

## Warm Up Question 1

A 0.50 kg ball bounces off a vertical wall. Immediately before hitting the wall, the ball travels horizontally to the right with speed 10 m/s. Immediately after, the ball bounces off horizontally to the left with the same speed. Does the momentum of the ball change or not? Explain your answer.

1. Yes. Direction changes and momentum is a vector.
2. No. Momentum is the same but velocity changes.
3. No. Velocity is constant.
4. No. Momentum is conserved.

# Question 1

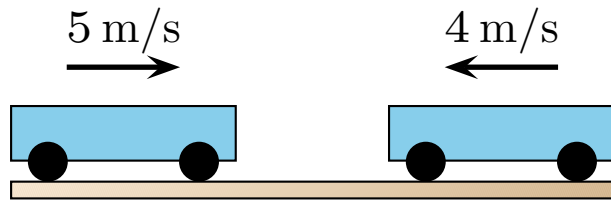
Two pool balls, each with mass  $0.15\text{ kg}$  travel in straight lines directly toward each other with the same speeds,  $10\text{ m/s}$ .

Which of the following is the total momentum of the system of the two balls?

1.  $0.0\text{ kgm/s}$
2.  $1.5\text{ kgm/s}$
3.  $-1.5\text{ kgm/s}$
4.  $3.0\text{ kgm/s}$
5.  $-3.0\text{ kgm/s}$

## Question 2

A 4 kg cart moves to the right with speed 5 m/s. A 6 kg cart moves to the left with speed 4 m/s. The two carts stick together.



Which of the following best describes the carts after the collision?

1. They will be at rest.
2. Both carts will *definitely* move right.
3. Both carts will *definitely* move left.
4. Whether the carts move left or right depends on the severity of the collision.

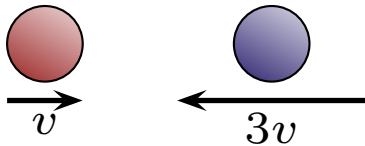
## Warm Up Question 2

A small piece of space debris approaches an astronaut, who is at rest in space. The astronaut would like to catch the debris and remain at rest. He believes that since the debris is very small, he can remain at rest provided that it moves toward him slowly enough. Explain, using momentum whether he is correct or not.

1. Not correct. The momentum of the debris will shift to the astronaut.
2. Not correct. Conservation of momentum. Total momentum is not zero. They must move afterwards.
3. Correct. Such a small object will not affect a larger object.
4. Correct. If the debris moves slow enough.

## Question 3

Two identical hockey pucks approach each other as illustrated and undergo a collision. The *speeds* are indicated.



Assume that the motion of the pucks is entirely horizontal and ignore spin. Which of the following is true regarding the *velocities* of the pucks after the collision?

1.  $v_{\text{red}} = -v$        $v_{\text{blue}} = 3v$
2.  $v_{\text{red}} = v$        $v_{\text{blue}} = 2v$
3.  $v_{\text{red}} = -3v$        $v_{\text{blue}} = v$
4.  $v_{\text{red}} = v$        $v_{\text{blue}} = 3v$