

Problems of Momentum and Collisions

1) An 117 kg astronaut tries to push on an 1460 kg satellite. The astronaut gives the satellite a speed of 6.5 m/s. How fast is the astronaut moving?

Answer: -81.1 m/s.

2) A 435 g soccer ball is rolling on the ground at 2.2 m/s. A soccer player kicks the ball, giving it a velocity of 14 m/s.

a) Find the impulse given to the ball by the player.

b) If the player's foot was in contact with the ball for 0.33 s, what force did the player put on the ball?

Answer: a) 7.05 N·s b) 21.4 N.

3) An 104 kg rock is blasted into pieces. One piece is moving at 9 m/s and has a mass of 26 kg. Find the speed of the other piece.

Answer: 3 m/s.

4) A 620 kg cannon that rests on a frictionless surface fires a 20 kg cannonball at 465 m/s. With what velocity does the cannon recoil?

Answer: -15 m/s.

5) An 1120 kg car travels at a constant speed of 29 m/s. Other car has a mass of 1730 kg and travels toward the first car at 11 m/s.

a) Find the momentum of each car.

b) Find the total momentum of both cars.

c) The two cars stick together after the collision. At what speed will they travel after the collision?

Answer: a) 32480 kg·m/s, -19030 kg·m/s b) 13450 kg·m/s c) 4.72 m/s.

6) A 27 kg mass moving at 15 m/s collides with a stationary 9 kg mass. After the collision, both the 27 kg and the 9 kg mass move off in the same direction. Calculate the speed of the 27 kg mass if the 9 kg mass is moving at 33 m/s.

Answer: 4 m/s.

7) In a collision, an 18 kg mass moving at 42 m/s transfers all of its momentum to a 21 kg mass. Find the velocity of the 21 kg mass after the collision.

Answer: 36 m/s.

8) A 0.385 kg projectile is fired with a velocity of 600 m/s at a 2 kg wooden block that rests on a frictionless table. The speed of the block immediately after the projectile passes through it is 44 m/s. Calculate the speed with which the projectile exits from the block.

Answer: 371 m/s.

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9) A 73 kg man, running horizontally at 5.2 m/s, jumps onto a 30 kg sled that rests on a frictionless table. Calculate the speed of the sled and man just after the collision.

Answer: 3.69 m/s.