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

Momentum Practice

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

1. A very elastic rubber ball is dropped from a certain height and hits the floor with a downward speed *v.* Since it is so elastic, the ball bounces back with the same speed *v* going upward. Which of the following statements about the bounce are correct?
   a. The magnitude of the ball's momentum was the same just before and just after the bounce.
   b. The ball had the same momentum just before and just after the bounce.
   c. The ball's momentum was conserved during the bounce.
   d. None of the above statements are correct.

2. The momentum of an isolated system is conserved
   a. only in elastic collisions.
   b. in both elastic and inelastic collisions.
   c. only in inelastic collisions.

3. Two friends are standing on opposite ends of a canoe that is initially at rest with respect to a frictionless lake. The person in the front throws a very massive ball toward the back, and the person in the back catches it. After the ball is caught, the canoe is
   a. moving forward.
   b. stationary.
   c. moving backward.

4. A small car meshes with a large truck in a head-on collision. Which of the following statements concerning the magnitude of the momentum change during the collision is correct?
   a. The magnitude of the momentum change experienced by each one is inversely proportional to its mass.
   b. The truck experiences the greater magnitude momentum change.
   c. The small car and the truck experience the same magnitude momentum change.
   d. The small car experiences the greater magnitude momentum change.
   e. The magnitude of the momentum change experienced by each one is directly proportional to its mass.

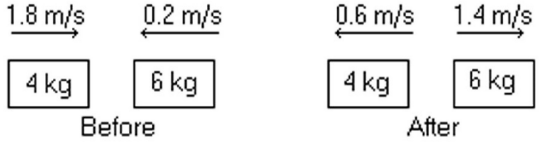
5. Three cars, car X, car Y, and car Z, begin accelerating from rest at the same time. Car X is more massive than car Y, which is more massive than car Z. The net accelerating force exerted on each car is identical. After 10 seconds, which car has the most amount of momentum?
   a. They all have the same amount of momentum.
   b. Car X
   c. Car Y
   d. Car Z

6. A very light ping-pong ball moving east at a speed of 4 m/s collides with a very heavy stationary bowling ball. The Ping-Pong ball bounces back to the west, and the bowling ball moves very slowly to the east. Which object experiences the greater magnitude impulse during the collision?
   a. the Ping-Pong ball
   b. the bowling ball
   c. Neither; both experienced the same magnitude impulse.
   d. It is impossible to tell since the actual mass values are not given.
   e. It is impossible to tell since the velocities after the collision are unknown.

7. In an inelastic collision involving an isolated system, the final total momentum is
   a. less than the initial momentum.
   b. more than the initial momentum.
   c. exactly the same as the initial momentum.

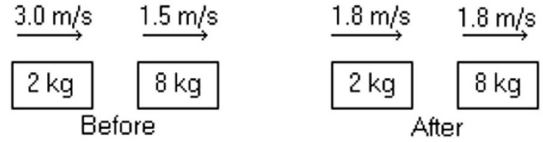
8. In a game of pool, the white cue ball hits the #5 ball and stops, while the #5 ball moves away with the same velocity as the cue ball had originally. Both balls have the same mass. This type of collision is
   a. elastic.
   b. somewhat inelastic.
   c. completely inelastic.

9. In the figure, determine the character of the collision. The masses of the blocks, and the velocities before and after, are shown. The collision is



   a. perfectly elastic.
   b. completely inelastic.
   c. partially inelastic.
   d. characterized by an increase in kinetic energy.
   e. not possible because momentum is not conserved.

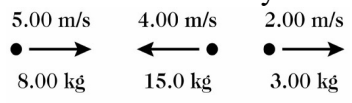
10. In the figure, determine the character of the collision. The masses of the blocks, and the velocities before and after, are shown. The collision is



   a. partially inelastic.
   b. completely inelastic.
   c. perfectly elastic.
   d. characterized by an increase in kinetic energy.
   e. not possible because momentum is not conserved.

11. A 2.0-kg ball moving eastward at 3.0 m/s suddenly collides with and sticks to a 4.0-kg ball moving northward at 2.0 m/s. What is the magnitude of the momentum of this system just after the collision?
   a. 2.0 kg•m/s
   b. 8.0 kg•m/s
   c. 10 kg•m/s
   d. 14 kg•m/s
   e. 6.0 kg•m/s

12. Three objects are moving along a straight line as shown in the figure. Taking the positive direction to be to the right, what is the total momentum of this system?



a. -14.0 kg•m/s
b. +14.0 kg•m/s
c. +106 kg•m/s
d. -106 kg•m/s
e. 0.00 kg•m/s

13. A 0.140-kg baseball is dropped and reaches a speed of 1.20 m/s just before it hits the ground and bounces. It rebounds with an upward velocity of 1.00 m/s. What is the change of the ball's momentum during the bounce?
a. 0.308 kg•m/s upwards
b. 0.000 kg•m/s
c. 0.0280 kg•m/s downwards
d. 0.0280 kg•m/s upwards
e. 0.308 kg•m/s downwards

14. Two ice skaters suddenly push off against one another starting from a stationary position. The 45-kg skater acquires a speed of 0.375 m/s relative to the ice. What speed does the 60-kg skater acquire relative to the ice?
a. 0.50 m/s
b. 0.28 m/s
c. 0.00 m/s
d. 0.75 m/s
e. 0.38 m/s

15. A 1200-kg cannon suddenly fires a 100-kg cannonball at 35 m/s. What is the recoil speed of the cannon? Assume that frictional forces are negligible and the cannon is fired horizontally.
a. 3.2 m/s
b. 2.9 m/s
c. 35 m/s
d. 3.5 m/s

16. Astronaut Jennifer's lifeline to her spaceship comes loose and she finds herself stranded, "floating" 100 m from the mothership. She suddenly throws her 2.00-kg wrench at 20 m/s in a direction away from the ship. If she and her spacesuit have a combined mass of 200 kg, how long does it take her to coast back to her spaceship?
a. 2.50 min
b. 250 s
c. 750 s
d. 500 s
e. 1000 s

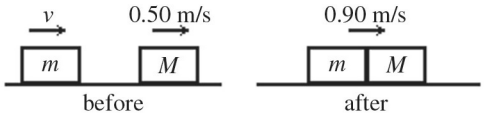
17. A golf club exerts an average horizontal force of 1000 N on a 0.045-kg golf ball that is initially at rest on the tee. The club is in contact with the ball for 1.8 ms. What is the speed of the golf ball just as it leaves the tee?
a. 30 m/s
b. 35 m/s
c. 45 m/s
d. 40 m/s
e. 50 m/s

18. A 0.140-kg baseball is thrown with a velocity of 27.1 m/s. It is struck by the bat with an average force of 5000 N, which results in a velocity of 37.0 m/s in the opposite direction from the original velocity. How long were the bat and ball in contact?
a. 4.30×10^{-3} s
b. 3.07×10^{-2} s
c. 1.28×10^{-2} s
d. 1.79×10^{-3} s

19. Calculate the impulse due to a force of 4.5 N that lasts for 1.4 s.
a. 5.0 kg•m/s
b. 6.9 kg•m/s
c. 6.3 kg•m/s
d. 5.7 kg•m/s

20. A 0.24 kg blob of clay is thrown at a wall with an initial horizontal velocity of 16 m/s. If the clay comes to a stop in 91 ms, what is the average horizontal force on the clay due to the wall?
    a. 35 N
    b. 26 N
    c. 51 N
    d. 42 N

21. A block of mass m = 34 kg and speed V is behind a block of mass M = 81 kg and speed of 0.5 m/s, as shown in the figure. The surface is frictionless and the blocks collide and couple. After the collision, the blocks have a common speed of 0.90 m/s. What is the magnitude of the impulse on the 34-kg block due to the collision?



    a. 57 N•s
    b. 73 N•s
    c. 32 N•s
    d. 41 N•s
    e. 14 N•s

22. A 0.140-kg baseball is dropped from rest. It has a speed of 1.20 m/s just before it hits the ground, and it rebounds with an upward speed of 1.00 m/s. The ball is in contact with the ground for 0.0140 s. What is the average force exerted by the ground on the ball during the time of contact?
    a. 2.00 N upwards
    b. 0.00 N
    c. 22.0 N downwards
    d. 22.0 N upwards
    e. 2.00 N downwards

23. A 1200-kg car moving at 15.6 m/s suddenly collides with a stationary car of mass 1500 kg. If the two vehicles lock together, what is their combined velocity immediately after the collision?
    a. 12.1 m/s
    b. 8.6 m/s
    c. 5.5 m/s
    d. 6.9 m/s

24. A 1000-kg whale swims horizontally to the right at a speed of 6.0 m/s. It suddenly collides directly with a stationary seal of mass 200 kg. The seal grabs onto the whale and holds fast. What is the speed of these two sea creatures just after their collision? You can neglect any drag effects of the water during the collision.
    a. 0.00 m/s
    b. 4.0 m/s
    c. 3.0 m/s
    d. 6.0 m/s
    e. 5.0 m/s

25. A 50-g ball moving at 10 m/s in the $+x$ direction suddenly collides head-on with a stationary ball of mass 100 g. If the collision is perfectly elastic, what is the velocity of each ball immediately after the collision?
    a. -6.7 m/s, +3.3 m/s
    b. +6.7 m/s, -3.3 m/s
    c. +3.3 m/s, -6.7 m/s
    d. -3.3 m/s, +6.7 m/s

26. A 900-kg car traveling east at 15.0 m/s suddenly collides with a 750-kg car traveling north at 20.0 m/s. The cars stick together after the collision. What is the speed of the wreckage just after the collision?
    a. 17.3 m/s
    b. 6.10 m/s
    c. 12.2 m/s
    d. 25.0 m/s
    e. 35.0 m/s

Momentum Practice
Answer Section

MULTIPLE CHOICE

1. ANS: A PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Momentum and Force
2. ANS: B PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Momentum
3. ANS: B PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Momentum
4. ANS: C PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Momentum
5. ANS: A PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Collisions and Impulse
6. ANS: C PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Collisions and Impulse
7. ANS: C PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Momentum
8. ANS: A PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Energy and Momentum in Collisions
9. ANS: A PTS: 1 DIF: 0 REF: Conceptual Question
   TOP: Conservation of Energy and Momentum in Collisions
10. ANS: B PTS: 1 DIF: 0 REF: Conceptual Question
    TOP: Conservation of Energy and Momentum in Collisions
11. ANS: C PTS: 1 DIF: 0 REF: Conceptual Question
    TOP: Conservation of Energy and Momentum in Collisions
12. ANS: A PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Momentum and Force
13. ANS: A PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Momentum and Force
14. ANS: B PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Conservation of Momentum
15. ANS: B PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Conservation of Momentum
16. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Conservation of Momentum
17. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Collisions and Impulse
18. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Collisions and Impulse
19. ANS: C PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Collisions and Impulse
20. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
    TOP: Collisions and Impulse

21. ANS: C PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Collisions and Impulse
22. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Collisions and Impulse
23. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Conservation of Energy and Momentum in Collisions
24. ANS: E PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Conservation of Energy and Momentum in Collisions
25. ANS: D PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Elastic Collisions
26. ANS: C PTS: 1 DIF: 0 REF: Numeric Problem
TOP: Collisions in Two Dimensions