Example Problems – momentum & impulse

1. A rifle has a mass of 4 kg. The rifle fires a 20-g bullet that leaves the muzzle of the rifle at 600 m/s. What is the speed and direction of the rifle after firing the bullet?

2. A 10-kg cart is rolling right at 3 m/s toward a person. The person throws a 0.2-kg ball toward the cart at 20 m/s. The ball hits the cart and rebounds off the cart back toward the person at 12 m/s. What is the speed and direction of the cart after the ball hits the cart?

3. A 60-kg sled (sled A) is moving at 2 m/s. A 40-kg sled (sled B) is moving toward sled A at 4 m/s. The sleds collide and stick together as a result of the collision.

The collision between the two sleds lasts for 1.5 seconds.

(a) What is the speed and direction of the sleds after the collision?

(b) What impulse did sled B impress on sled A?

(c) What impulse did sled A impress on sled B?

(d) What average force did sled B apply to sled A?

(e) What average force did sled A apply to sled B?

4. A 10-g bullet is moving at 600 m/s when it strikes a stationary 10-kg block of wood. Calculate the speed and the direction of the block of wood after the bullet strikes the block under the following conditions:

(a) The bullet passes straight through the wood, exiting with a speed of 200 m/s.

(b) The bullet sticks into the wood.

(c) The bullet passes straight through the wood, exiting with a speed of 200 m/s

and in the process knocks off a 2-kg piece of wood that moves in the

direction of the bullet at 10 m/s.

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