Name: KEY

Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics
DOBBS

Momentum II

1. A 13.0 g marble moving to the right at 16 cm/s gets hit in the back by a 33.0 g marble traveling in the same direction at 29.0 cm/s. After an elastic collision, the 13.0 g marble moves to the right at 24.2 cm/s. Find the *velocity* of the 33.0 g marble after the collision. (remember to give speed and direction)

(1) (2)

$m_1v_{1,i} + m_2v_{2,i} = m_1v_{1,f} + m_2v_{2,f}$

$(.013)(16) + (.033)(29) = (.013)(24.2) + (.033)(V_{2f})$

$.208 + .957 = .3146 + .033\,V_{2f}$

$.8504 = .033\,V_{2f}$

$V_{2f} = 25.77$ cm/s to the right

2. A 19.0 g toy car moving to the right at 20.0 cm/s has an elastic head-on collision with a 30.0 g toy car moving in the opposite direction at 38.0 cm/s. After colliding, the 19.0 g car moves with a velocity of 17.0 cm/s to the left. Find the velocity of the 30.0 g car after the collision.

(1) (2)

$m_1v_{1,i} + m_2v_{2,i} = m_1v_{1,f} + m_2v_{2,f}$

$(.019)(20) + (.03)(-38) = (.019)(-17) + (.03)(V_{2f})$

$-.437 = .03\,V_{2f}$

-14.57 cm/s $= V_{2f}$

14.57 cm/s to the left

(−) ⟷ (+)

3. Playing in the gym, two students try to get two balls to collide by tossing them towards each other in mid-air. One student throws a 0.3 kg volleyball 15 m/s toward the middle, while another throws a .5 kg basketball at 12 m/s. If the volleyball flies backward at 20 m/s, how fast would the basketball fly back?

(1) (2)

$m_1v_{1,i} + m_2v_{2,i} = m_1v_{1,f} + m_2v_{2,f}$

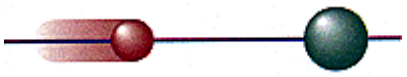
$(.3)(15) + (.5)(-12) = (.3)(-20) + (.5)(V_{2f})$

$4.5 = .5\,V_{2f}$

9 m/s $= V_{2f}$

scalar, no direction

4. A 0.500 kg bead slides on a straight frictionless wire with a velocity of 4.00 cm/s to the right. The bead collides elastically with a larger 0.800 kg bead initially at rest. After the collision, the smaller bead moves to the left with a velocity of 0.70 cm/s. Find the distance the larger bead moves along the wire in the first 7.0 s following the collision. (assume constant velocities)



$m_1 = .5$ kg, $V_{1i} = 4$ cm/s; $m_2 = .8$ kg, $V_{2i} = 0$

$$m_1v_{1,i} + m_2v_{2,i} = m_1v_{1,f} + m_2v_{2,f}$$

$$(.5)(4) + (.8)(0) = (.5)(-.7) + (.8)V_{2f}$$

$$2.35 = .8\,V_{2f}$$

2.9375 cm/s to the right $= V_{2f}$

$$\Delta x = V\,\Delta t$$

$$\Delta x = 2.9375 \cdot 7$$

$$\Delta x = 20.56 \text{ cm}$$

5. ***Pool Question:*** Imagine that a pool player strikes the cue ball at 5 m/s, and it has an elastic head-on collision with an object ball of equal mass that is initially at rest. If the cue ball remains at rest after the collision, what would the speed be of the object ball after the collision? $V_{1f} = 0$

$m_1 = m_2$

$$m_1v_{1,i} + m_2v_{2,i} = m_1v_{1,f} + m_2v_{2,f}$$

$$5 + 0 = 0 + V_{2f}$$

5 m/s $= V_{2f}$