Answer Key

1.2

REINFORCING KEY CONCEPTS

1. a. The black ball has three times the speed of the gray ball because it moved three times the distance in the same amount of time.

   b. The black ball has a speed of 3 m/1 s = 3 m/s; the gray ball has a speed of 1 m/1 s = 1 m/s.

2. Fact b represents velocity because it describes the animal's direction (vertical) as well as its speed (97.2 m/s). Facts a and c represent speeds because no direction is given.

Answer Key

1.3

REINFORCING KEY CONCEPTS

1. yes; yes; yes; no
2. $A = \frac{15\ \text{m/s} - 30\ \text{m/s}}{5\ \text{s}} = \frac{-15\ \text{m/s}}{5\ \text{s}}$
   $= -3\ \text{m/s}^2$

Answer Key

2.1

REINFORCING KEY CONCEPTS

1. a. Answers should show an understanding of the way contact forces affect motion. Sample answer: writing: your pen applies a contact force as you press it against the paper, and the paper applies a contact force on the pen.

   b. Answers should show an understanding of the way gravity affects motion. Sample answer: riding a bicycle on the road; Earth's gravity is pulling the bicycle, holding it to the ground.

   c. Answers should show an understanding of the way friction affects motion. Sample answer: applying the brakes to slow a bicycle down; the friction between the brakes and the wheel causes the bicycle to slow down.

2. The child in the swing should be labeled with a blue box. The child getting ready to push should be labeled with a red arrow.

Answer Key

2.2

REINFORCING KEY CONCEPTS

1. Students will use the formula $F = ma$. Acceleration = 0.5 m/s^2
2. The centripetal force is the pull from the rope that ties the ball to the pole. The accelerating force is the force from the child's hand.

Answer Key

2.3

REINFORCING KEY CONCEPTS

1. The diver jumping on the diving board produces a downward force on the board. The board applies an equal and opposite force back on the diver, pushing the diver up.
2. a. The net force on an object is equal to its acceleration times its mass. If the child pushes the merry-go-round harder, it will spin faster.

   b. An object that is at rest, will stay at rest unless it is acted upon by an unbalanced force. The croquet ball will not move until it is hit by the mallet.

   c. If one object exerts a force on another object, the second object exerts a force of equal strength in the opposite direction. The force on the air rushing out of the balloon is matched by the force on the balloon moving it in the opposite direction.

Answer Key

2. A

REINFORCING KEY CONCEPTS

1. The mass of ball A is greater than the mass of ball B.
2. The two objects will bounce off each other, and the object with less mass will move farther than the object with more mass.
3. a. Most of the force goes into changing the motion of the two cars. Each car continues to travel separately after the collision, and the total momentum after the collision is the same as it was before the collision.

   b. When the two test cars collide, the total momentum of the two cars moving together is the same as the momentum of the moving car before it collided with the stationary car.
4. When the rocket is launched, the action force of the air (and water) as it rushes out the rocket's base creates an equal and opposite reaction force, propelling the rocket upward.

Answer Key

3.1

REINFORCING KEY CONCEPTS

1. Gravity is greater if the masses are greater. If the distance between masses increases, gravitational force decreases. Gravity is considered universal because the force exists between any two masses in the universe.
2. Sample answer: At boy—If an object has a great enough horizontal velocity, it will fall around Earth instead of to the ground. At one force/velocity arrow pair—The force of gravity is pulling the object toward the center of Earth. At the orbit line—As the object falls, it moves forward fast enough so that it curves around Earth.

Answer Key

3.2

REINFORCING KEY CONCEPTS

1. Answers should include pictures of people moving objects or sports activities such as hockey or running.
2. a. Before the parachute was opened, the force of gravity was greater than or equal to the force of air resistance.

   b. After the parachute opened, the force of air resistance increased, decreasing the skydiver's velocity. Air resistance arrow should point up and be longer than downward-pointing gravity arrow.