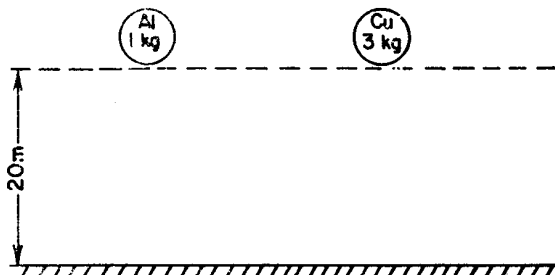


Practice - Impulse and Momentum

Name: _____

Date: _____

1. The diagram here shows a 1-kilogram aluminum sphere and a 3-kilogram copper sphere of equal radius located 20 meters above the ground.

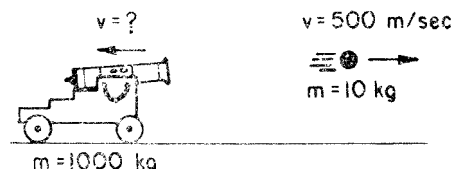


Just before striking the ground, the speed of the copper sphere is 20 meters per second. What is the momentum of the copper sphere?

- A. 10 kg·m/sec B. 20 kg·m/sec
 C. 60 kg·m/sec D. 600 kg·m/sec
2. When objects exert forces on each other, the total momentum of the system
- A. decreases B. increases
 C. remains the same
3. The momentum of a 5-kilogram object moving at 6 meters per second is
- A. 1 kg · m/sec B. 5 kg · m/sec
 C. 11 kg · m/sec D. 30 kg · m/sec
4. Which of the following objects has the greatest momentum?
- A. a 1-kg object moving at 200 m/sec
 B. a 10-kg object moving at 30 m/sec
 C. a 20-kg object moving at 20 m/sec
 D. a 100-kg object moving at 2 m/sec

5. The momentum of a rocket is equal to the
- A. sum of its mass and velocity
 B. product of its mass and velocity
 C. difference between its mass and velocity
 D. average of its mass and velocity

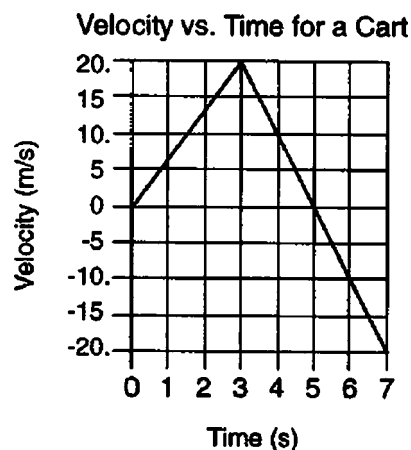
6. In the diagram shown, a 10-kilogram ball is fired with a velocity of 500 meters per second from a 1,000-kilogram cannon. What is the recoil velocity of the cannon?



- A. 5 m/sec B. 2 m/sec
 C. 10 m/sec D. 500 m/sec
7. As the unbalanced force applied to an object increases, the time rate of change of the object's momentum
- A. decreases B. increases
 C. remains the same
8. An unbalanced 6.0-newton force acts eastward on an object for 3.0 seconds. The impulse produced by the force is
- A. 18 N · s east B. 2.0 N · s east
 C. 18 N · s west D. 2.0 N · s west
9. What is the magnitude of the velocity of a 25-kilogram mass that is moving with a momentum of 100 kilogram-meters per second?
- A. 0.25 m/s B. 2500 m/s
 C. 40 m/s D. 4.0 m/s

10. A constant braking force of 10 newtons applied for 5 seconds is used to stop a 2.5-kilogram cart traveling at 20 meters per second. The magnitude of the impulse applied to stop the cart is
- A. $10\text{ N} \cdot \text{s}$ B. $30\text{ N} \cdot \text{s}$
 C. $50\text{ N} \cdot \text{s}$ D. $100\text{ N} \cdot \text{s}$
11. A 0.025-kilogram bullet is fired from a rifle by an unbalanced force of 200 newtons. If the force acts on the bullet for 0.1 second, what is the maximum speed attained by the bullet?
- A. 5 m/s B. 20 m/s
 C. 400 m/s D. 800 m/s
12. A bullet traveling at 5.0×10^2 meters per second is brought to rest by an impulse of 50 newton-seconds. What is the mass of the bullet?
- A. $2.5 \times 10^4\text{ kg}$ B. $1.0 \times 10^1\text{ kg}$
 C. $1.0 \times 10^{-1}\text{ kg}$ D. $1.0 \times 10^{-2}\text{ kg}$
13. Two rocks weighing 5 newtons and 10 newtons, respectively, fall freely from rest near the Earth's surface. After 3 seconds of free-fall, compared to the 5-newton rock, the 10-newton rock has greater
- A. acceleration B. height
 C. momentum D. speed
14. A force of 20 newtons is exerted on a cart for 10 seconds. How long must a 50-newton force act to produce the same impulse?
- A. 10 s B. 2.0 s C. 5.0 s D. 4.0 s
15. If a net force of 10 newtons acts on a 6.0-kilogram mass for 8.0 seconds, the total change of momentum of the mass is
- A. $48\text{ kg} \cdot \text{m/s}$ B. $60\text{ kg} \cdot \text{m/s}$
 C. $80\text{ kg} \cdot \text{m/s}$ D. $480\text{ kg} \cdot \text{m/s}$

16. In a baseball game, a batter hits a ball for a home run. Compared to the magnitude of the impulse imparted to the ball, the magnitude of the impulse imparted to the bat is
- A. less B. greater C. the same
17. A 0.60-kilogram softball initially at rest is hit with a bat. The ball is in contact with the bat for 0.20 second and leaves the bat with a speed of 25 meters per second. What is the magnitude of the average force exerted by the ball on the bat?
- A. 8.3 N B. 15 N C. 3.0 N D. 75 N
18. The accompanying velocity-time graph represents the motion of a 3-kilogram cart along a straight line. The cart starts at $t = 0$ and initially moves north.



- What is the magnitude of the change in momentum of the cart between $t = 0$ and $t = 3$ seconds?
- A. $20\text{ kg} \cdot \text{m/s}$ B. $30\text{ kg} \cdot \text{m/s}$
 C. $60\text{ kg} \cdot \text{m/s}$ D. $80\text{ kg} \cdot \text{m/s}$
19. A 1000-kilogram car traveling due east at 15 meters per second is hit from behind and receives a forward impulse of 6000 newton-seconds. Determine the magnitude of the car's change in momentum due to this impulse.

20. Calculate the magnitude of the impulse applied to a 0.75-kilogram cart to change its velocity from 0.50 meter per second east to 2.00 meters per second east. [Show all work, including the equation and substitution with units.]

21. A baseball bat exerts an average force of 600. newtons east on a ball, imparting an impulse of 3.6 newtonseconds east to the ball. Calculate the amount of time the baseball bat is in contact with the ball.

22. Calculate the time required for a 6000.-newton net force to stop a 1200.-kilogram car initially traveling at 10 meters per second. [Show all work, including the equation and substitution with units.]

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1.
Answer: C
2.
Answer: C
3.
Answer: D
4.
Answer: C
5.
Answer: B
6.
Answer: A
7.
Answer: B
8.
Answer: A
9.
Answer: D
10.
Answer: C
11.
Answer: D
12.
Answer: C
13.
Answer: C
14.
Answer: D
15.
Answer: C
16.
Answer: C
17.
Answer: D
18.
Answer: C
19.
Answer: $6000 \frac{\text{kg} \cdot \text{m}}{\text{s}}$
20.
Answer: 1.1 N s

21.
Answer: $-t = \frac{3.6N \cdot s}{600.N}$
 $-t = 0.0060 \text{ s}$
22.
Answer: $F_{net}t = \delta p; t = 2.0 \text{ s}$