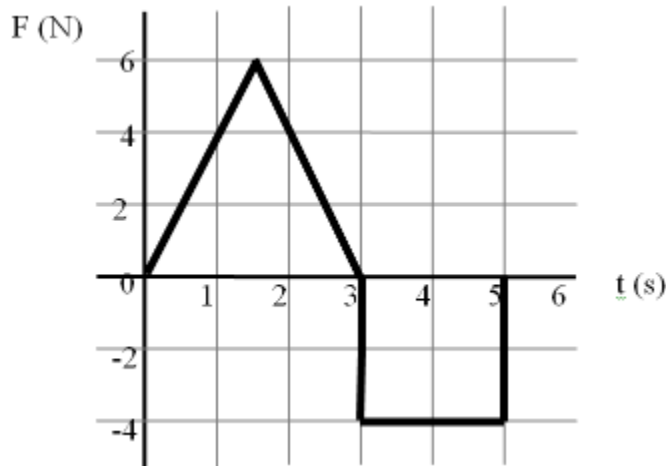**Momentum test review**

1. What is momentum? When do you see it?

2. Define the law of conservation of momentum. When do you see it?

3. What is impulse? What are 2 ways you can calculate it?

4. What is the total impulse of an object described in the graph below? (1 Ns)

5. If the object in the graph above has a mass of 0.50 kg, what is its change in velocity? (2 m/s)

6. An arrow is shot through an apple. If the 0.15 kg arrow changes speed from 35 m/s to 25 m/s and the apple goes from rest to a speed of 3.0 m/s during the collision, what is the mass of the apple? (0.50 kg)

7. A bat striking a 0.125 kg baseball is in contact with the ball for a time of 0.030 seconds.   The ball travels in a straight line as it approaches and then leaves the bat. If the ball arrives at the bat with a speed of 14.5 m/s and leaves with a speed of 16.5 m/s in the opposite direction, what is the magnitude of the average force acting on the ball? (130 N)

8. A 50 kg skater at rest on a frictionless rink throws a 2 kg ball, giving the ball a velocity of 20 m/s. What is the subsequent motion of the skater? (0.8 m/s in the opposite direction of the ball)

9. A force of 540 N is used to stop a car with a mass of 65 kg moving 175 m/s. How long will it take to bring the object to a complete stop? (21 s)

10. A ball with a mass of 12 kg moving at 15 m/s collides with a second ball of 36 kg moving at 5.0 m/s. After the collision, the 12 kg ball moves at 6.0 m/s. What is the velocity of the 36 kg ball? (8.0 m/s)

11. Two balls roll *toward* each other. The red ball has a mass of 0.50 kg and a speed of 4.0 m/s just before impact. The green ball has a mass of 0.30 kg and a speed of 2.0 m/s. What are the new velocities of the balls? (v_{red} = -.50 m/s, v_{green} = 5.5 m/s)

12. A raft of mass 180 kg carries one swimmer of mass 51 kg . The raft is initially floating at rest. The swimmer dives off one end of the raft with a horizontal velocity of 3.0 m/s. With what velocity and in what direction does the raft start to move? (0.85 m/s in opposite direction from swimmer)

13. In the problem above, how long will it take the raft to travel 13 m? (15 s)

14. You throw a tennis ball at a box filled with newspaper. This time, though, the box is not on a table but suspended from the ceiling. Once the ball enters the box, the box swings upward (like a ballistic pendulum). The mass of the tennis ball is 0.058 kg and is thrown with a velocity of 9.3 m/s. The box and paper together have a mass of 1.4 kg. How high above resting will the box rise? (0.0066 m)