

## CONSERVATION OF MOMENTUM

**Instructions:** Show your work completely in your journal when answering the following questions.

1. Timmy and Tommy are playing billiards. A billiard ball (mass = 0.15 kg) is moving at  $1.0 \text{ m/s}$ . It rebounds from a side cushion with the same speed.
  - a. What was the ball's change in momentum? (Note: Be sure to designate which direction is "positive" and "negative.")
  - b. How is momentum conserved in this collision?
2. Kenny is doing an experiment. He has a 4.0 kg mass moving at  $3.0 \text{ m/s}$  toward the right and a 6.0 kg mass moving at  $2.0 \text{ m/s}$  to the left on a horizontal frictionless table. If the two masses collide and remain together after the collision, what is their final momentum?
3. Scotty Smalls is playing with his new train set. A toy train car with a mass of 200. g and a velocity of  $0.80 \text{ m/s}$  collides with a second car that is at rest and has equal mass. The two cars couple together.
  - a. Assuming no friction, what is the velocity of the 2 cars after collision?
  - b. What is the momentum of the 2-car system before and after the collision?
  - c. The two moving cars above collide with a 3<sup>rd</sup> car, mass of 150 g (at rest), and couple together. What is the resulting velocity of the 3 cars?
  - d. What is the momentum before and after the collision?
4. A Squints is on a sled (total mass 45 kg) being pulled by Benny so that the sled goes from rest to  $4.5 \text{ m/s}$ .
  - a. If the force applied is 40. N, what is the total distance covered during the impulse?
  - b. What is the change in momentum of the child and sled? Is momentum conserved? Explain...
5. Ham and Bertram are at the rail yard. A 1200 kg railroad car travels alone on a level frictionless track with a constant speed of  $18 \text{ m/s}$ . A 5750 kg additional load is dropped (initially at rest) onto the car. What will the cars speed be after the additional cargo is added?
6. Yeah-Yeah joins his friends at the rail yard and sees a 9500 kg boxcar traveling at  $16 \text{ m/s}$  that strikes a second car at rest. The two stick together and move off with a speed of  $6.0 \text{ m/s}$ . What is the mass of the second car?