

## Sample Test - Impulse and Momentum

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

- What are the SI units for momentum?  
a.  $\text{N}\cdot\text{m}$                       b. J                      c.  $\text{kg}\cdot\text{m}/\text{s}$                       d.  $\text{kg}\cdot\text{m}/\text{s}^2$
- A person sitting in a chair with wheels stands up, causing the chair to roll backward across the floor. The momentum of the chair  
a. was zero while stationary and increased when the person stood.  
b. was greatest while the person sat in the chair.  
c. remained the same.  
d. was zero when the person got out of the chair and increased while the person sat.
- Which of the following equations can be used to directly calculate the change in an object's momentum?  
a.  $\mathbf{p} = m\mathbf{v}$                       b.  $\mathbf{p} = \frac{m}{v}$                       c.  $\mathbf{p} = \mathbf{F}\Delta t$                       d.  $\Delta\mathbf{p} = \mathbf{F}\Delta t$
- If a force is exerted on an object, which statement is true?  
a. A large force always produces a large change in the object's momentum.  
b. A large force produces a large change in the object's momentum only if the force is applied over a very short time interval.  
c. A small force applied over a long time interval can produce a large change in the object's momentum.  
d. A small force always produces a large change in the object's momentum.
- A ball with a momentum of  $4.0 \text{ kg}\cdot\text{m}/\text{s}$  hits a wall and bounces straight back without losing any kinetic energy. What is the change in the ball's momentum?  
a.  $-8.0 \text{ kg}\cdot\text{m}/\text{s}$                       b.  $-4.0 \text{ kg}\cdot\text{m}/\text{s}$                       c.  $0.0 \text{ kg}\cdot\text{m}/\text{s}$                       d.  $8.0 \text{ kg}\cdot\text{m}/\text{s}$
- The impulse experienced by a body is equivalent to the body's change in  
a. velocity.                      b. kinetic energy.                      c. momentum.                      d. force.
- A 20 kg shopping cart moving at a velocity of 0.5 m/s collides with a store wall and stops. The momentum of the shopping cart  
a. increases.                      c. remains the same.  
b. decreases.                      d. is conserved.
- Two objects with different masses collide and bounce back after an elastic collision. Before the collision, the two objects were moving at velocities equal in magnitude but opposite in direction. After the collision,  
a. the less massive object had gained momentum.  
b. the more massive object had gained momentum.  
c. both objects had the same momentum.  
d. both objects lost momentum.
- A soccer ball collides with another soccer ball at rest. The total momentum of the balls  
a. is zero.                      b. increases.                      c. remains constant.                      d. decreases.
- Two objects stick together and move with a common velocity after colliding. Identify the type of collision.  
a. elastic                      b. nearly elastic                      c. inelastic                      d. perfectly inelastic
- Two skaters stand facing each other. One skater's mass is 60 kg, and the other's mass is 72 kg. If the skaters push away from each other without spinning,  
a. the lighter skater has less momentum.

- b. their momenta are equal but opposite.
  - c. their total momentum doubles.
  - d. their total momentum decreases.
12. The law of conservation of momentum states that
- a. the total initial momentum of all objects interacting with one another usually equals the total final momentum.
  - b. the total initial momentum of all objects interacting with one another does not equal the total final momentum.
  - c. the total momentum of all objects interacting with one another is zero.
  - d. the total momentum of all objects interacting with one another remains constant regardless of the nature of the forces between the objects.
13. In an inelastic collision between two objects with unequal masses,
- a. the total momentum of the system will increase.
  - b. the total momentum of the system will decrease.
  - c. the kinetic energy of one object will increase by the amount that the kinetic energy of the other object decreases.
  - d. the momentum of one object will increase by the amount that the momentum of the other object decreases.
14. A billiard ball collides with a stationary identical billiard ball in an elastic head-on collision. After the collision, which of the following is true of the first ball?
- a. It maintains its initial velocity.
  - b. It has one-half its initial velocity.
  - c. It comes to rest.
  - d. It moves in the opposite direction.
15. A billiard ball collides with a second identical ball in an elastic head-on collision. What is the kinetic energy of the system after the collision compared with the kinetic energy before the collision?
- a. unchanged
  - b. one-fourth as great
  - c. two times as great
  - d. four times as great

### Problem

16. A pool cue strikes a 0.16 kg billiard ball with a force of 15 N. The cue remains in contact with the ball for 0.085 s. The ball was initially at rest. What is the final speed of the ball?
17. A player at first base catches a throw traveling 22 m/s. The baseball, which has a mass of 0.21 kg, comes to a complete stop in the glove after 0.15 s. Assuming the force of the glove was uniform, what force did the glove exert on the ball?
18. A 65.0 kg ice-skater standing on frictionless ice throws a 0.15 kg snowball horizontally at a speed of 32.0 m/s. At what speed does the skater move backward?
19. A diver with a mass of 80.0 kg jumps from a dock into a 130.0 kg boat at rest on the west side of the dock. If the velocity of the diver in the air is 4.10 m/s to the west, what is the final velocity of the diver after landing in the boat?
20. A 15 g marble moves to the right at 3.6 m/s and makes an elastic head-on collision with a 22 g marble. The final velocity of the 15 g marble is 5.4 m/s to the left, and the final velocity of the 22 g marble is 2.0 m/s to the right. What was the initial velocity of the 22 g marble?