Physics 2204
Assignment 4
Momentum and Impulse
Outcome: 326-3

Name:_____

1. A net force of 12 N changes the momentum of a 250-g ball by 3.7 kgm/s. How long does the force act?
   A) 0.31 s B) 3.2 s C) 0.81 s D) 44 s

2. A car with a mass of 1800 kg slows from 42 km/h [E] to 28 km/h [E]. What is the impulse from the brakes?
   A) 2.5×10^4 Ns [E] B) 2.1×10^4 Ns [W]
   C) 2.5×10^4 Ns [W] D) 7.0×10^3 Ns [W]

3. A ball, dropped vertically, hits the sidewalk with a speed of 18 m/s and rebounds at 10 m/s. If its mass is 0.2 kg, what change in momentum is caused by the impact?
   A) 1.6 kgm/s B) 2.0 kgm/s
   C) 3.6 kgm/s D) 5.6 kgm/s

4. How long a time would it take a force of 200 N to reduce a 1000 kg car's momentum from 28000 kg m/s to 4000 kg m/s?
   A) 2 minutes B) 5 minutes
   C) 4 minutes D) 120 minutes

5. What force, when acting on an object for 0.50 s, would produce the same impulse as a force of 10 N acting on the same object for 0.10 s?
   A) 1.0 N B) 2.0 N C) 5.0 N D) 10.0 N

6. To increase the impulse imparted on a baseball, what should you do?

   A) Don't follow through when you hit the ball because this will increase the force imparted to the ball.
   B) Don't follow through when you hit the ball because this will increase the impact time.
   C) Follow through when you hit the ball because it increases the force imparted to the ball.
   D) Follow through when you hit the ball because it increases the impact time.

7. Karate fighters minimize follow-through in a punch, so that the fist is withdrawn as quickly as possible after contact. Why does this strategy inflict more damage?
   A) larger impulse
   B) larger change of momentum
   C) greater force of contact
   D) smaller force of contact

8. Which of the following has the greatest momentum?
   A) a cat running after a mouse
   B) a hockey puck flying past a goalie into the net
   C) a transport truck moving at 100 km/h on a highway
   D) the Moon in its orbit around Earth

9. A bullet with a mass of 28 g is fired from a 2.8-kg gun that is stationary, but free to recoil. After the bullet is fired, the gun is observed to be moving at 1.4 m/s [left]. What is the velocity of the bullet?

A) 71 m/s [left] B) 71 m/s [right]
C) 140 m/s [left] D) 140 m/s [right]

10. An arrow slows down from 43 m/s to 28 m/s as it passes through an apple. If the 493-g apple was originally at rest and sped up to 0.44 m/s, what is the mass of the arrow?

A) 5.0 g B) 7.7 g
C) 7.7 kg D) 14 g

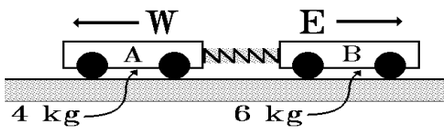
11. A 5.0 kg object, initially at rest, explodes and breaks into two pieces of mass 1.0 kg and 4.0 kg. What is the speed of the 1.0 kg block compared to the 4.0 kg block?

A) one-fourth the speed of the 4.0 kg block
B) one-fifth the speed of the 4.0 kg block
C) four times the speed of the 4.0 kg block
D) five times the speed of the 4.0 kg block

12. A 1.00 kg firecracker explodes into two pieces. One piece, with a mass of 0.400 kg moves off with a velocity of 32 m/s to the right. What happens to the second piece?

A) It moves left at 21 m/s. B) It moves left at 32 m/s.
C) It moves left at 48 m/s. D) It moves upward at 32 m/s

13. Two carts have a spring compressed between them as shown below. If both carts are released at the same time, which of the following is true?



A) The sum of the velocities of carts A and B is 0 m/s.
B) Velocity of Cart A is equal to the velocity of Cart B.
C) Velocity of Cart A is greater than the velocity of Cart B.
D) Velocity of Cart A is less than the velocity of Cart B.

14. An object of mass “m” moves in a straight line along a frictionless surface with a speed “v” when it collides with a second object of mass “2m”, which is moving in exactly the same direction with a speed of “v/2". If the two objects stick together upon impact, what is the speed at which the objects move immediately after collision?

A) 1/3 v B) ½ v C) 2/3 v D) 3/2 v

15. A 0.25 kg soccer ball is rolling at 6.0 m/s toward a player. The player kicks the ball back in the opposite direction and gives it a velocity of 14 m/s. What is the average force during the interaction between the player’s foot and the ball if the interaction lasts 2.0×10^{-2} s?

16. A baseball strikes a ball with a mass of 0.322 kg and changes its velocity from 35.0 m/s [W] to 62.0 m/s [E] in a time of 0.028 s. What average force was required?

17. Suppose you throw a ball against a wall and catch it on the rebound. How many impulses were applied to the ball? Which impulse was the greatest? Why?

18. A 60 g tennis ball moving at 25 m/s[E] is hit by a racquet and returned at 35 m/s[W]. If the interaction force between the ball and the racquet is 400 N, find

A) the change of momentum of the ball.

B) the time of contact between the ball and the racket.

19. In a curling match, a 50 kg player is moving at 1.0 m/s[E] with a 5.0 kg curling rock. Just before releasing the rock, she pushes the rock with a force of 10 N for 2.0 s. Find the velocity of the rock just after it is pushed.

20. When a 200.0 g cue ball traveling at 1.8 m/s strikes the eight ball, the cue ball slows down to 0.60 m/s. How much momentum is gained by the eight ball?

21. A 2.0 kg gun fires a 0.020 kg bullet with a velocity of 500.0 m/s[E]. Determine the initial recoil velocity, *v,* of the gun.

22. In a movie, a 20 g bullet travels at 500 m/s[E] toward a cowboy who is standing beside his horse. The bullet hits the cowboy's 200 g hat, and the hat flies away at a velocity of 40 m/s[E]. Find the velocity, *v*, of the bullet just after the impact.

23. A large rubber ball with a mass of 0.40 kg is moving to the right at 2.2 m/s when it collides with a smaller rubber ball with a mass of 0.050 kg and moving to the right at 1.4 m/s. The smaller ball rebounds at 2.0 m/s to the right. What will be the velocity of the larger ball after the collision?

24. Three coupled freight cars, each of mass ‘m’, are travelling with a constant speed of ‘v’ on a straight and level track. They collide with two coupled stationary cars, each of mass ‘2m’. If all 5 cars are coupled together after the collision, what is their common speed?

25. A ball of putty with a mass of 0.10 kg collides with and sticks to a dynamics cart with a mass of 1.20 kg. If the ball of putty was moving to the RIGHT at 32 m/s and the dynamics cart was moving to the LEFT at 2.5 m/s, what will be the velocity of the combined object after the collision?

26. A 1.5 kg wooden trolley on wheels on wheels is stationary on a horizontal, frictionless track. What will be the final velocity of the trolley if a bullet of mass 2.0 g is fired into it with a horizontal velocity of 300 m/s along the direction of the track?