# Section 12.3 Newton's Third Law of Motion and Momentum
(pages 372–377)

This section describes action-reaction forces and how the momentum of objects is determined.

Reading Strategy (page 372)

Summarizing As you read about momentum in this section, complete the concept map to organize what you learn. For more information on this Reading Strategy, see the **Reading and Study Skills** in the **Skills and Reference Handbook** at the end of your textbook.

Momentum

is measured in — kg•m/s

is calculated by multiplying — Mass — Velocity
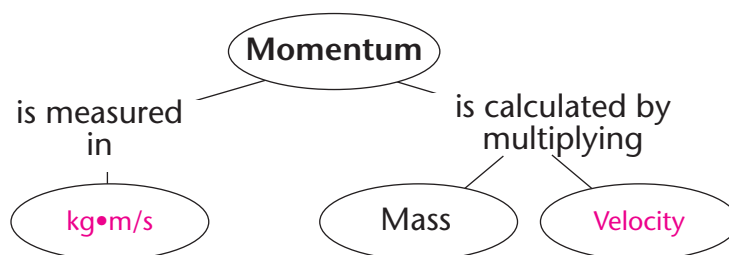
Newton's Third Law (page 373)

1. According to Newton's third law of motion, whenever one object exerts a force on a second object, the second object exerts _____ on the first object. Circle the best answer.

   a. an equal force

   b. an opposite force

   c. an equal and opposite force

2. Circle the letters that identify each sentence that is true about action-reaction forces.

   a. All action-reaction forces produce motion.

   b. Forces always exist in pairs.

   c. Action-reaction forces never cancel.

Momentum (pages 374–375)

3. Circle the letter of each factor that affects the momentum of a moving object.

   a. mass

   b. volume

   c. velocity

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4. Is the following sentence true or false? An object with a small mass can have a large momentum if the object is traveling at a high speed.

   _____true_____

5. Circle the letter of the object that has the greatest momentum.

   a. a 700-gram bird flying at a velocity of 2.5 m/s

   b. a 40-kilogram shopping cart rolling along at 0.5 m/s

   (c.) a 300-kilogram roller coaster car traveling at 25 m/s

Conservation of Momentum (pages 376–377)

6. Is the following sentence true or false? Objects within a closed system can exert forces on one another, but other objects and forces cannot

   leave or enter the system. _____true_____

7. According to the law of conservation of momentum, what happens to the total momentum of a system if no net force acts on the system? Circle the letter of the correct answer.

   (a.) The total momentum does not change.

   b. The total momentum decreases.

   c. The total momentum increases.

8. Is the following sentence true or false? In a closed system with two objects, the loss of momentum of one object equals the gain in

   momentum of the other object. _____true_____

For questions 9 and 10, refer to the graph below.

Momentum of a 0.25-kg Ball
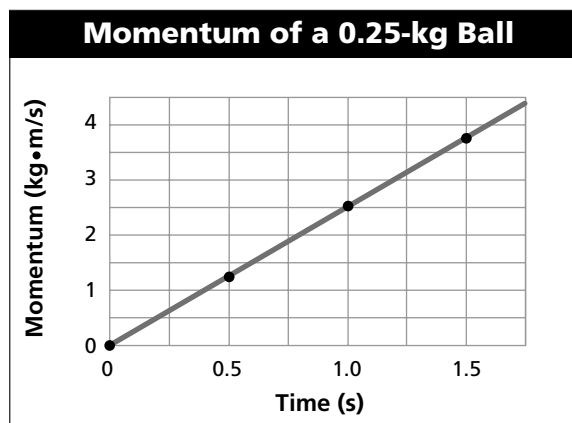
9. The momentum of the ball at 1 second is ____2.5 kg•m/s____.

10. What is the speed of the ball at 0.5 seconds? Show your calculation. Use the momentum formula, momentum = mass × velocity.

    $1.25 \text{ kg•m/s} = 0.25 \text{ kg} \times \text{Velocity; Velocity} = \dfrac{1.25 \text{ kg•m/s}}{0.25 \text{ kg}} = 5 \text{ m/s}$