

59. Since the valley is frictionless, the only reason for the speed being less when it reaches the higher level is the gain in potential energy $\Delta U = mgh$ where $h = 1.1$ m. Sliding along the rough surface of the higher level, the block finally stops since its remaining kinetic energy has turned to thermal energy

$$\Delta E_{\text{th}} = f_k d = \mu mgd$$

where $\mu = 0.60$. Thus, Eq. 8-31 (with $W = 0$) provides us with an equation to solve for the distance d :

$$K_i = \Delta U + \Delta E_{\text{th}} = mg(h + \mu d)$$

where $K_i = \frac{1}{2}mv_i^2$ and $v_i = 6.0$ m/s. Dividing by mass and rearranging, we obtain

$$d = \frac{v_i^2}{2\mu g} - \frac{h}{\mu} = 1.2 \text{ m} .$$