Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Chapter 9 Momentum and Its Conservation

Multiple Choice

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

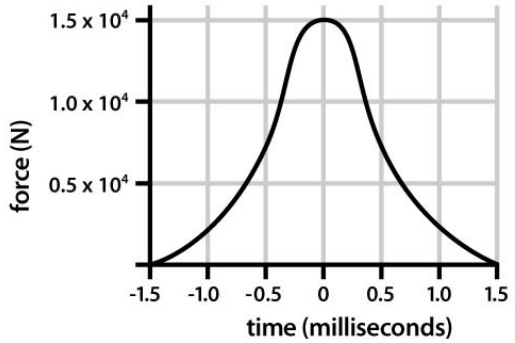
____ 1. What is the correct definition of momentum, **p** =
   a. m**a**
   b. m$\mathbf{v}^2$
   c. m**v**
   d. mc^2

____ 2. Which conditions will result in the smallest change in momentum?
   a. a large force over a long time period
   b. a large force over a short time period
   c. a small force over a long time period
   d. a small force over a short time period

____ 3. A rocket leaves a launch pad at liftoff with a great deal of upward momentum. What was initially given downward momentum?
   a. the launch pad
   b. the astronauts aboard the rocket
   c. the expelled fuel
   d. the entire Earth

____ 4. Analyze the collision of a baseball with a bat. During which portion of the collision does the baseball's velocity reach zero?
   a. before the collision
   b. during the collision
   c. one second after the collision
   d. one-hundredth of a second after the collision

____ 5. Analyze the graph. Which quantity is equal to the impulse?



   a. time of collision
   b. distance along curve
   c. slope of the curve
   d. area under the curve

Problem

6. A 6110-kg bus traveling at 20.0 m/s can be stopped in 24.0 s by gently applying the brakes. If the driver slams on the brakes, the bus stops in 3.90 s. What is the average force exerted on the bus in both these stops?

7. A 0.140-kg baseball is pitched horizontally at 36.7 m/s. When a player hits the ball, it moves at the same speed, but in the opposite direction. If the bat and the ball are in contact for 0.450 ms, calculate the average force the bat exerts on the ball.

8. Candona strikes a 0.055-kg golf ball with a force of 260 N. If the ball moves with a velocity of 65 m/s, calculate the time the ball is in contact with the club.
9. A force of 200 N acts on a 7.20-kg bowling ball for 0.350 s. Calculate its change in velocity.
10. The moment of inertia of an asteroid rotating about its own axis is 5.00×10^4 kg·m^2. Its angular velocity is 40.0 rad/s. If a force acts on the asteroid for 0.100 s, increasing the angular velocity to 48.0 rad/s, find its magnitude.
11. A toy car X of mass 0.200 kg moves along a frictionless surface with a velocity of 0.180 m/s. It collides with another toy car Y, with a mass of 0.250 kg and a speed of 0.130 m/s in the same direction. After the collision, toy car X continues to move in the same direction with a velocity of 0.177 m/s. Calculate the speed of toy car Y after the collision.
12. A marksman at rest fires a 4.00-kg gun that expels a bullet of mass 0.0140 kg with a velocity of 181 m/s. The marksman's mass is 81.0 kg. What is the marksman's velocity after firing the gun?
13. A rocket expels gases at a rate of 1.30×10^3 kg/s with a speed of 3.00×10^4 m/s. What is the force exerted on the rocket?
14. Ball A, with a mass of 1.75 kg, moves with a velocity 3.50 m/s. It collides with a stationary ball B, with a mass of 2.50 kg. After the collision, ball A moves in a direction 55.0° to the left of its original direction, while ball B moves in a direction 35.0° to the right of ball A's original direction. Calculate the velocity of each ball after the collision.
15. A lump of clay with a mass of 5.0×10^{-2} kg is thrown toward a wall with a velocity of 3.0 m/s. The clay bounces off the wall with a velocity of –0.5 m/s. What is the impulse on the clay?
16. If the clay in the previous problem impacted the wall for 5.0 ms, what was the average force on the clay?
17. A 1.5×10^{-2} kilogram bullet traveling at 850 m/s hits a block of wood. The bullet and wood together fly off in the same direction at 25 m/s. What is the impulse on the bullet?
18. A 0.80 kg basketball traveling upward at 5.0 m/s impacts an 8.0×10^{-2} kg tennis ball traveling downward at 5.0 m/s. The basketball's velocity after the collision is 3.0 m/s upward. What is the velocity of the tennis ball after the collision?
19. A 2.0 kg bird lands on a 1.0×10^1 kg bit of tree bark sitting on a frictionless ice-covered pond. The bird's initial horizontal speed is 6.0 m/s. What is the final speed of the bird and bark?
20. A 91 kg wide receiver with no horizontal speed leaps into the air to catch a 0.45 kg football moving at 27 m/s. What horizontal speed does the wide receiver obtain if he catches the football?
21. In the previous problem, suppose the ball bounces off the wide receiver's chest and moves in the other direction at 4 m/s. Now what is the wide receiver's horizontal velocity?
22. If a 91 kg wide receiver running at 5.0 m/s in the y direction leaps into the air and catches a 0.45 kg ball moving 27 m/s in the x direction, what is the speed and direction of the receiver and ball just before the receiver touches the ground?
23. A mouse of mass 5.0 g spots the corner of a peanut butter sandwich of mass 8.0 g left on an ice rink after a game. Excited, the mouse runs out onto the ice, but immediately begins to slide. The mouse reaches the peanut butter sandwich and sinks its teeth in. Both the mouse and peanut butter sandwich continue to slide with a speed of 0.45 m/s. What was the initial speed of the mouse?