

Name: _____ Date: _____

m_r^β **Physics Practice: Momentum and impulse**

As before, some of the exercises can use done by simulating collisions using the computer (see <http://www.mrbenson.org/momentum-and-collisions-in-one-dimension/>).

1. Railroad car A is sitting on the tracks, not moving. Railroad car B is rolling towards A. Consider two scenarios: in the first scenario, B strikes A, and B bounces backward. In the second scenario, B strikes A, and stops. In which scenario is A moving faster after the collision? Explain your answer using what you know about momentum.

2. A 3kg blue cube is moving 10m/s and a 6kg red cube is moving -20m/s. Find the momentum of each before and after an elastic collision. What is the impulse experienced by each?

3. A 3kg blue cube is moving 10m/s and a 6kg red cube is moving -20m/s. What is the impulse experienced by each during an inelastic collision?

4. An 8kg blue cube is moving 10m/s and an 8kg red cube is stationary. What is the impulse experienced by each during an elastic collision?

5. What do you notice about the impulses in problems 2-4?

6. Recall that when an object is being accelerated, $\Delta\vec{v} = \vec{a}_{\text{average}}\Delta t$. In other words, the change in velocity is the average acceleration times the length of time the object was accelerated. Multiply both sides of that equation by mass m . Interpret your equation in terms of momentum, force, and time.

7. A baseball with a mass of 142.5 grams is traveling 40 m/s when it is struck by a bat, and 0.8 milliseconds later, the ball leaves the bat traveling in the opposite direction at 60 m/s. Answer the following questions.

a. What is the momentum of the baseball approaching the bat?

b. What is the impulse experienced by a baseball being struck by the bat?

c. What is the average force experienced by the baseball while it is being struck?

d. What is the average acceleration experienced by the baseball while it is being struck?

e. How many g 's did the baseball experience?

f. Did the bat experience the same acceleration in the opposite direction? Explain.
