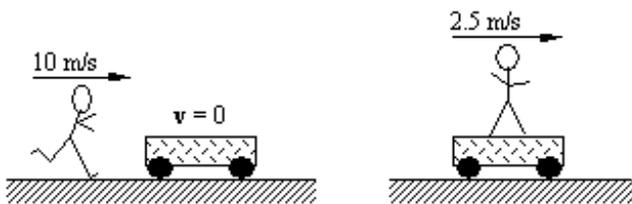


1. Determine the momentum of an object of mass 0.5 kg moving with a velocity of 25 m/s . Determine the kinetic energy of this object.
2. The momentum of an object of mass 5 kg is 100 kgm/s . Determine the kinetic energy of the object.
3. The momentum of an object is 200 kgm/s and its kinetic energy is 5000 J . Determine the mass of the object.
4. A force of magnitude 350 N acts on a object for 0.2 s . Determine the impulse delivered to the object.
5. A ball of mass 0.12 kg moving with a velocity of 25 m/s due east bounces back with a velocity of 25 m/s due west. Determine the impulse delivered to the ball. Assuming that the ball is in contact with the bat for 0.12 s determine the average force exerted on the ball.
6. A 50.0-kg boy runs at a speed of 10.0 m/s and jumps onto a cart as shown in the figure. The cart is initially at rest. If the speed of the cart with the boy on it is 2.50 m/s , what is the mass of the cart?



7. Lucy is walking at 1.63 m/s . If Lucy weighs 583 N , what is the magnitude of her momentum?
8. A stunt person jumps from the roof of a tall building, but no injury occurs because the person lands on a large, air-filled bag. Which one of the following best describes why no injury occurs?

1. The bag provides the necessary force to stop the person.
 2. The bag reduces the impulse to the person.
 3. The bag increases the amount of time the force acts on the person and reduces the change in momentum.
 4. The bag decreases the amount of time during which the momentum is changing and reduces the average force on the person.
 5. The bag increases the amount of time during which the momentum is changing and reduces the average force on the person.
9. A 1.0 kg ball has a velocity of 12 m/s downward just before it strikes the ground and bounces up with a velocity of 12 m/s upward. What is the change in momentum of the ball?
 10. A 0.1 kg steel ball is dropped straight down onto a hard, horizontal floor and bounces straight up. The ball's speed just before and just after impact with the floor is 10 m/s . Determine the magnitude of the impulse delivered to the floor by the steel ball.
 11. A 0.065 kg tennis ball moving to the right with a speed of 15 m/s is struck by a tennis racket, causing it to move to the left with a speed of 15 m/s . If the ball remains in contact with the racket for 0.020 s , what is the magnitude of the average force experienced by the ball?
 12. An airplane is traveling at 225 m/s when it strikes a weather balloon ($m = 1.82\text{ kg}$), which can be considered to be at rest relative to the ground below. After the collision, the balloon is caught on the fuselage and is traveling with the airplane. The collision takes place over a time interval of $4.44 \times 10^{-3}\text{ s}$. What is the average force that the balloon exerts on the airplane?

13. A bat strikes a 0.050 kg baseball so that its velocity changes by $+30\text{ m/s}$ in 0.10 s . With what average force was the ball struck?
14. The head of a hammer ($m = 1.5\text{ kg}$) moving at 4.5 m/s strikes a nail and bounces back with the same speed after an elastic collision lasting 0.075 s . What is the magnitude of the average force the hammer exerts on the nail?
15. A football player kicks a 0.41 kg football initially at rest; and the ball flies through the air. If the kicker's foot was in contact with the ball for 0.051 s and the ball's initial speed after the collision is 21 m/s , what was the magnitude of the average force on the football?
16. A 100 kg cannon at rest contains a 10 kg cannon ball. When fired, the cannon ball leaves the cannon with a speed of 90 m/s . What is the recoil speed of the cannon?
17. While in Earth's orbit, an 80 kg astronaut carrying a 20 kg tool kit is initially drifting toward a stationary (to her) space shuttle at a speed of 2 m/s . She throws the tool kit toward the shuttle with a speed of 6 m/s as seen from the shuttle. Determine her final speed.
18. On an interplanetary mission, a 58.5 kg astronaut is floating toward the front of her ship at 0.15 m/s , relative to the ship. She wishes to stop moving, relative to the ship. She decides to throw away the 2.50 kg book she's carrying. What should the speed and direction of the book be to achieve her goal?
19. Complete the following statement: Momentum will be conserved in a two-body collision only if
 1. both bodies come to rest.
 2. the collision is perfectly elastic.
 3. the kinetic energy of the system is conserved.
 4. the net external force acting on the two-body system is zero.
5. the internal forces of the two body system cancel in action-reaction pairs.
20. A 1000 kg car traveling east at 20 m/s collides with a 1500 kg car traveling west at 10 m/s . The cars stick together after the collision. What is the common velocity of the cars after the collision?
21. A 0.050 kg lump of clay moving horizontally at 12 m/s strikes and sticks to a stationary 0.10 kg cart that can move on a frictionless air track. Determine the speed of the cart and clay after the collision.
22. A 0.10 kg cart traveling in the positive x direction at 10.0 m/s collides with a 0.30 kg cart at rest. The collision is elastic. What is the velocity of the 0.10 kg cart after the collision?
23. A bullet of mass 0.05 kg moving with a velocity of 120 m/s gets embedded in a ballistic pendulum of mass 8 kg . Determine the velocity of the block-bullet system right after the collision. Determine the maximum height reached by the block-bullet system.
24. A bullet of mass 0.08 kg strikes and gets embedded in a block of mass 5 kg of a ballistic pendulum. It is observed that the block-bullet system reach a maximum height of 0.2 m . Determine the velocity with which the bullet strikes the block.
25. A block of mass 0.5 kg has a head-on, elastic collision with another block of mass 0.5 kg sitting at rest on a smooth level surface. Determine the velocities of the two blocks right after the collision.
26. A 0.015 kg marble moving to the right at 0.40 m/s has a head-on, elastic collision with a 0.045 kg marble sitting at rest on a smooth, level surface. Determine the velocities of the two marbles right after the collision.