

Chapter 18 Problem 59 †

Given

$$m_{ice} = 6.3 \text{ g}$$

$$m_{rock} = 8.5 \text{ kg}$$

Solution

Find the height from which the rock was dropped.

The system begins and ends with all of the objects at 0°C . We then assume that all of the potential energy of the falling rock is converted into thermal energy which in turn melts the ice. The energy required to melt the ice is

$$Q = m_{ice}L_f = (6.3 \text{ g})(334 \text{ J/g}) = 2104 \text{ J}$$

The potential energy of the rock is

$$E_{Pot.} = mgh$$

Solving for the height gives

$$h = \frac{E_{Pot.}}{mg} = \frac{2104 \text{ J}}{(8.5 \text{ kg})(9.8 \text{ m/s}^2)} = 25.3 \text{ m}$$

†Problem from Essential University Physics, Wolfson