6 Momentum

Solutions to Chapter 6 Exercises

3. Air bags lengthen the time of impact thereby reducing the force of impact.

4. The extra thickness extends the time during which momentum changes and reduces impact force.

14. Although the impulses may be the same for the two cases, the times of impact are not. When the egg strikes the wall, impact time is short and impact force correspondingly large. The egg breaks. But when the egg strikes the sagging sheet, impact time is long and the force correspondingly small. Doing this makes a nice demonstration of impulse-momentum.

27. To get to shore, the person may throw keys, coins or an item of clothing. The momentum of what is thrown will be accompanied by the thrower's oppositely-directed momentum. In this way, one can recoil towards shore. (One can also inhale facing the shore and exhale facing away from the shore.)

40. This exercise is similar to the previous one. If we consider Bronco to be the system, then a net force acts and momentum changes. In the system composed of Bronco alone, momentum is not conserved. If, however we consider the system to be Bronco and the world (including the air), then all the forces that act are internal forces and momentum is conserved. Momentum is conserved only in systems not subject to external forces.

48. The magnitude of force, impulse, and change in momentum will be the same for each. The Ford Escort undergoes the greater acceleration because its mass is less.

49. Cars brought to a rapid halt experience a change in momentum, and a corresponding impulse. But greater momentum change occurs if the cars bounce, with correspondingly greater impulse and therefore greater damage. Less damage results if the cars stick upon impact than if they bounce apart.

Chapter 6 Problem Solutions

3. From $Ft = \Delta mv$, $F = \frac{\Delta mv}{t}$ = [(75 kg)(25 m/s)]/0.1 s = **18,750 N**.

9. By momentum conservation,
asteroid mass × 800 m/s = Superman's mass × Δv.
Since asteroid's mass is 1000 times Superman's,
$(1000m)(800 \text{ m/s}) = mv$
v = **800,000 m/s**. This is nearly 2 million miles per hour!