CHAPTER 4 Highlights

KEY TERMS

force (p. 120)

inertia (p. 125)

net force (p. 126)

equilibrium (p. 129)

weight (p. 135)

normal force (p. 135)

static friction (p. 136)

kinetic friction (p. 137)

coefficient of friction (p. 138)

PROBLEM SOLVING

See **Appendix D: Equations** for a summary of the equations introduced in this chapter. If you need more problem-solving practice, see **Appendix I: Additional Problems.**

KEY IDEAS

Section 1 Changes in Motion

- Force is a vector quantity that causes acceleration (when unbalanced).
- Force can act either through the physical contact of two objects (contact force) or at a distance (field force).
- A free-body diagram shows only the forces that act on one object. These forces are the only ones that affect the motion of that object.

Section 2 Newton's First Law

- The tendency of an object not to accelerate is called *inertia*. Mass is the physical quantity used to measure inertia.
- The net force acting on an object is the vector sum of all external forces acting on the object. An object is in a state of equilibrium when the net force acting on the object is zero.

Section 3 Newton's Second and Third Laws

- The net force acting on an object is equal to the product of the object's mass and the object's acceleration.
- When two bodies exert force on each other, the forces are equal in magnitude and opposite in direction. These forces are called an action-reaction pair. Forces always exist in such pairs.

Section 4 Everyday Forces

- The weight of an object is the magnitude of the gravitational force on the object and is equal to the object's mass times the acceleration due to gravity.
- A normal force is a force that acts on an object in a direction perpendicular to the surface of contact.
- Friction is a resistive force that acts in a direction opposite to the direction of the relative motion of two contacting surfaces. The force of friction between two surfaces is proportional to the normal force.

Variable Symbols

Quantities	Units	Conversions
F (vector) force	N newtons	$= \text{kg} \bullet \text{m/s}^2$
F (scalar)		
μ coefficient of friction	(no units)	