1. A 780 N force is applied to a 300 g ball moving at 18 m/s. The force is exerted for 45 milliseconds.
    a. How much does the ball weigh?
    b. If the force is in a direction opposite to the initial velocity of the ball, find the final speed of the ball?
    c. What is the acceleration of the ball during the collision?
    d. By what factor would the velocity change if the force applied to the book was doubled?

2. The Dynamic Duo Claude and Maude are performing in the final round of the *Championnat de France Elite*. Maude begins by skating into Claude, who is standing still. After the collision they move off together with a momentum of 960 N•s to the right. Assume that Maude has a mass of 55 kg and Claude has a mass of 65 kg.
    a. What is the skaters final velocity?
    b. What was the skaters' total final momentum? Show or explain how you got your answer.
    c. What was the skaters' total initial momentum? Show or explain how you got your answer.
    d. Calculate Maude's initial velocity.
    e. What type of collision is this?

3. Claude and Maude's rivals, Damian and Amy Anne, whip around the ice rink with a stunning display of speed and agility. Assume that Damian has a mass of 55 kg and Amy Anne has a mass of 75 kg. They ramp up to do their signature trick, "The Collision," in which they demonstrate the conservation of momentum to all of their loving fans. Amy Anne starts skating towards Damian at -3 m/s. In the audience, Damian's mom records his velocity using a sonic detector (like we did in the lab). Data that Damian's mom took before and after the collision is shown below.

Damian's Motion During "The Collision"

Velocity *v* (m/s) vs. Time *t* (s)
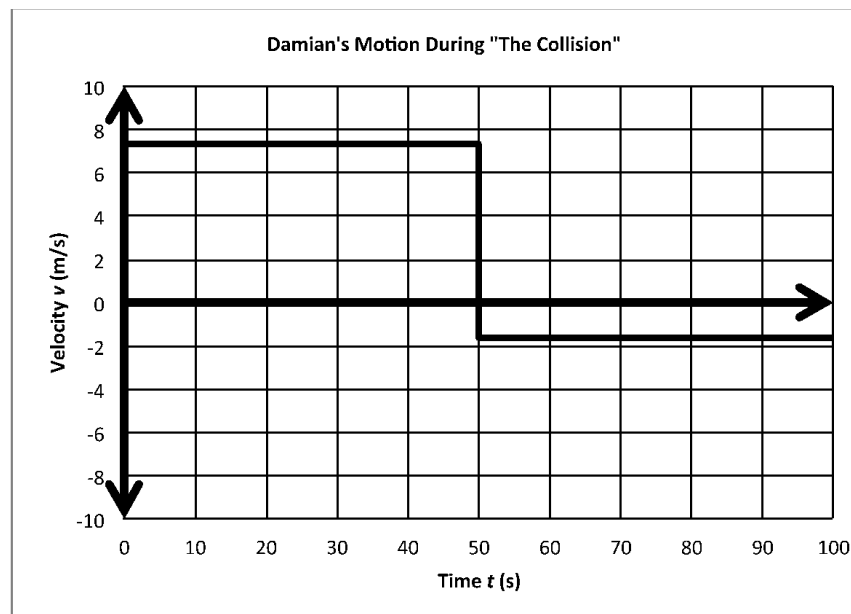
    a. What was Damian's initial velocity?

    b. What was Damian's final velocity?

    c. Calculate Damian's initial momentum.

    d. Calculate the total final momentum.

    e. Calculate Amy Anne's final velocity.

    f. What is the impulse on Amy Ann?

    g. What type of collision is this?

4. A bullet (5 g) is shot at 900 m/s into a block of wood (8 kg) sitting in the middle of a parking lot.

    a. How fast is the bullet/block moving immediately after the collision?

    b. Sketch the FBD of the bullet/block immediately after the collision.

    c. If the force of friction on the block is 9 N, how far will it move across the parking lot before it comes to rest?

    d. Would you expect your answer to part c increase, decrease or stay of air resistance was taken into account? Explain why.

5. A baseball (150 g) that weighs 1.47 N is thrown into the air and takes about 3 seconds to reach its maximum height.

    a. How high did the baseball go?

    b. How much force would the ball exert on the ground if it takes .01 of a second to come to a stop?

6. A bowling ball (7 kg) is dropped from a helicopter 500 m in the air. The bowling ball lands on a large spring on the ground.

    a. What is the momentum of the bowling ball right as it hits the spring?

    b. If the ball hits the spring and rebounds to a height of 200 m, what was the impulse on the ball?

    c. How much force did the spring exert on the ball if the impact lasted .2 seconds?