}1} + W_{\text{friction}2}$
 $mgh_i = F_1 d_1 + F_2 d_2$

$F_k = F_f$
 $\mu_k = .075$
 $d_2 = ?$

 $m = ?$ $d_1 = 200$ $d_2 = ?$

Main question

 $h_i = 36.45 \text{ m}$ 

$$h_i = (200)(\sin 10.5)$$

$$h_i = 36.45 \text{ m}$$

① Find F_1

$$F_{\text{net}y} = F_N - F_{gy} = 0$$

$$F_N = F_{gy} = mg \cos \theta$$

$$\mu_k = \frac{F_k}{F_N}$$

$$F_k = \mu_k F_N$$

$$F_k = \mu_k mg \cos \theta = F_1$$

② Find F_2

$$F_{\text{net}y} = F_N - F_g = 0$$

$$F_N = F_g = mg$$

$$\mu_k = \frac{F_k}{F_N}$$

$$F_k = \mu_k F_N$$

$$F_k = \mu_k mg = F_2$$

$$mgh_i = F_1 d_1 + F_2 d_2$$

$$mg(36.45) = (\mu_k mg \cos \theta)(200) + (\mu_k mg) d_2$$

$$\frac{36.45 - (\mu_k \cos \theta)(200)}{\mu_k} = d_2$$

$$d_2 = \frac{36.45 - 14.75}{.075}$$

$$d_2 = \frac{21.7}{.075}$$

$$d_2 = 289.3 \text{ m}$$