PRACTICE E

Perfectly Inelastic Collisions

1. A 1500 kg car traveling at 15.0 m/s to the south collides with a 4500 kg truck that is initially at rest at a stoplight. The car and truck stick together and move together after the collision. What is the final velocity of the two-vehicle mass?
2. A grocery shopper tosses a 9.0 kg bag of rice into a stationary 18.0 kg grocery cart. The bag hits the cart with a horizontal speed of 5.5 m/s toward the front of the cart. What is the final speed of the cart and bag?
3. A 1.50×10^4 kg railroad car moving at 7.00 m/s to the north collides with and sticks to another railroad car of the same mass that is moving in the same direction at 1.50 m/s. What is the velocity of the joined cars after the collision?
4. A dry cleaner throws a 22 kg bag of laundry onto a stationary 9.0 kg cart. The cart and laundry bag begin moving at 3.0 m/s to the right. Find the velocity of the laundry bag before the collision.
5. A 47.4 kg student runs down the sidewalk and jumps with a horizontal speed of 4.20 m/s onto a stationary skateboard. The student and skateboard move down the sidewalk with a speed of 3.95 m/s. Find the following:
   a. the mass of the skateboard
   b. how fast the student would have to jump to have a final speed of 5.00 m/s

Kinetic energy is not conserved in inelastic collisions

In an inelastic collision, the total kinetic energy does not remain constant when the objects collide and stick together. Some of the kinetic energy is converted to sound energy and internal energy as the objects deform during the collision.

This phenomenon helps make sense of the special use of the words *elastic* and *inelastic* in physics. We normally think of *elastic* as referring to something that always returns to, or keeps, its original shape. In physics, an elastic material is one in which the work done to deform the material during a collision is equal to the work the material does to return to its original shape. During a collision, some of the work done on an *inelastic* material is converted to other forms of energy, such as heat and sound.

The decrease in the total kinetic energy during an inelastic collision can be calculated by using the formula for kinetic energy, as shown in Sample Problem F. It is important to remember that not all of the initial kinetic energy is necessarily lost in a perfectly inelastic collision.