Q1W6-Ph.-Test 1.- Momentum and Collisions

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

____ 1. Two swimmers relax close together on air mattresses in a pool. One swimmer's mass is 48 kg, and the other's mass is 55 kg. If the swimmers push away from each other,
a. their total momentum doubles.
b. their total momentum decreases.
c. their total momentum triples.
d. their momenta are equal but opposite.

____ 2. 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. both objects had the same momentum.
c. the more massive object had gained momentum.
d. both objects lost momentum.

____ 3. A ball with a momentum of 4.0 kg•m/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 kg•m/s
b. 0.0 kg•m/s
c. –4.0 kg•m/s
d. 8.0 kg•m/s

____ 4. Two objects stick together and move with a common velocity after colliding. Identify the type of collision.
a. perfectly inelastic
b. elastic
c. nearly elastic
d. inelastic

____ 5. The law of conservation of momentum states that
a. the total initial momentum of all objects interacting with one another does not equal the total final momentum.
b. the total momentum of all objects interacting with one another remains constant regardless of the nature of the forces between the objects.
c. the total initial momentum of all objects interacting with one another usually equals the total final momentum.
d. the total momentum of all objects interacting with one another is zero.

____ 6. If a force is exerted on an object, which statement is true?
a. A small force always produces a large change in the object's momentum.
b. A large force always produces a large change in the object's momentum.
c. A small force applied over a long time interval can produce a large change in the object's momentum.
d. A large force produces a large change in the object's momentum only if the force is applied over a very short time interval.

____ 7. 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. four times as great
c. one-fourth as great
d. two times as great

____ 8. Which of the following statements about the conservation of momentum is *not* correct?
a. Momentum is conserved for a system of objects pushing away from each other.
b. Momentum is conserved when two or more interacting objects push away from each other.
c. Momentum is not conserved for a system of objects in a head-on collision.
d. The total momentum of a system of interacting objects remains constant regardless of forces between the objects.

____ 9. Which of the following has the greatest momentum?
   a. a tortoise with a mass of 275 kg moving at a velocity of 0.55 m/s
   b. a roadrunner with a mass of 1.8 kg moving at a velocity of 6.7 m/s
   c. a hare with a mass of 2.7 kg moving at a velocity of 7.5 m/s
   d. a turtle with a mass of 91 kg moving at a velocity of 1.4 m/s

____ 10. A 0.2 kg baseball is pitched with a velocity of 40 m/s and is then batted to the pitcher with a velocity of 60 m/s. What is the magnitude of change in the ball's momentum?
   a. 20 kg•m/s
   b. 2 kg•m/s
   c. 4 kg•m/s
   d. 8 kg•m/s

____ 11. Two balls of dough collide and stick together. Identify the type of collision.
   a. elastic
   b. inelastic
   c. nearly elastic
   d. perfectly inelastic

____ 12. A rubber ball moving at a speed of 5 m/s hit a flat wall and returned to the thrower at 5 m/s. The magnitude of the momentum of the rubber ball
   a. increased.
   b. remained the same.
   c. was not conserved.
   d. decreased.

____ 13. A child with a mass of 23 kg rides a bike with a mass of 5.5 kg at a velocity of 4.5 m/s to the south. Compare the momentum of the child with the momentum of the bike.
   a. The bike has a greater momentum than the child.
   b. Neither the child nor the bike has momentum.
   c. The child has a greater momentum than the bike.
   d. Both the child and the bike have the same momentum.

____ 14. Which of the following statements properly relates the variables in the equation $\mathbf{F}\Delta t = \Delta\mathbf{p}$?
   a. A large constant force changes an object's momentum at various time intervals.
   b. A large constant force does not necessarily cause a change in an object's momentum.
   c. A large constant force changes an object's momentum over a long time interval.
   d. A large constant force acting over a long time interval causes a large change in momentum.

____ 15. 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. is conserved.
   b. increases.
   c. remains the same.
   d. decreases.

____ 16. A 75 kg person walking around a corner bumped into an 80 kg person who was running around the same corner. The momentum of the 80 kg person
   a. increased.
   b. decreased.
   c. remained the same.
   d. was conserved.

____ 17. The change in an object's momentum is equal to
   a. the product of the mass of the object and the time interval.
   b. the net external force divided by the time interval.
   c. the product of the force applied to the object and the time interval.
   d. the time interval divided by the net external force.

____ 18. The impulse experienced by a body is equivalent to the body's change in
   a. velocity.
   b. force.
   c. kinetic energy.
   d. momentum.

____ 19. 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. remained the same.
   b. was zero while stationary and increased when the person stood.
   c. was greatest while the person sat in the chair.

d. was zero when the person got out of the chair and increased while the person sat.

____ 20. Which of the following equations can be used to directly calculate the change in an object's momentum?

a. $\mathbf{p} = \frac{m}{\mathbf{v}}$

b. $\mathbf{p} = m\mathbf{v}$

c. $\mathbf{p} = \mathbf{F}\Delta t$

d. $\Delta\mathbf{p} = \mathbf{F}\Delta t$

____ 21. In a two-body collision,

a. momentum is always conserved.
b. both momentum and kinetic energy are always conserved.
c. kinetic energy is always conserved.
d. neither momentum nor kinetic energy is conserved.

____ 22. Which of the following best describes the momentum of two bodies after a two-body collision if the kinetic energy of the system is conserved?

a. is doubled in value
b. must be less
c. might also be conserved
d. must also be conserved

____ 23. When comparing the momentum of two moving objects, which of the following is correct?

a. The more massive object will have less momentum if its velocity is greater.
b. The more massive object will have less momentum if the velocities are the same.
c. The less massive object will have less momentum if the velocities are the same.
d. The object with the higher velocity will have less momentum if the masses are equal.

____ 24. A soccer ball collides with another soccer ball at rest. The total momentum of the balls

a. increases.
b. is zero.
c. remains constant.
d. decreases.

____ 25. Two objects move separately after colliding, and both the total momentum and total kinetic energy remain constant. Identify the type of collision.

a. elastic
b. nearly elastic
c. perfectly inelastic
d. inelastic

____ 26. Which of the following situations is an example of a visible change in momentum?

a. A car drives over a pebble.
b. A volleyball hits a mosquito in the air.
c. A baseball is hit by a bat.
d. A hiker walks through a spider's web.

____ 27. After colliding, objects are deformed and lose some kinetic energy. Identify the type of collision.

a. nearly elastic
b. inelastic
c. elastic
d. perfectly inelastic

____ 28. Two billiard balls collide. Identify the type of collision.

a. perfectly inelastic
b. elastic
c. nearly elastic
d. inelastic

____ 29. Which of the following situations is an example of a significant change in momentum?

a. An airplane flies into some scattered white clouds.
b. A tennis ball is hit into a net.
c. A helium-filled balloon rises upward into the sky.
d. A bicyclist rides over a leaf on the pavement.

____ 30. A roller coaster climbs up a hill at 4 m/s and then zips down the hill at 30 m/s. The momentum of the roller coaster

a. remains the same throughout the ride.
b. is zero throughout the ride.
c. is greater down the hill than up the hill.
d. is greater up the hill than down the hill.

Problems

1. A 56.0 kg diver jumps off a diving platform, rises about 1.0 m above the platform, then falls to the pool. What is the diver's momentum at her highest point in the dive?

   A. 10 kg•m/s
   B. 0 kg•m/s
   C. 20 kg•m/s
   D. 30 kg•m/s

2. A diver with a mass of 79.0 kg jumps from a dock into a 111.0 kg boat at rest on the west side of the dock. If the velocity of the diver in the air is 4.70 m/s to the west, what is the final velocity of the diver after landing in the boat?

   A. 4.95 m/s to the west
   B. 3.95 m/s to the west
   C. 2.95 m/s to the west
   D. 1.95 m/s to the west

3. A swimmer with a mass of 59 kg dives off a raft with a mass of 400 kg. If the swimmer's speed is 3 m/s immediately after leaving the raft, what is the speed of the raft?

   A. 0.4 m/s
   B. 0.5 m/s
   C. 0.6 m/s
   D. 0.7 m/s

4. A baseball bat strikes a baseball with a force of 37 N. The bat is in contact with the ball for 0.19 s. What is the magnitude of the change in momentum of the ball?

   A. 6.0 kg.m/s
   B. 7.0 kg.m/s
   C. 8.0 kg.m/s
   D. 9.0 kg.m/s

5. A train with a mass of 2.1×10^{5} kg is moving at 12 m/s when the engineer applies the brakes. If the braking force is constant at 3.7×10^{4} N, how long does it take the train to stop? How far does the train travel during this time?

   A. 48 s; 4.1×10^{2} m
   B. 58 s; 4.1×10^{2} m
   C. 68 s; 4.1×10^{2} m
   D. 78 s; 4.1×10^{2} m

6. A bullet with a mass of 6.58 g is fired through a 1.95 kg block of wood on a frictionless surface. The initial speed of the bullet is 822 m/s, and the speed of the bullet after it exits the block is 439 m/s. At what speed does the block move after the bullet passes through it?

    A. 4.29 m/s

    B. 3.29 m/s
    C. 2.29 m/s
    D. 1.29 m/s

7. An infant throws 7 g of applesauce at a velocity of 0.5 m/s. All of the applesauce collides with a nearby wall and sticks to it. What is the decrease in kinetic energy of the applesauce?

    A. 6×10^{-4} J

    B. 7×10^{-4} J
    C. 8×10^{-4} J
    D. 9×10^{-4} J

8. A 19 g marble moves to the right at 3.4 m/s and makes an elastic head-on collision with a 27 g marble. The final velocity of the 19 g marble is 5.1 m/s to the left, and the final velocity of the 27 g marble is 2.8 m/s to the right. What was the initial velocity of the 27 g marble?

    A. 0.2 m/s to the left

    B. 1.2 m/s to the left
    C. 2.2 m/s to the left
    D. 3.2 m/s to the left

9. A 83 kg halfback runs north and is tackled by a 123 kg opponent running south at 7.8 m/s. The collision is perfectly inelastic. Just after the tackle, both players move at a velocity of 2.2 m/s north. Calculate the velocity of the 83 kg player just before the tackle.

    A. 11 m/s to the north
    B. 13 m/s to the north
    C. 15 m/s to the north
    D. 17 m/s to the north

10. A pool cue strikes a 0.16 kg billiard ball with a force of 11 N. The cue remains in contact with the ball for 0.065 s. The ball was initially at rest. What is the final speed of the ball?

    A. 1.5 m/s
    B. 2.5 m/s
    C. 3.5 m/s
    D. 4.5 m/s

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