Answer on Question #70577-Physics-Mechanics-Relativity

A 73.5-kg person, running horizontally with a velocity of +4.66 m/s, jumps onto a 17.4-kg sled that is initially at rest. (a) Ignoring the effects of friction during the collision, find the velocity of the sled and person as they move away. (b) The sled and person coast 30.0 m on level snow before coming to rest. What is the coefficient of kinetic friction between the sled and the snow?

Solution

(a) From the conservation of momentum:

$$Mv_i = (m + M)v_f$$

The velocity of the sled and person as they move away is

$$v_f = \frac{Mv_i}{(m + M)} = (4.66)\frac{73.5}{17.4 + 73.5} = 3.77\frac{m}{s}.$$

(b)

From the conservation of energy:

$$\frac{(m + M)v_f^2}{2} = \mu g(m + M)l$$

The coefficient of kinetic friction between the sled and the snow is

$$\mu = \frac{v_f^2}{2gl} = \frac{(3.77)^2}{2(9.81)(30)} = 0.0241.$$

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