

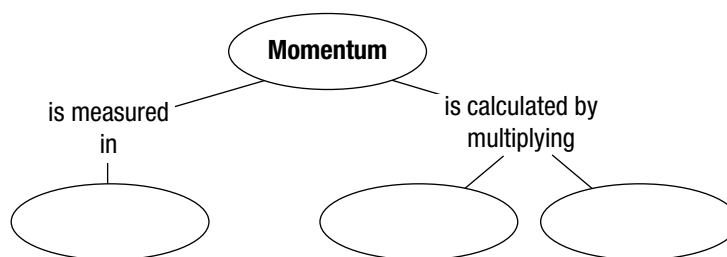
## Chapter 12 Forces and Motion

**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.

**Newton's Third Law (page 373)**

1. According to Newton's third law of motion, what happens whenever one object exerts a force on a second object? \_\_\_\_\_  
\_\_\_\_\_
2. The equal and opposite forces described by Newton's third law are called \_\_\_\_\_ and \_\_\_\_\_ forces.
3. Circle the letters that identify each sentence that is true about action-reaction forces.
  - a. Newton's second law describes action-reaction forces.
  - b. Forces always exist in pairs.
  - c. Action-reaction forces never cancel.
  - d. All action-reaction forces produce motion.
4. Is the following statement true or false? Action-reaction forces do not cancel each other because the action force is always greater than the reaction force. \_\_\_\_\_

**Momentum (pages 374–375)**

5. Circle the letter of each factor that affects the momentum of a moving object.
  - a. mass
  - b. volume
  - c. shape
  - d. velocity
6. If two identical objects are moving at different velocities, the object that is moving faster will have \_\_\_\_\_ momentum.

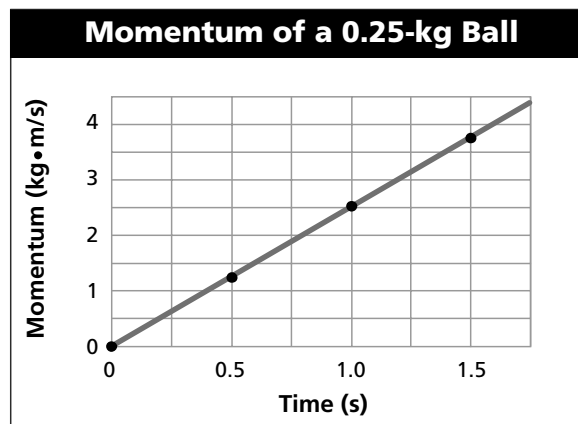
**Chapter 12 Forces and Motion**

7. Your in-line skates are sitting in a box on a shelf in the closet. What is their momentum? \_\_\_\_\_
8. 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. \_\_\_\_\_
9. Write the momentum formula, including the correct units.  
\_\_\_\_\_
10. 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 1000-kilogram car traveling at 5 m/s
  - c. a 40-kilogram shopping cart rolling along at 0.5 m/s
  - d. a 300-kilogram roller coaster car traveling at 25 m/s

**Conservation of Momentum (pages 376–377)**

11. What does conservation of momentum mean? \_\_\_\_\_  
\_\_\_\_\_
12. 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. \_\_\_\_\_
13. 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?  
\_\_\_\_\_
14. 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. \_\_\_\_\_

For questions 15 and 16, refer to the graph below.



15. The momentum of the ball at one second is \_\_\_\_\_.
16. What is the speed of the ball at 0.5 seconds? Show your calculation. *Hint:* Solve the momentum formula for velocity.