

Momentum Concepts 1.

Whenever an interaction occurs in a system, forces occur in equal and opposite pairs. Which of the following do *not* always occur in equal and opposite pairs?



- a) Impulses.
- b) Accelerations.
- c) Momentum changes.
- d) But all of these occur in equal and opposite pairs.
- e) None of these.

2. Strictly speaking, when a cannon is fired, the momentum of the ball compared to the momentum of the cannon is [more][less][the same].



Q. How does this relate the 3rd law with the conservation of momentum?



3. (a)



Which would be more damaging:

Driving into a massive concrete wall, or driving at the same speed into a head-on collision with an identical car traveling toward you at the same speed?

(b)

Car A is on the left. Car B is on the right. If A is moving faster than B, which has more change in momentum? Which suffers more damage?

(c) (After we discuss b in class) If A and B initially were going at the same speed, does your answer in (b) indicate that it is better for A to speed up? To slow down? Come up with a mathematical comparison too.

4.

A massive frog drops vertically from a tree branch onto a skateboard that moves horizontally below. When the frog lands, the skateboard slows, consistent with the conservation of momentum. The *impulse* that slows the skateboard is

- a) the friction force of the frog's feet acting backward on the skateboard \times time during which the speed changes.
- b) equal and opposite to the impulse that brings the frog up to speed.
- c) Both of these.
- d) Neither of these.



5. **Falling on or off a sled.** (a) An empty sled is sliding on frictionless ice when Susan drops vertically from a tree down onto the sled. When she lands, does the sled speed up, slow down, or keep the same speed? (b) Later: Susan falls sideways off the sled. When she drops off, does the sled speed up, slow down, or keep the same speed?

6. A railroad tank car contains milk and rolls at a constant speed along a level track. The milk begins to leak out the bottom. The car then

- (a) slows down.
- (b) speeds up.
- (c) maintains a constant speed.
- (d) Need more information about the rate of the leak.

7. You are lying in bed and want to shut your bedroom door. You have a bouncy "superball" and a blob of clay, both with the same mass. Which one would be more effective to throw at your door to close it?

- (a) The superball.
- (b) The blob of clay.
- (c) Both the same.
- (d) Neither will work.