

# Momentum Practice Problems

1. A bowling ball with a mass of 5 kg strikes a pin that has a mass of 1.5 kg. The pin flies forward with a velocity of 7 m/s and the ball continues forward at 3 m/s. What was the original velocity of the ball?
2. A swimmer with a mass of 70 kg dives off of a raft with a mass of 450 kg. The raft and the swimmer are initially at rest. If the diver's velocity is 3 m/s immediately after leaving the raft, what is the speed of the raft?
3. A bullet with a mass of  $5 \times 10^{-3}$  kg is loaded into a gun. The loaded gun has a mass of .65 kg. The bullet is fired, causing the empty gun to recoil at a velocity of 2.5 m/s. What is the velocity of the bullet?
4. A 2 kg melon is balanced on a bald man's head. His son shoots a 50 g arrow at it with a speed of 30 m/s. The arrow passes through the melon and emerges with a speed of 18 m/s. Find the speed of the melon as it flies off of the man's head.
5. A 1500 kg car traveling at 15 m/s to the south collides with a 4500 kg truck that is initially at rest at a stoplight. The car and truck stick together and move together after the collision. What is the velocity of the two vehicle mass?
6. A grocery shopper tosses a 9 kg bag of rice into a stationary 18 kg grocery cart. The bag hits the cart with a horizontal speed of 5.5 m/s toward the front of the cart. What is the final speed of the cart and the bag?

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7. A 63 kg astronaut is on a spacewalk when the tether line to the shuttle breaks. The astronaut is able to throw a 10 kg oxygen tank in a direction away from the shuttle with a speed of 12 m/s, propelling the astronaut back to the shuttle. Assuming the astronaut starts from rest, find the final speed of the astronaut after throwing the tank.
  
8. Calculate the momentum of a bike with a mass of 135 kg moving at a velocity 1.5 m/s.
  
9. Calculate the mass of a professional fullback running at 9.2 m/s with a momentum of 1000 kg x m/s.
  
10. A baseball has a mass of .14 kg and a velocity of 35 m/s. Find the velocity at which a bowling ball with a mass of 7.26 kg would have the same momentum as the baseball.
  
11. A .144 kg baseball is pitched horizontally at 38 m/s. After it is hit by a bat, it moves at 38 m/s in the other direction. What impulse did the bat deliver to the ball?
  
12. Rank the following objects from least to greatest momentum:
  - a. Car with a mass of 1250 kg moving at a velocity of 20 m/s
  - b. Car with a mass of 1210 kg moving at a velocity of 40 m/s
  - c. Truck with a mass of 6050 kg moving at a velocity of 10 m/s
  - d. Car with a mass of 1500 kg moving at a velocity of 28 m/s