PHYS 1200 Physics of Everyday Experience

Review questions and exercises for Lecture 7 (M-6)

1. A box of weight W rests on the floor. Identify the action/reaction forces acting on the box.
2. The earth exerts a force on you which is your weight. You exert a force of magnitude force on the earth in the opposite direction. Why doesn't the earth experience the same acceleration that you experience?
3. What is the momentum of a 5 kg object moving at 15 m/s? What would be the speed of a 15 kg object that had the same momentum?
4. Explain why friction is necessary for movement.
5. A ball hits the ground and rebounds upward. Identify the action and reaction forces acting in this example.
6. What law of mechanics is the principle of conservation of momentum based on?
7. How does an airbag minimize injury in a collision?

Answers and Solutions:

1. The box exerts a downward force on the floor equal to its weight, and the floor exerts an equal upward force on the box. Thus the weight of the box and the upward force of the floor on the box form an action/reaction pair.
2. The force on you $F_{you} = m\ a_{you}$; the force on the earth $F_E = M_E\ a_{E.}$ Newton's third law tells us that in magnitude $F_{you} = F_{E.}$ However, since M_E is >> (much greater than) m, the acceleration that the earth experiences is << (much smaller than) your acceleration.
3. p = 5 kg x 15 m/s = 75 kg m/s. Then 75 kg m/s = 15 kg x v → v = 75 / 15 = 5 m/s.
4. When we walk our feet exert a backward force on the ground. The reaction force of the ground on our feet (due to Newton's 3rd law) is what pushes us forward.
5. When a ball hit the ground it exerts a downward force on the ground. The ground then exerts an upward reaction force on the ball that causes it to rebound upward.
6. Conservation of momentum is based on Newton's third law.
7. Without an airbag, you hit the windshield and stop abruptly causing a large force to be exerted on you causing injury. With the airbag, you stop over a longer time interval which reduces the force and minimizes the injury.