Momentum and Impulse

A. What is momentum?

Example 1: A 5.0 kg bowling ball has a speed of 4.0 m/s to the right.

  a) Find the momentum of the bowling ball.
  b) What is the ball's change in momentum if a force is applied to bring it to rest?

## B. What can be learned about momentum from Newton's second law?

C. Impulse

Example 2: The bowling ball from Example 1 is brought to rest by applying a force that has a magnitude of 10 N for 2.0 s.

  a) Calculate the impulse on the ball.
  b) What other combination of force and time interval would provide the same impulse?

D. Momentum Principle

Example 3: Justin Case is sitting at rest on a skateboard (combined mass of 65 kg) with a 4.0 kg bowling ball in front of him. He pushes on the bowling ball with an average force of 8.0 N for 1.0 second. (Assume friction is negligible.)

1. Draw velocity vectors on the Before and After pictures. Draw force vectors on the Event picture.

| **Before** | **Event** | **After** |
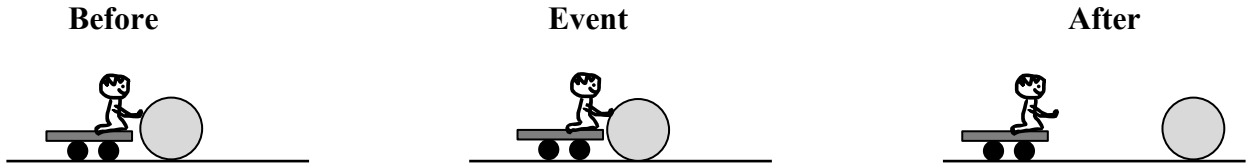
2. For each different choice of system, find the impulse on the system, the final momentum of the system, and the final velocity. Draw a momentum bar chart.

   A . System: <u>Ball</u>
   Net external force on system? _____ Is momentum of the system constant? _____

   B. System: <u>Justin with Skateboard</u>
   Net external force on system? _____ Is momentum of the system constant? _____