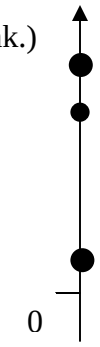
Sample test questions:

Multiple choices: (Only one answer is correct. Please choose the best answer you think.)



1. The drawing shows two 4.5 kg balls located on the y axis at 1.0 and 9.0 m, respectively; a third ball with a mass 2.3 kg is located at 6.0 m. what is the location of the center of mass of this system?

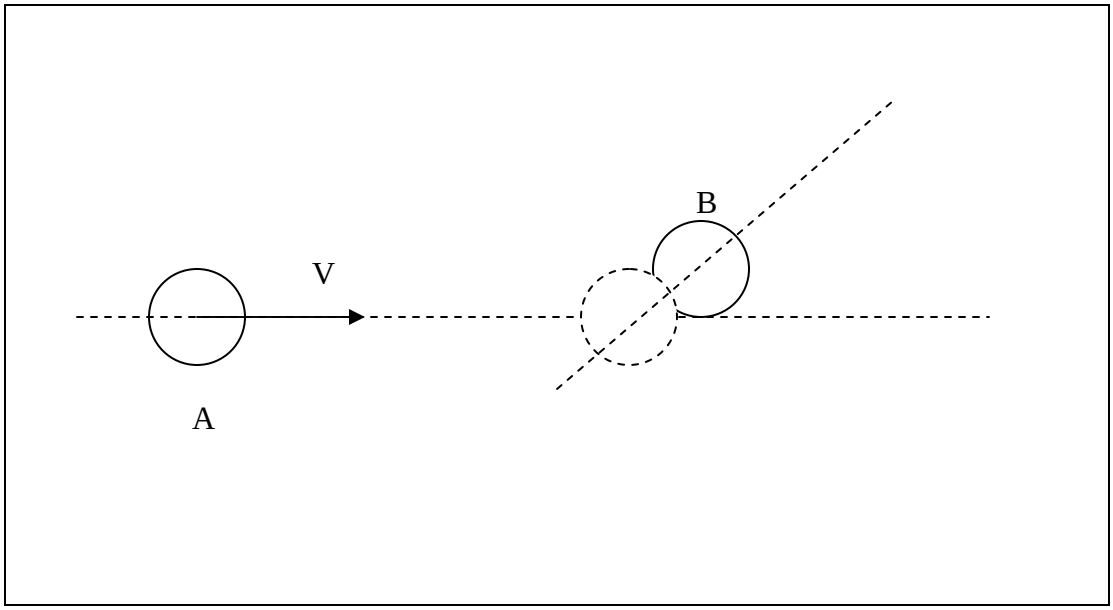
(a) 4.8 m
(b) 5.2 m
(c) 5.6 m
(d) 6.0 m
(e) 6.4 m

2. An object of mass 3m, initially at rest, explodes breaking into two fragments of mass m and 2m, respectively. Which of the following statements concerning the fragments after the explosion is true?

(a) They may fly off at right angles.
(b) They may fly off in the same direction.
(c) The smaller fragment will have twice the speed of the larger fragment.
(d) The larger fragment will have twice the speed of he smaller fragment.
(e) The smaller fragment will have four times the speed of the larger fragment.

Comprehensive questions:

A billiard ball, A, with an initial velocity of 3 m/s collides into a stationary billard B at 30° angle elastically, as shown in the graph. What is the velocity of ball A after collision?



Answer:

1. B
2. C. (conservation of momentum)

Brief Solution:

1.

Since the two billiards had an elastic collision, both momentum and energy were conserved in the process.

For momentum conservation:

$$m_1\ (3m/s) = m_1 v_{1x} + m_2 v_{2x}$$

And

$$0 = m_1 v_{1y} + m_2 v_{2y}$$

using $v_{2x} = v_2 cos30°$, $v_{2y} = v_2 sin30°$, $m_1 = m_2$, one can easily get:

$$3 = v_{1x} + v_2(cos30°)$$

And

$$v_{1y} = -v_2 \sin(30°)$$

Using energy conservation, one has:

$$\frac{1}{2} m_1 (3m/s)^2 = \frac{1}{2} m_1 v_{1x}^2 + \frac{1}{2} m_1 v_{1y}^2 + \frac{1}{2} m_2 v_2^2$$

Plug the previous two expressions into the last equation, one can solve out v_2 as 2.31 m/s

Therefore, v_{1x}=1 m/s and v_{1y}=1.15 m/s.

This is correspondent to a v_1=1.53 m/s at $\tan^{-1}(1.15/1)$=49° downward.