



Physics Olympiad and Problem Solving Programs  
N210 - Introductory Physics Olympiad  
Problem Set 8.1 - Impulse and Momentum Solutions

Name:

Date:

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1. What is the friction force acting on a 50-kg carton sliding at 4 m/s if it stops in 3 s?
2. How fast must a small car with a mass of 800 kg be moving in order to have the same momentum as a large truck with a mass of 2,000 kg moving at 20 m/s?
3. A 2.5 kg ball strikes a wall with a velocity of 8.5 m/s to the left. The ball bounces off with a velocity of 7.5 m/s to the right. If the ball is in contact with the wall for 0.25 s, what is the constant force exerted on the ball by the wall?
4. Brian punts a 0.55kg football which accelerates from rest to a speed of 8.0 m/s in 0.25 s. What constant force does Brian exert on the ball?
5. A 0.15 kg baseball moving at 26 m/s is slowed to a stop by a catcher who exerts a constant force of -390 N. How long does it take this force to stop the ball? How far does the ball travel before stopping?
6. A tennis player places a 55 kg ball machine on a frictionless surface. The machine fires a 0.057 kg tennis ball horizontally with a velocity of 36 m/s toward the north. What is the final velocity of the machine?
7. A 3 kg rifle, which is initially at rest, contains a bullet with a mass of 0.03 kg. The bullet is fired from the rifle at a speed of 300 m/s toward the east. What is the recoil velocity of the rifle?
8. (SAT) A hockey puck is sliding on the ice with a momentum of 5 kg m/s when it is struck by a hockey stick giving it an impulse of 100 N s in the direction of motion of the puck. Afterward, the momentum of the puck is  
(A) 500 kg m/s    (B) 105 kg m/s    (C) 100 kg m/s    (D) 50 kg m/s    (E) 20 kg m/s
9. (SAT) A cannonball is fired from a cannon so that the cannon recoils backward as the ball is fired forward. Which of the following statement is true?  
(A) The velocity of the cannonball is equal and opposite to the velocity of the cannon.  
(B) The mass of the cannonball is equal and opposite to the velocity of the cannon.  
(C) The momentum of the cannonball must be greater than the magnitude of the momentum of the canon.  
(D) The momentum of the cannon must be equal to the magnitude of the momentum of the cannonball.  
(E) The momentum of the cannon must be greater than the magnitude of the momentum of the cannonball.
10. (SAT) A 5,000 kg railroad car collides and sticks to a stationary railroad car of mass 7,000 kg and they move off together with a speed of 5 m/s. What was the speed of the 5,000 kg car before the collision?  
(A) 5 m/s    (B) 12 m/s    (C) 14 m/s    (D) 35 m/s    (E) 60 m/s