Unit 5 Practice Test - Physics

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

1. Which of the following equations can be used to directly calculate an object's momentum, \( p \)?
   a. \( p = mv \)
   b. \( p = \frac{m}{v} \)
   c. \( p = F \Delta t \)
   d. \( \Delta p = F \Delta t \)

2. When comparing the momentum of two moving objects, which of the following is correct?
   a. The object with the higher velocity will have less momentum if the masses are equal.
   b. The more massive object will have less momentum if its velocity is greater.
   c. The less massive object will have less momentum if the velocities are the same.
   d. The more massive object will have less momentum if the velocities are the same.

3. 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 hare with a mass of 2.7 kg moving at a velocity of 7.5 m/s
   c. a turtle with a mass of 91 kg moving at a velocity of 1.4 m/s
   d. a roadrunner with a mass of 1.8 kg moving at a velocity of 6.7 m/s

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

5. 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.

6. Which of the following equations can be used to directly calculate the change in an object's momentum?
   a. \( p = mv \)
   b. \( p = \frac{m}{v} \)
   c. \( p = F \Delta t \)
   d. \( \Delta p = F \Delta t \)

7. A ball with a momentum of 4.0 kg\( \cdot \)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\( \cdot \)m/s
   b. -4.0 kg\( \cdot \)m/s
   c. 0.0 kg\( \cdot \)m/s
   d. 8.0 kg\( \cdot \)m/s

8. 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. 2 kg\( \cdot \)m/s
   b. 4 kg\( \cdot \)m/s
   c. 8 kg\( \cdot \)m/s
   d. 20 kg\( \cdot \)m/s
9. Which of the following statements properly relates the variables in the equation \( F\Delta t = \Delta p \)?
   a. A large constant force changes an object's momentum over a long time interval.
   b. A large constant force acting over a long time interval causes a large change in momentum.
   c. A large constant force changes an object's momentum at various time intervals.
   d. A large constant force does not necessarily cause a change in an object's momentum.

10. 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.

11. 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.  
   b. decreases.  
   c. remains the same.  
   d. is conserved.

12. 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.

13. 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.

14. 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.

15. 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 triples.
   b. their momenta are equal but opposite.
   c. their total momentum doubles.
   d. their total momentum decreases.

16. In a two-body collision,
   a. momentum is always conserved.
   b. kinetic energy is always conserved.
   c. neither momentum nor kinetic energy is conserved.
   d. both momentum and kinetic energy are always conserved.
17. 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.

18. 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. inelastic
   d. perfectly inelastic

19. 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

20. After colliding, objects are deformed and lose some kinetic energy. Identify the type of collision.
   a. elastic
   b. nearly elastic
   c. inelastic
   d. perfectly inelastic

21. Two billiard balls collide. Identify the type of collision.
   a. elastic
   b. nearly elastic
   c. inelastic
   d. perfectly inelastic

22. 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.

23. 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.

24. 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

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

26. Compare the momentum of a 5450 kg truck moving at 8.00 m/s to the momentum of a 2725 kg car moving at 16.0 m/s.

27. Which has a greater momentum—a truck with a mass of 3530 kg moving at a speed of 21 m/s or a car with a mass of 1620 kg moving at a speed of 54 m/s?

28. A $5.68 \times 10^{-2}$ kg tennis ball moves at a speed of 13 m/s. The ball is struck by a racket, causing it to rebound in the opposite direction at a speed of 18 m/s. What is the change in the ball’s momentum?

29. A rubber ball with a mass of 0.41 kg is dropped onto a moveable steel plate. The ball’s speed just before impact is 2.1 m/s and just after impact is 1.9 m/s. What is the change in the ball’s momentum?

30. 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?
31. 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?

32. A player at first base catches a throw traveling 38 m/s. The baseball, which has a mass of 0.145 kg, comes to a complete stop in the glove after 0.14 s. Assuming the force of the glove was uniform, what force did the glove exert on the ball?

33. An astronaut with a mass of 81 kg is outside a space capsule when the tether line breaks. To return to the capsule, the astronaut throws a 2.5 kg wrench away from the capsule at a speed of 16 m/s. At what speed does the astronaut move toward the capsule?

34. 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?

35. A bullet with a mass of $4.87 \times 10^{-3}$ kg is loaded into a gun. The loaded gun has a mass of 0.74 kg. The bullet is fired, causing the empty gun to recoil at a speed of 4.3 m/s. What is the speed of the bullet?

36. Two snowballs with masses of 0.48 kg and 0.81 kg, respectively, collide head-on and combine to form a single snowball. The initial speed for each is 14 m/s. If the velocity of the new combined snowball is 2.4 m/s after the collision, what is the decrease in kinetic energy?
37. A $5.3 \times 10^3$ kg truck moving at 16 m/s strikes a $1.7 \times 10^3$ kg automobile stopped at a traffic light. The vehicles hook bumpers and skid together at 10.4 m/s. What is the decrease in kinetic energy?

38. A 0.12 kg object makes an elastic head-on collision with a 0.18 kg stationary object. The final velocity of the 0.12 kg object after the collision is 0.048 m/s in the direction opposite its initial movement. The final velocity of the 0.18 kg object after the collision is 0.19 m/s in the same direction as the object which strikes it. What was the initial velocity of the 0.12 kg object?

39. A bowling ball with a mass of 6.8 kg strikes a stationary pin that has a mass of 1.6 kg. The pin flies forward with a velocity of 6.8 m/s, and the ball continues forward at 4.5 m/s. What was the original velocity of the ball?

40. 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?

41. A clay ball with a mass of 0.25 kg strikes another 0.25 kg clay ball at rest, and the two balls stick together. The final velocity of the balls is 4.4 m/s north. What was the first ball’s initial velocity?