

**Chapter 8 Momentum**

**Exercises**

**8.1 Momentum (page 125)**

1. Define momentum. \_\_\_\_\_
2. What is the equation for momentum? \_\_\_\_\_
3. A moving object can have a large momentum if it has a(n) \_\_\_\_\_, a(n) \_\_\_\_\_, or both.

**8.2 Impulse Changes Momentum (pages 125–129)**

4. Is the following sentence true or false? If the momentum of an object changes, either the mass or the velocity or both change.  
\_\_\_\_\_
5. If a force is increased on an object, what happens to the velocity and the momentum?  
\_\_\_\_\_
6. The change in momentum depends on the \_\_\_\_\_ that acts and the length of \_\_\_\_\_ it acts.
7. What is the short-hand notation for impulse? \_\_\_\_\_
8. What is the formula that relates impulse and change in momentum?  
\_\_\_\_\_
9. Explain why a baseball player follows through with his or her swing.  
\_\_\_\_\_  
\_\_\_\_\_
10. Is the following sentence true or false? By hitting a soft object, such as a haystack, instead of a hard object, such as a concrete wall, you extend the contact time in which the momentum is brought to zero.  
\_\_\_\_\_
11. Circle the letter of each sentence that is true about impulse and momentum.
  - a. When jumping from an elevated position down to the ground, you should keep your legs stiff to decrease the momentum.
  - b. A wrestler thrown to the floor should extend his time hitting the mat by relaxing his muscles and spreading the impulse to his foot, knee, hip, ribs, and shoulder.
  - c. When a boxer gets punched, she should move her head away from the punch to increase the contact time and reduce the force.
  - d. A dropped dish is more likely to survive a fall on carpet rather than concrete, because the softness of the carpet leads to increased contact time.

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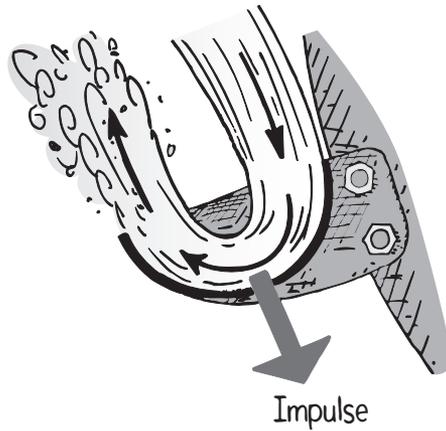
**8.3 Bouncing (pages 129–130)**

12. Is the following sentence true or false? The impulse required to bring an object to a stop and then to “throw it back again” is less than the impulse merely to bring the object to a stop. \_\_\_\_\_
13. Explain how a person practicing karate can break bricks with his or her bare hand.

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14. Use the diagram of the Pelton Wheel above to explain how the blades work.

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**8.4 Conservation of Momentum (pages 130–131)**

*Match each phrase with another phrase that makes the statement true.*

- |   |  |
|---|--|
| _____ 15. If you wish to change the momentum of an object,              | a. no change in momentum is possible.                      |
| _____ 16. The force or impulse must be exerted on the object            | b. exert an impulse on it.                                 |
| _____ 17. If no outside force is present,                               | c. and opposite to the force causing the cannon to recoil. |
| _____ 18. The force on the cannonball inside the cannon barrel is equal | d. by something outside the object.                        |

19. Explain why the total momentum of a cannon–cannonball system is zero after firing.

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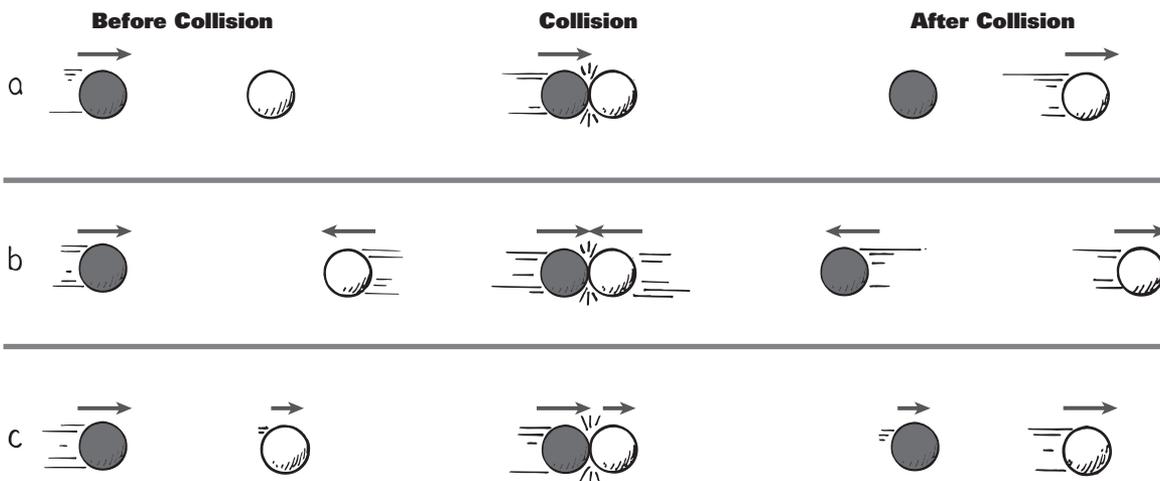
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- 20. Is momentum a vector or a scalar quantity? \_\_\_\_\_
- 21. Is the following sentence true or false? The law of conservation of momentum states that, in the absence of an external force, the momentum of a system remains unchanged. \_\_\_\_\_
- 22. Is the following sentence true or false? If a system undergoes changes wherein all the forces are internal, such as an atomic nuclei undergoing nuclear decay, the net momentum of the system before and after the event is the same. \_\_\_\_\_

**8.5 Collisions (pages 132–134)**

- 23. Is the following sentence true or false? Whenever objects collide in the absence of external forces, the net momentum of both objects before the collision does not equal the net momentum of both objects after the collision. \_\_\_\_\_
- 24. When objects collide without being permanently deformed and without generating heat, the collision is said to be a(n) \_\_\_\_\_.
- 25. Describe how the velocities of each of the billiard balls changes in the elastic collisions below.



a. \_\_\_\_\_  
 \_\_\_\_\_

b. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

c. \_\_\_\_\_  
 \_\_\_\_\_

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26. A collision in which the colliding objects become distorted and generate heat during the collision is a(n) \_\_\_\_\_.
27. What is the equation for the conservation of momentum?  
\_\_\_\_\_
28. Since there is no air resistance in space, what is the only opposing force that affects two docking space stations? \_\_\_\_\_
29. What is an example of a perfectly elastic collision at the microscopic level?  
\_\_\_\_\_

### 8.6 Momentum Vectors (pages 135–136)

30. Is this sentence true or false? Momentum is conserved only when interacting objects move along the same straight path.  
\_\_\_\_\_
31. Circle the letter of each sentence that is true.
- a. The vector sum of the momenta is the same before and after a collision.
  - b. The momentum of the car wreck is not equal to the vector sum of the momenta of car A and car B before the collision.
  - c. When a firecracker bursts, the vector sum of the momenta of its fragments add up to the firecracker's momentum just before bursting.
  - d. Momentum is not conserved for high-speed elementary particles in bubble chambers.
32. What two conservation laws are the most powerful tools in the study of mechanics?  
\_\_\_\_\_