Momentous Moments Name:_____ Block:_____ Date:_____

1. Gymnasts always perform on padded mats. Use the impulse-momentum theorem to discuss how these mats protect the athletes.

2. A 2.5 kg ball strikes a wall with a velocity of 8.5 m/s to the left. The ball bounces off with a velocity of 7.5 m/s to the right. If the ball is in contact with the wall for 0.25 s, what is the force exerted on the ball by the wall?

Ans:

3. A 0.15 kg baseball moving at +26 m/s is slowed to a stop by a catcher who exerts a constant force of –390 N. How long does it take this force to stop the ball? How far does the ball travel before stopping?

Ans:

Ans:

4. A player places a 55 kg tennis ball launcher on a frictionless surface. The machine fires a 0.057 kg tennis ball horizontally with a velocity of 36 m/s north. What is the recoil velocity of the machine?

Ans:

5. Two carts with masses of 4.0 kg and 3.0 kg, respectively, move toward each other on a frictionless track with speed of 5.0 m/s and 4.0 m/s. The carts stick together after colliding head-on. Find the final speed.

Ans:

Momentous Moments (cont.)

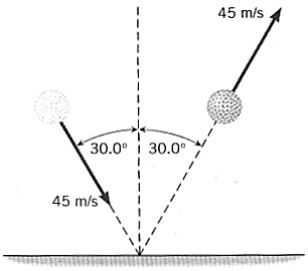
6. A 2150 kg car moving east at 10.0 m/s collides with a 3250 kg car moving east. The cars stick together and move east as a unit after the collision at a velocity of 5.22 m/s. Find the velocity of the 3250 kg car before the collision.

Ans:

7. An 85.0 kg astronaut is working on the engines of a spaceship that is drifting through space with a constant velocity. The astronaut turns away to look at Earth and several seconds later is 30.0 m behind the ship, at rest relative to the spaceship. The only way to return to the ship without a thruster is to throw a wrench directly away from the ship. If the wrench has a mass of 0.500 kg, and the astronaut throws the wrench with a speed of 20.0 m/s, how long does it take the astronaut to reach the ship?

Ans:

8. A golf ball strikes a hard, smooth floor at an angle of 30.0° and, at the drawing shows, rebounds at the same angle. The mass of the ball is 0.047 kg, and its speed is 45 m/s just before and after striking the floor. What is the magnitude of the impulse applied to the golf ball by the floor?



Ans:

9. A 5.00 kg ball, moving to the right at a velocity of +2.00 m/s on a frictionless table, collides head-on with a stationary 7.50 kg ball. Find the final velocity of the second ball if the collision is elastic and the first ball stops, and find the final velocity of the balls if the collision is totally inelastic.

Ans:

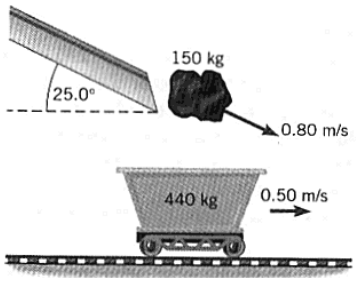
Ans:

Momentous Moments (cont.)

10. Three guns are mounted on a circle, 120.0° apart. They are aimed at the center of the circle, and each fires a bullet simultaneously. One bullet has an unknown mass and a speed of 575 m/s. The other two bullets have the same mass of 4.50×10^{-3} kg and the same speed of 324 m/s. The bullets collide at the center and mash into a stationary lump. What is the mass of the *magic* bullet?

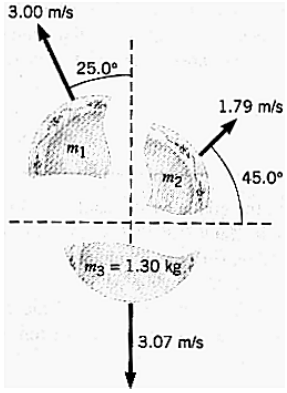
Ans:

11. A mine car, whose mass is 440 kg, rolls at a speed of 0.50 m/s on a horizontal track, as the drawing shows. A 150 kg chunk of coal has a speed of 0.80 m/s when it leaves the chute. Determine the velocity of the car/coal system after the coal has come to rest in the car.



Ans:

12. By accident, a large plate is dropped and breaks into three pieces. The pieces fly apart parallel to the floor. As the plate falls, its momentum has only a vertical component, and no component parallel to the floor. After the collision, the component of the total momentum parallel to the floor must remain zero, since the net external force acting on the plate has no component parallel to the floor. Using the data shown in the drawing, find the masses of pieces 1 and 2.



Ans: