

Name: \_\_\_\_\_

**Worksheet 4.3 Momentum, Impulse, Conservation of Momentum**

**Impulse**

1. A rocket at rest with a mass of  $9.5 \times 10^3$  kg is acted on by an average net force of  $1.5 \times 10^5$  N upwards for 15 s. What is the final velocity of the rocket?
2. A 26.3 kg object is traveling at 21.0 m/s north. What average net force is required to bring this object to a stop in 2.60 s?
3. An average force of 31.6 N south is used to accelerate a 15.0 kg object uniformly from rest to 10.0 m/s. What is the change in momentum?
4. An average net force of 25.0 N acts north on an object for  $7.20 \times 10^{-1}$  s. What is the change in momentum of the object?
5. A 5.00 kg object accelerates uniformly from rest to a velocity of 15.0 m/s east. What is the change in momentum on the object?
6. An average net force caused an 11.0 kg object to accelerate uniformly from rest. If this object travels 26.3 m west in 3.20 s, what is the change in momentum of the object?
7. A 1.30 kg object is dropped from a height of 6.5 m. How far did the object fall when its momentum is 6.0 kgm/s?
8. An average net force of 16.0 N acts on an object for  $2.00 \times 10^{-1}$  s causing it to accelerate from rest to 3.50 m/s. What is the mass of the object?
9. A 0.500 kg object is thrown vertically upward with an average applied force of 8.20 N by a student. The force is applied through a displacement of 1.50 m.
  - a. What is the average net force acting on the object?
  - b. What is the velocity of the object when it leaves the student's hand? (Assume initial velocity is zero)

1) 237 m/s 2) 212 N south 3) 150 Ns south 4) 18 Ns north 5) 75 Ns 6) 181 Ns west 7) 1.1 m 8) 0.91 kg 9)a. 3.30 N b. 4.4 m/s

**Conservation of Momentum**

1. A 1.0 kg ball hits the floor with a velocity of 2.0 m/s. If the ball bounces up with a velocity of 1.6 m/s, what is the ball's change in momentum?  
(3.6 kgm/s)
2. A 0.144 kg baseball is pitched horizontally at + 38 m/s. The batter hits a horizontal line drive at – 38 m/s (the opposite direction!). What is the ball's change in momentum?  
(- 10.9 kgm/s)
3. The 800 kg physics dragster is traveling at 35 km/h east when it hits the gas and accelerates at  $12.5 \text{ m/s}^2$  for 3.25 s. What is its change in momentum during this time?  
(32500 kgm/s)
4. A 30.0 kg object moving to the right at a velocity of 1.00 m/s collides with a 20.0 kg object moving to the left with a velocity of 5.00 m/s. If the 20.0 kg object continues to move to the left at a velocity of 1.25 m/s, what is the velocity of the 30.0 kg object?  
(1.50 m/s left)
5. A  $4.50 \times 10^3$  kg railway car is moving east at a velocity of 5.0 m/s on a level frictionless track when it collides with a stationary  $6.50 \times 10^3$  kg caboose. If the two cars lock together upon impact, how fast are they moving after collision?  
(2.0 m/s east)
6. A 925 kg car moving at a velocity of 18.0 m/s right collides with a stationary truck of unknown mass. The two vehicles lock together and move off at a velocity of 6.50 m/s. What is the mass of the truck?  
(1640 kg)
7. A 50.0 g bullet strikes a 7.00 kg wooden block. If the bullet becomes imbedded in the block and they both move off at a velocity of 5.00 m/s, what was the initial velocity of the bullet?  
(705 m/s)
8. A 40.0 g hot dog moving with a velocity of 9.00 m/s to the right collides with a 55.0 g hot dog bun with a velocity of 6.00 m/s to the left. If the two objects stick together upon collision, what is the velocity of the combined masses?  
(0.316 m/s right)
9. A 76 kg student, standing at rest on a frictionless surface throws a 0.20 kg cream pie horizontally at 22 m/s at her friend who is standing to the student's left. What was the velocity of the student after she threw the pie?  
(0.058 m/s right)
10. A 25 kg turkey is fired from a  $1.1 \times 10^3$  kg turkey launcher. If the horizontal velocity of the turkey is 325 m/s east, what is the recoil velocity of the launcher?  
(7.4 m/s west)
11. A vehicle with a rocket engine is being tested on a smooth track. Starting from rest the engine is fired for a short period of time, releasing  $4.5 \times 10^2$  kg of gases. It is estimated that the average velocity of the gases is  $1.4 \times 10^3$  m/s to the right, and that the maximum velocity of the vehicle is 45 m/s left. What is the mass of the vehicle?  
( $1.4 \times 10^4$  kg)