KINETIC ENERGY

$$KE = \frac{1}{2}mv^2$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times (\text{speed})^2$$

Kinetic energy is a scalar quantity, and the SI unit for kinetic energy (and all other forms of energy) is the joule. Recall that a joule is also used as the basic unit for work.

Kinetic energy depends on both an object's speed and its mass. If a bowling ball and a volleyball are traveling at the same speed, which do you think has more kinetic energy? You may think that because they are moving with identical speeds they have exactly the same kinetic energy. However, the bowling ball has more kinetic energy than the volleyball traveling at the same speed because the bowling ball has more mass than the volleyball.

SAMPLE PROBLEM B

Kinetic Energy

PROBLEM

A 7.00 kg bowling ball moves at 3.00 m/s. How fast must a 2.45 g table-tennis ball move in order to have the same kinetic energy as the bowling ball? Is this speed reasonable for a table-tennis ball in play?

SOLUTION

Given: The subscripts b and t indicate the bowling ball and the table-tennis ball, respectively.

$m_b = 7.00 \text{ kg} \qquad m_t = 2.45 \text{ g} \qquad v_b = 3.00 \text{ m/s}$

Unknown: $v_t = ?$

First, calculate the kinetic energy of the bowling ball.

$$KE_b = \frac{1}{2}m_b v_b^2 = \frac{1}{2}(7.00 \text{ kg})(3.00 \text{ m/s})^2 = 31.5 \text{ J}$$

Then, solve for the speed of the table-tennis ball having the same kinetic energy as the bowling ball.

$$KE_t = \frac{1}{2}m_t v_t^2 = KE_b = 31.5 \text{ J}$$

$$v_t = \sqrt{\frac{2KE_b}{m_t}} = \sqrt{\frac{(2)(31.5 \text{ J})}{2.45 \times 10^{-3} \text{ kg}}}$$

$$\boxed{v_t = 1.60 \times 10^2 \text{ m/s}}$$

This speed would be very fast for a table-tennis ball.