

**Impulsive Force Model Worksheet 2: Quantitative Conservation of Momentum**

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

1. Kim holds a 2.0 kg air rifle loosely and fires a bullet of mass 1.0 g. The muzzle velocity of the bullet is 150 m/s. Find the recoil speed of the gun.

Momentum conservation equation:

Recoil speed = \_\_\_\_\_

2. If the girl in the previous question holds the gun tightly against her body, the recoil speed is less. Calculate the new recoil speed for the 48 kg girl.

Momentum conservation equation:

Recoil speed - \_\_\_\_\_

3. In a freight yard a train is being put together from freight cars. An empty freight car, coasting at 10 m/s, strikes a loaded car that is stationary, and the cars couple together. Each of the cars has a mass of 3000 kg when empty, and the loaded car contains 12,000 kg of canned soda (a year's supply for the Physics class). Find the speed of the two coupled railcars.

Momentum conservation equation:

Speed = \_\_\_\_\_

4. An astronaut of mass 80. kg carries an empty oxygen tank of mass 10. kg. He throws the tank away from himself with a speed of 2.0 m/s. Find the speed with which he moves off into space.

Momentum conservation equation:

Speed = \_\_\_\_\_

5. A tennis player returns a 30. m/s serve straight back at 25. m/s, after making contact with the ball for 0.50 s. If the ball has a mass of 0.20 kg, what is the force she exerted on the ball?

Equation:

Force = \_\_\_\_\_

6. A 50. kg cart is moving across a frictionless floor at 2.0 m/s. A 70. kg boy, riding in the cart, jumps off so that he hits the floor with zero velocity.

Momentum conservation equation:

a. How large an impulse did the boy give to the cart? \_\_\_\_\_

b. What was the velocity of the cart after the boy jumped? \_\_\_\_\_