PRACTICE F

Kinetic Energy in Perfectly Inelastic Collisions

1. A 0.25 kg arrow with a velocity of 12 m/s to the west strikes and pierces the center of a 6.8 kg target.
   a. What is the final velocity of the combined mass?
   b. What is the decrease in kinetic energy during the collision?
2. During practice, a student kicks a 0.40 kg soccer ball with a velocity of 8.5 m/s to the south into a 0.15 kg bucket lying on its side. The bucket travels with the ball after the collision.
   a. What is the final velocity of the combined mass?
   b. What is the decrease in kinetic energy during the collision?
3. A 56 kg ice skater traveling at 4.0 m/s to the north meets and joins hands with a 65 kg skater traveling at 12.0 m/s in the opposite direction. Without rotating, the two skaters continue skating together with joined hands.
   a. What is the final velocity of the two skaters?
   b. What is the decrease in kinetic energy during the collision?

ELASTIC COLLISIONS

elastic collision

a collision in which the total momentum and the total kinetic energy are conserved

When a player kicks a soccer ball, the collision between the ball and the player's foot is much closer to elastic than the collisions we have studied so far. In this case, *elastic* means that the ball and the player's foot remain separate after the collision.

In an **elastic collision,** two objects collide and return to their original shapes with no loss of total kinetic energy. After the collision, the two objects move separately. In an elastic collision, both the total momentum and the total kinetic energy are conserved.

Most collisions are neither elastic nor perfectly inelastic

In the everyday world, most collisions are not perfectly inelastic. That is, colliding objects do not usually stick together and continue to move as one object. Most collisions are not elastic, either. Even *nearly* elastic collisions, such as those between billiard balls or between a football player's foot and the ball, result in some decrease in kinetic energy. For example, a football deforms when it is kicked. During this deformation, some of the kinetic energy is converted to internal elastic potential energy. In most collisions, some of the kinetic energy is also converted into sound, such as the click of billiard balls colliding. In fact, any collision that produces sound is not elastic; the sound signifies a decrease in kinetic energy.

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