Momentum Problem-Solving

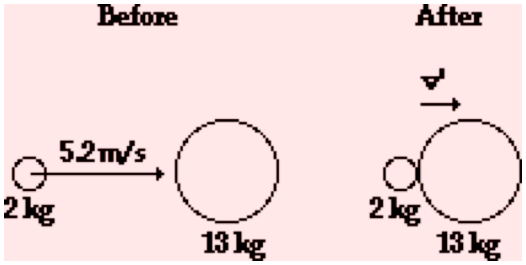
Read from **Lesson 2** of the **Momentum and Collisions** chapter at **The Physics Classroom**:

http://www.physicsclassroom.com/Class/momentum/u4l2d.html
http://www.physicsclassroom.com/Class/momentum/u4l2e.html

MOP Connection: Momentum and Collisions: sublevels 8 and 9

1. Determine the post-collision velocities of the following objects or combination of objects.

a.

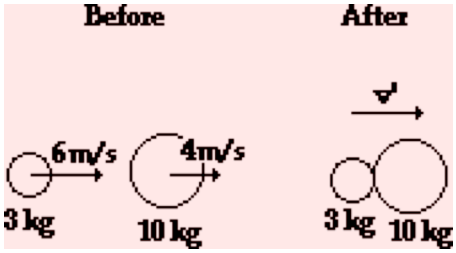


$2(5.2) + 13(0) = 15v'$

$10.4 = 15v'$

$v' = 0.69$ m/s

b.

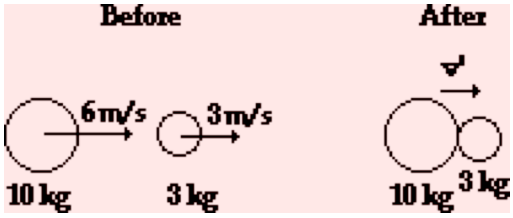


$3(6) + 10(4) = 13v'$

$18 + 40 = 58 = 13v'$

$v' = 4.46$ m/s

c.

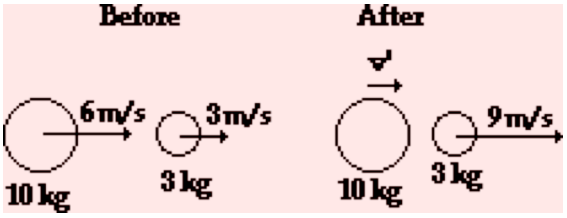


$10(6) + 3(3) = 13v'$

$60 + 9 = 69 = 13v'$

$v' = 5.31$ m/s

d.



$10(6) + 3(3) = 10v' + 3(9)$

$69 = 10v' + 27$

$v' = 4.2$ m/s

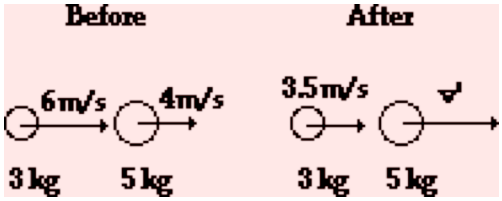
e.

$3(3) + 2(-2) = 3v' + 2(4)$

$9 + -4 = 5 = 3v' + 8$

$v' = -1$ m/s (left)

f.



$3(6) + 5(4) = 3(3.5) + 5v'$

$38 = 5v' + 10.5$

$v' = 5.5$ m/s

As long as your units for mass and velocity are the same on both sides of the equation, you do not have to use "normal metric units."

2. A 2.1-kg brick is placed gently upon a 2.9-kg cart originally moving with a speed of 26 cm/s. Determine the post-collision speed of the combination of brick and cart.

Forward: +

$$2.9(26) = 5 \cdot v'$$

$$v' = 15.08 \text{ cm/s}$$

3. A 98-kg fullback is running along at 8.6 m/s when a 76-kg defensive back running in the same direction at 9.8 m/s jumps on his back. What is the post-collision speed of the two players immediately after the tackle?

Forward: +

$$98(8.6) + 76(9.8) = 174 \cdot v'$$

$$v' = 9.12 \text{ m/s}$$

4. A 0.112-kg billiard ball moving at 154 cm/s strikes a second billiard ball of the same mass moving in the opposite direction at 46 cm/s. The second billiard ball rebounds and travels at 72 cm/s after the head-on collision. Determine the post-collision velocity of the first billiard ball.

Forward: +

$$0.112(154) + 0.112(-46) = 0.112(v') + 0.112(72)$$

$$v' = 36 \text{ cm/s (in its original direction)}$$

5. A 225-kg bumper car (and its occupant) is moving north at 98 cm/s when it hits a 198-kg car (occupant mass included) moving north at 28 cm/s. The 198-kg car is moving north at 71 cm/s after the head-on collision. Determine the post-collision velocity of the 225-kg car.

North: +

$$225(98) + 198(28) = 198(71) + 225(v')$$

$$v' = 60.2 \text{ cm/s, North}$$

6. A 4.88-kg bowling ball moving east at 2.41 m/s strikes a stationary 0.95-kg bowling pin. Immediately after the head-on collision, the pin is moving east at 5.19 m/s. Determine the post-collision velocity of the bowling ball.

East: +

$$4.88(2.41) + 0.95(0) = 4.88(v') + 0.95(5.19)$$

$$v' = 1.4 \text{ m/s, East}$$

