

Critical Thinking Items

8.1 Linear Momentum, Force, and Impulse 9.

Consider two objects of the same mass. If a force of 100 N acts on the first for a duration of 1 s and on the other for a duration of 2 s , which of the following statements is true?

- a. The first object will acquire more momentum.
- b. The second object will acquire more momentum.
- c. Both objects will acquire the same momentum.
- d. Neither object will experience a change in momentum.

10.

Cars these days have parts that can crumple or collapse in the event of an accident. How does this help protect the passengers?

- a. It reduces injury to the passengers by increasing the time of impact.
- b. It reduces injury to the passengers by decreasing the time of impact.
- c. It reduces injury to the passengers by increasing the change in momentum.
- d. It reduces injury to the passengers by decreasing the change in momentum.

11.

How much force would be needed to cause a 17 kg m/s change in the momentum of an object, if the force acted for 5 seconds ?

- a. 3.4 N
- b. 12 N
- c. 22 N
- d. 85 N

8.2 Conservation of Momentum 12.

A billiards ball rolling on the table has momentum \mathbf{p}_1 . It hits another stationary ball, which then starts rolling. Considering friction to be negligible, what will happen to the momentum of the first ball?

- a. It will decrease.
- b. It will increase.
- c. It will become zero.
- d. It will remain the same.

13.

A ball rolling on the floor with momentum \mathbf{p}_1 collides with a stationary ball and sets it in motion. The momentum of the first ball becomes \mathbf{p}'_1 , and that of the second becomes \mathbf{p}'_2 . Compare the magnitudes of \mathbf{p}_1 and \mathbf{p}'_2 .

- a. Momenta \mathbf{p}_1 and \mathbf{p}'_2 are the same in magnitude.
- b. The sum of the magnitudes of \mathbf{p}_1 and \mathbf{p}'_2 is zero.

- c. The magnitude of \mathbf{p}_1 is greater than that of \mathbf{p}'_2 .
- d. The magnitude of \mathbf{p}'_2 is greater than that of \mathbf{p}_1 .

14.

Two cars are moving in the same direction. One car with momentum \mathbf{p}_1 collides with another, which has momentum \mathbf{p}_2 . Their momenta become \mathbf{p}'_1 and \mathbf{p}'_2 respectively. Considering frictional losses, compare $(\mathbf{p}'_1 + \mathbf{p}'_2)$ with $(\mathbf{p}_1 + \mathbf{p}_2)$.

- a. The value of $(\mathbf{p}'_1 + \mathbf{p}'_2)$ is zero.
- b. The values of $(\mathbf{p}_1 + \mathbf{p}_2)$ and $(\mathbf{p}'_1 + \mathbf{p}'_2)$ are equal.
- c. The value of $(\mathbf{p}_1 + \mathbf{p}_2)$ will be greater than $(\mathbf{p}'_1 + \mathbf{p}'_2)$.
- d. The value of $(\mathbf{p}'_1 + \mathbf{p}'_2)$ will be greater than $(\mathbf{p}_1 + \mathbf{p}_2)$.

8.3 Elastic and Inelastic Collisions 15.

Two people, who have the same mass, throw two different objects at the same velocity. If the first object is heavier than the second, compare the velocities gained by the two people as a result of recoil.

- a. The first person will gain more velocity as a result of recoil.
- b. The second person will gain more velocity as a result of recoil.
- c. Both people will gain the same velocity as a result of recoil.
- d. The velocity of both people will be zero as a result of recoil.