A 65.3-kg skier coasts up a snow-covered hill that makes an angle of 35.0 ° with the horizontal. The initial speed of the skier is 9.64 m/s. After coasting a distance of 2.37 m up the slope, the speed of the skier is 4.00 m/s. (a) Find the work done by the kinetic frictional force that acts on the skis. (b) What is the magnitude of the kinetic frictional force?

Solution

(a)

Use energy equation:

Let U (potential energy) be 0 at the bottom of the hill and be of the form $m * g * h$ elsewhere, K is kinetic energy.

So $(K + U)_1 + W_{friction} = (K + U)_2$

or

$W_{friction} = K_2 + U_2 - K_1 - U_1 = \frac{1}{2} * m * v_2^2 + m * g * d * \sin(\theta) - \frac{1}{2} * m * v_1^2.$

$W_{friction} = \frac{1}{2} * 65.3 * 4.00^2 + 65.3 * 9.80 * 2.37 * \sin 35.0\,^\circ - \frac{1}{2} * 65.3 * 9.64^2 = -1642\ J.$

(Negative because it removes energy from the system)

(b) Now $W_{friction} = F * d$, so

$F = \frac{W_{friction}}{d} = \frac{1642}{2.37} = 693\ N.$

Answer: (a) $-1642\ J$; (b) $693\ N$.