

SECTION 3

Elastic and Inelastic Collisions

SECTION OBJECTIVES

- Identify different types of collisions.
- Determine the changes in kinetic energy during perfectly inelastic collisions.
- Compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions.
- Find the final velocity of an object in perfectly inelastic and elastic collisions.

perfectly inelastic collision

a collision in which two objects stick together after colliding

COLLISIONS

As you go about your day-to-day activities, you probably witness many collisions without really thinking about them. In some collisions, two objects collide and stick together so that they travel together after the impact. An example of this action is a collision between football players during a tackle, as shown in **Figure 10**. In an isolated system, the two football players would both move together after the collision with a momentum equal to the sum of their *momenta* (plural of *momentum*) before the collision. In other collisions, such as a collision between a tennis racquet and a tennis ball, two objects collide and bounce so that they move away with two different velocities.

The total momentum remains constant in any type of collision. However, the total kinetic energy is generally not conserved in a collision because some kinetic energy is converted to internal energy when the objects deform. In this section, we will examine different types of collisions and determine whether kinetic energy is conserved in each type. We will primarily explore two extreme types of collisions: elastic and perfectly inelastic collisions.

Perfectly inelastic collisions can be analyzed in terms of momentum

When two objects, such as the two football players, collide and move together as one mass, the collision is called a **perfectly inelastic collision**. Likewise, if a meteorite collides head on with Earth, it becomes buried in Earth and the collision is perfectly inelastic.



Figure 10

When one football player tackles another, they both continue to fall together. This is one familiar example of a perfectly inelastic collision.