

**cq6-9**

1. CJ6 7.CQ.001. [310898] Two identical automobiles have the same speed, one traveling east and one traveling west. Do these cars have the same momentum?

- yes  
 no

Explain.

2. CJ6 7.CQ.003. [311043] Two objects have the same momentum.

(a) Do the velocities of these objects necessarily have the same directions?

- yes  
 no

Give your reasoning.

(b) Do the velocities of these objects necessarily have the same magnitudes?

- yes  
 no

Give your reasoning.

3. CJ6 7.CQ.004. [311071] (a) Can a single object have kinetic energy but no momentum?

- yes  
 no

Account for your answer.

(b) Can a system of two or more objects have a total kinetic energy that is not zero but a total momentum that is zero?

- yes
- no

Account for your answer.

4. CJ6 7.CQ.007. [310893] An object slides along the surface of the earth and slows down because of kinetic friction. If the object itself is considered as the system, the kinetic frictional force must be identified as an external force that, according to Equation 7.4, decreases the momentum of the system.

(a) If *both* the object and the earth are considered to be part of the system, is the force of kinetic friction still an external force?

- yes
- no

Give your reasoning.

(b) Can the friction force change the total linear momentum of the two-body system?

- yes
- no

Give your reasoning.

5. CJ6 7.CQ.013. [310928] An ice boat is coasting along on a frozen lake. Friction between the ice and the boat is negligible, and so is air resistance. Nothing is propelling the boat. From a bridge someone jumps straight down and lands in the boat, which continues to coast straight ahead.

(a) Does the horizontal momentum of the boat change?

yes

no

Explain your answer.

(b) Does the speed of the boat increase, decrease, or remain the same?

decrease

increase

remain the same

Explain your answer.

6. CJ6 7.CQ.014. [310957] On a distant asteroid, a large catapult is used to "throw" chunks of stone into space. Could such a device be used as a propulsion system to move the asteroid closer to the earth?

yes

no

Explain.