

## **Collisions**

### **Concept Questions**

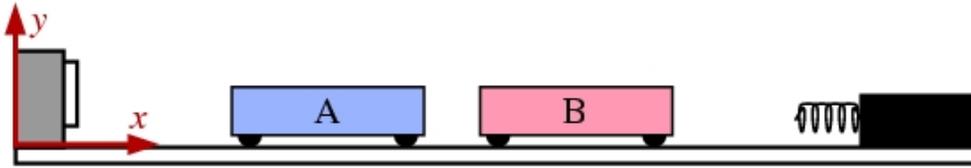
**Question 1** Cart A is at rest. An identical cart B, moving to the right, collides inelastically with cart A. They stick together. After the collision, which of the following is true?

1. Carts A and B are both at rest.
2. Carts A and B moves to the right with speed greater than Cart B's original speed.
3. Carts A and B move to the right with a speed less than cart B's original speed.
4. Cart B stops and cart A moves to the right with speed equal to the original speed of cart B.

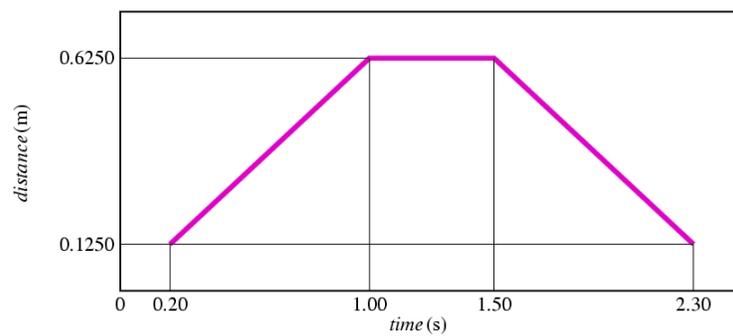
**Question 2** Cart A is at rest. An identical cart B, moving to the right, collides elastically with cart A. After the collision, which of the following is true?

1. Carts A and B are both at rest.
2. Cart B stops and cart A moves to the right with speed equal to the original speed of cart B.
3. Cart A remains at rest and cart B bounces back with speed equal to its original speed.
4. Cart A moves to the right with a speed slightly less than the original speed of cart B and cart B moves to the right with a very small speed.

**Question 3** The figure below shows an experimental setup to study the collision between two carts.



In the experiment cart A rolls to the right on the level track, away from the motion sensor at the left end of the track. The graph below shows the distance from the motion sensor to cart A as a function of time.



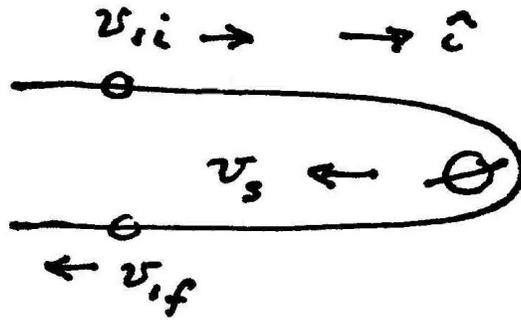
What objects collide when  $t = 1.5$  s?

1. Cart B and the spring.
2. Cart B and the motion sensor.
3. Carts A and B.
4. Cart A and the spring.
5. Cart A and the motion sensor.

**Question 4** Two balls that are dropped from a height  $h_i$  above the ground, one on top of the other. Ball 1 is on top and has mass  $m_1$ , and ball 2 is underneath and has mass  $m_2$  with  $m_2 \gg m_1$ . Ball 2 first collides with the ground and rebounds with speed  $v_0$ . Then, as ball 2 starts to move upward, it collides elastically with the ball 1 which is still moving downwards also with speed  $v_0$ . The final relative speeds after ball 1 and ball 2 collide is

1. Zero
2.  $v_0$
3.  $2v_0$
4.  $3v_0$
5. None of the above.

**Question 5** A spacecraft with speed  $v_{li}$  approaches Saturn which is moving in the opposite direction with a speed  $v_s$ . After interacting gravitationally with Saturn, the spacecraft swings around Saturn and heads off in the opposite direction it approached. The final speed of the spacecraft  $v_{lf}$  after it is far enough away from Saturn to be nearly free of Saturn's gravitational pull is



1.  $v_{li}$
2.  $v_s$
3.  $2v_{li}$
4.  $2v_s$
5.  $v_{li} + v_s$
6.  $v_{li} - v_s$
7.  $v_{li} + 2v_s$
8.  $v_{li} - 2v_s$
9.  $2v_{li} + v_s$
10.  $2v_{li} - v_s$

### Question 6

An explosion splits an object initially at rest into two pieces of unequal mass. Which piece has the greater kinetic energy? Explain your answer.

1. The more massive piece.
2. The less massive piece.
3. They both have the same kinetic energy.
4. There is not enough information to tell.

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