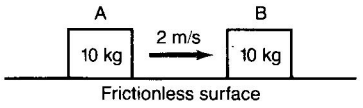
QUESTIONS

1. A 10.-kilogram mass moving at a speed of 5.0 meters per second on a frictionless surface collides with a stationary 10.-kilogram mass. If the two masses remain joined after the collision, their speed will be (1) 0.0 m/s (2) 2.5 m/s (3) 5.0 m/s (4) 10. m/s
2. A 1.0-kilogram object falls freely from rest. The magnitude of its momentum after 1.0 second of fall is (1) 1.0 kg · m/s (2) 4.9 kg · m/s (3) 9.8 kg · m/s (4) 20. kg · m/s
3. A 10-kilogram gun recoils with a speed of 0.1 meter per second as it fires a 0.001-kilogram bullet. Neglecting friction, what is the speed of the bullet as it leaves the gun? (1) 10 m/s (2) 100 m/s (3) 1,000 m/s (4) 10,000 m/s
4. Which is a scalar quantity? (1) speed (2) displacement (3) force (4) momentum
5. A mass having a momentum of 40. kilogram · meters per second receives an impulse of 20. newton · seconds in the direction of motion. The final momentum of the mass is (1) 2.0 kg · m/s (2) 20. kg · m/s (3) 60. kg · m/s (4) 800 kg · m/s
6. A mass of 2.0 kilograms that experiences a momentum change of 50. kilogram · meters per second must have received an impulse of (1) 25 N · s (2) 2.0 N · s (3) 50. N · s (4) 100 N · s
7. A mass experiences a change of momentum of 35 kilogram · meters per second in 10. seconds. What is the magnitude of the average force causing this change? (1) 3.5 N (2) 35 N (3) 45 N (4) 350 N
8. If a 2.0-kilogram mass moves with a constant speed of 20. meters per second, the magnitude of its momentum is (1) 8.0 kg · m/s (2) 10. kg · m/s (3) 40. kg · m/s (4) 160 kg · m/s
9. A 1-kilogram ball of putty traveling at 5 meters per second hits a wall perpendicularly and sticks to it. The ball experiences a change of momentum of (1) 1 kg · m/s (2) 5 kg · m/s (3) 10 kg · m/s (4) 0 kg · m/s
10. A 1-kilogram ball hits a surface perpendicularly with a speed of 3 meters per second and bounces back with a speed of 2 meters per second. The ball undergoes a change in momentum of (1) 1 kg · m/s (2) 5 kg · m/s (3) 3 kg · m/s (4) 6 kg · m/s
11. An average unbalanced force of 30. newtons acts on a 2.0-kilogram object for 3.0 seconds. The object's change in momentum is (1) 10. kg · m/s (2) 15 kg · m/s (3) 6.0 kg · m/s (4) 90. kg · m/s
12. As an object falls freely toward the earth, the momentum of the object-earth system (1) decreases (2) increases (3) remains the same
13. As the momentum of a moving mass increases, the magnitude of the impulse required to stop the mass (1) decreases (2) increases (3) remains the same
14. When two stationary objects are suddenly pushed apart by a compressed spring between them, and no friction acts on the objects, the total momentum of the system (1) increases (2) decreases (3) remains the same

15. As a freely falling object approaches the earth's surface, the impulse required to stop the object (1) decreases (2) increases (3) remains the same

16–19. Base your answers to Questions 16 through 19 on the following information and the diagram at the right.

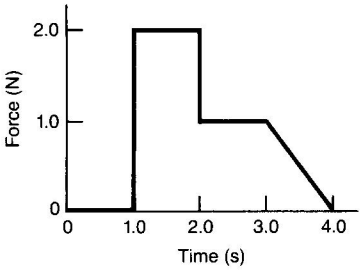


Block *A* moves with a velocity of 2 meters per second to the right and then collides with block *B*, which is at rest. After the collision, block *A* stops moving, and block *B* moves to the right.

16. What is the magnitude of the combined momentum of blocks *A* and *B* before the collision? (1) 0 kg · m/s (2) 10 kg · m/s (3) 20 kg · m/s (4) 40 kg · m/s
17. What is the total change in momentum of blocks *A* and *B* during the collision? (1) 0 kg · m/s (2) 20 kg · m/s (3) 40 kg · m/s (4) 200 kg · m/s
18. If block *A* is stopped in 0.1 second, the magnitude of the average force acting on block *A* is (1) 50 N (2) 100 N (3) 200 N (4) 400 N
19. If the blocks had remained together after collision, the magnitude of their velocity would have been (1) 1 m/s (2) 2 m/s (3) 0 m/s (4) 0.5 m/s

20–23. Base your answers to Questions 20 through 23 on the following information.

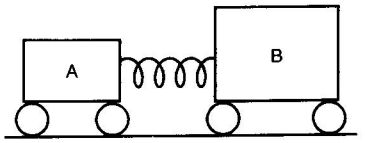
A horizontal force is applied to a 5.0-kilogram object resting on a horizontal surface. The force is always applied in the same direction, but its magnitude varies with time according to the graph. (Neglect friction.)



20. What is the acceleration of the object at time $t = 2.5$ seconds? (1) 1.0 m/s^2 (2) 0.20 m/s^2 (3) 5.0 m/s^2 (4) 9.8 m/s^2
21. During which time interval did the object have a constant velocity? (1) 0.0 s to 1.0 s (2) 1.0 s to 2.0 s (3) 2.0 s to 3.0 s (4) 3.0 s to 4.0 s
22. The greatest change in momentum of the object occurred during the time interval from (1) 0.0 s to 1.0 s (2) 1.0s to 2.0 s (3) 2.0 s to 3.0 s (4) 3.0 s to 4.0 s
23. If a 5.0-kilogram mass is added to the original mass at the time t = 2.5 seconds, the acceleration of the object will (1) decrease (2) increase (3) remain the same

24–28. Base your answers to Questions 24 through 28 on the following information.

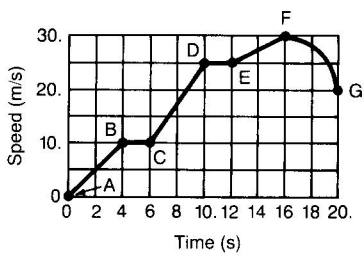
A compressed spring is "exploded" between two carts that



are initially at rest, as shown. The mass of cart *B* is twice that of cart *A*. The magnitude of the impulse applied to cart *B* is 8.0 newton · seconds. (Neglect friction.)

24. The magnitude of the impulse applied to cart *A* is (1) 8.0 N · s (2) 2.0 N · s (3) 16 N · s (4) 4 N · s
25. If the time for the spring to explode is 0.1 second, the average force on cart *B* is (1) 0.8 N (2) 8 N (3) 40 N (4) 80 N
26. If the total momentum of the carts before the explosion is 0.0 kg · m/s, the total momentum after the explosion is
    (1) 0.0 kg · m/s (3) 16 kg · m/s
    (2) 8.0 kg · m/s (4) 4.0 kg · m/s
27. The ratio of the magnitude of the change in the momentum of cart *A* to the magnitude of the change in momentum of cart *B* is (1) 1/1 (2) 1/2 (3) 2/1 (4) 8/1
28. A constant unbalanced force acts on an object initially at rest. As the time the force acts increases, the momentum of the object (1) decreases (2) increases (3) remains the same

29–31. Base your answers to Questions 29 through 31 on the graph at right, which shows the speed of a 1,500-kilogram car during a 20.-second time interval.



29. The acceleration of the car during time interval *AB* is (1) 0.40 m/s^2 (2) 2.5 m/s^2 (3) 10. m/s^2 (4) 40. m/s^2
30. During time interval *CD*, the average speed of the car is (1) 7.5 m/s (2) 17.5 m/s (3) 15 m/s (4) 35 m/s
31. The impulse applied to the car during time interval *AB* is
    (1) 9.0×10^2 N · s (3) 6.0×10^3 N · s
    (2) 4.5×10^3 N · s (4) 1.5×10^4 N · s