8.00 m? (0.048 s)

**Worksheet 4.3 – Law of Conservation of Momentum**

1. You are doing a space walk outside the International Space Station, with no cable between you and the station. Your small maneuvering rocket pack suddenly quits on you! You are stranded in space with nothing but a $100,000 camera. What will you do to get back to the space station?
2. 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. 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?
4. The 800 kg physics dragster is traveling at 35 km/h east when it hits the gas and accelerates at 12.5 m/s2 for 3.25 s. What is its change in momentum during this time?
5. 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?
6. A 4.50 x 103 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 x 103 kg caboose. If the two cars lock together upon impact, how fast are they moving after collision?
7. 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?
8. 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?
9. 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?
10. A 76 kg student, standing at rest on a frictionless surface throws a 0.20 kg cream pie horizontally at 22 m/s at Mr. Lawson who is standing to the student’s left. What was the velocity of the student after they throw the pie?
11. A 25 kg turkey is fired from a 1.1 x 103 kg turkey launcher. If the horizontal velocity of the turkey is 325 m/s east, what is the recoil velocity of the launcher?
12. 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 x 102 kg of gases. It is estimated that the average velocity of the gases is 1.4 x 103 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?

Answers:

1. Throw the camera in the OPPOSITE direction of the station!
2. (3.6 kgm/s)
3. (- 10.9 kgm/s)
4. (32500 kgm/s)
5. (1.50 m/s left)
6. (2.0 m/s east)
7. (1640 kg)
8. (705 m/s)
9. (0.316 m/s right)
10. (0.058 m/s right)
11. (7.4 m/s west)
12. (1.4x104 kg)

A rocket at rest with a mass of 9.5 x 103 kg is acted on by an average net force of 1.5 x 105 N upwards for 15 s. What is the final velocity of the rocket?

**Worksheet 4.3 - Impulse**

1. 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?
2. 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?
3. An average net force of 25.0 N acts north on an object for 7.20 x 10-1 s. What is the change in momentum of the object?
4. 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?
5. 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?
6. 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?
7. An average net force of 16.0 N acts on an object for 2.00 x 10-1 s causing it to accelerate from rest to 3.50 m/s. What is the mass of the object?
8. 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. What impulse is needed to change the speed of a 10.0 kg body from 20.0 m/s to 12.0 m/s in a time of 5.0 s? What force is needed to do this?

1) 212 N south 2) 150 Ns south 3) 18 Ns north 4) 75 Ns 5) 181 Ns west 6) 1.1 m 7) 0.91 kg 8) a. 3.30 N b. 4.4 m/s 9) -80. Ns , F = -16 N