

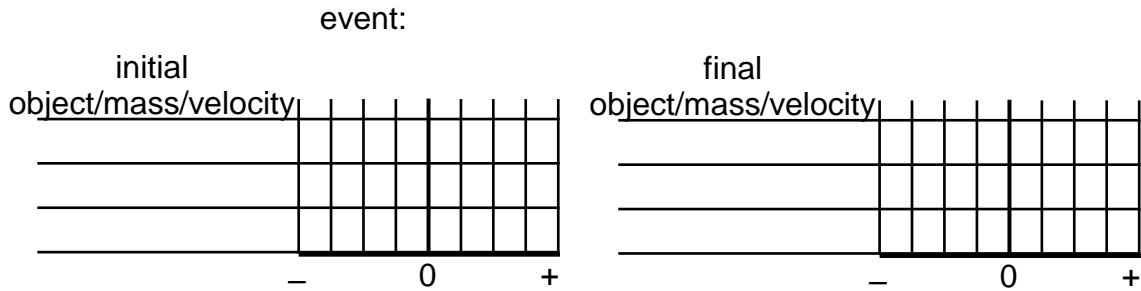
IB Physics – Unit 10 Worksheet 2:

- Two objects, A & B, have identical velocities. Object A has 3 times the mass of object B.
 - Find the value of the ratio of momentum A to momentum B. Justify your answer.
 - Find the value of the ratio of kinetic energy A to kinetic energy B. Justify your answer.
- Two objects, C & D, have the same momentum. Object C has $\frac{1}{2}$ the mass of object D.
 - Find the value of the ratio of velocity C to velocity D. Justify your answer.
 - Find the value of the ratio of kinetic energy C to kinetic energy D. Justify your answer.
- The following questions refer to the motion of a baseball.
 - While being thrown, a net force of 132 N acts on a baseball (mass = 140 g) for a period of 4.5×10^{-2} sec. What is the magnitude of the change in momentum of the ball?
 - If the initial speed of the baseball is $v = 0.0$ m/s, what will its speed be when it leaves the pitcher's hand?
 - When the batter hits the ball, a net force of 1150 N, opposite to the direction of the ball's initial motion, acts on the ball for 9.0×10^{-3} s during the hit. What is the final velocity of the ball?
 - How large is the force the ball exerts on the bat? Explain.

4. A rocket, weighing $4.36 \times 10^4 \text{N}$, has an engine that provides an upward force of $1.2 \times 10^5 \text{N}$. It reaches a maximum speed of 860 m/s .
 - a. Draw a force diagram for the rocket.
 - b. For how much time must the engine burn during the launch in order to reach this speed?

5. A golf ball that weighs 0.45 N is dropped from a height of 1.0 m . Assume that the golf ball has a perfectly elastic collision with the floor.
 - a. Construct a motion map for the golf ball from the time it is dropped until it reaches its highest point of rebound.
 - b. Determine the time required for the ball to reach the floor.
 - c. What will the instantaneous momentum of the golf ball be immediately *before* it strikes the floor?
 - d. What will be the change in momentum, (Δp) from the instant before the ball collides with the floor until the instant after it rebounds from the floor? (Illustrate with a vector diagram.)
 - e. Suppose that the golf ball was in contact with the floor for $4.0 \times 10^{-4} \text{ s}$. What was the average force on the ball while it was in contact with the floor?

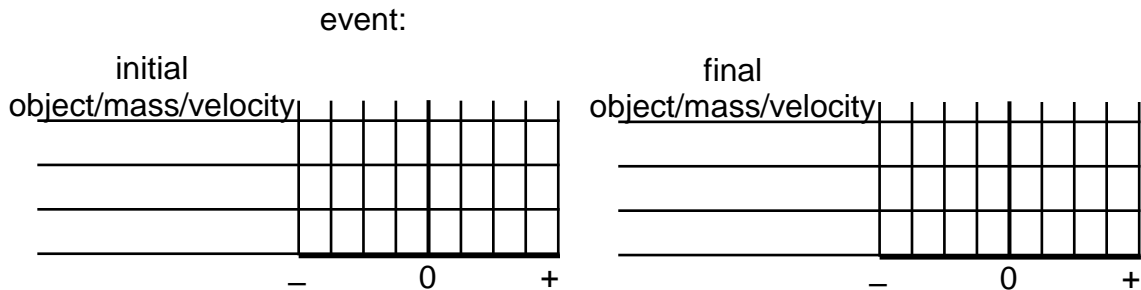
6. In a railroad yard, a train is being assembled. An empty boxcar, coasting at 3.0 m/s, strikes a loaded car that is stationary, and the cars couple together. Each of the boxcars has a mass of 9000 kg when empty, and the loaded car contains 55,000 kg of lumber.
- a. Complete the momentum conservation diagram.



b. Momentum conservation equation:

c. Find the speed of the coupled boxcars.

7. An astronaut of mass 80.0 kg carries an empty oxygen tank of mass 10.0 kg. By pushing the tank away with a speed of 2.0 m/s, the astronaut recoils in the opposite direction.
- a. Complete the momentum conservation diagram.



b. Momentum conservation equation:

c. Find the speed with which the astronaut moves off into space.