Exercise Set 1 Questions

Motion (Chapter 3)

1. A car starting from rest is speeding up with a constant acceleration of 5 m/s². (a) Draw a motion diagram using the particle model that shows her position at successive times and includes velocity and acceleration vectors. (b) How fast is the car moving after 5 seconds?

2. (a) Can an automobile with a velocity toward the north simultaneously have an acceleration toward the south? Explain. (b) Draw a motion diagram using the particle model that shows her position at successive times and includes velocity and acceleration vectors.

3. You are driving north on a highway. Then, without changing speed, you round a curve and drive east. (a) Do you accelerate? Explain. (b) Draw a motion diagram using the particle model that shows her position at successive times and includes velocity and acceleration vectors.

4. Cite an example of something with a constant speed that also has a varying velocity. Can you cite an example of something with a constant velocity and a varying speed? Defend your answers.

5. Someone standing at the edge of a cliff throws a ball nearly straight up at a certain speed and another ball nearly straight down with the same initial speed. If air resistance is negligible, which ball will have the greater speed when it strikes the ground below?

6. A skydiver jumps out of an airplane. Her speed steadily increases until she deploys her parachute, at which point her speed quickly decreases. She subsequently falls to earth at a constant rate, stopping when she lands on the ground. Draw a motion diagram using the particle model that shows her position at successive times and includes velocity and acceleration vectors.

Newton’s 1st Law (Chapter 2)

1. A hockey puck slides along the surface of the ice. If friction and air resistance are negligible, what force is required to keep the puck moving?

2. If you are squatting down (such as when you are examining the books on the bottom shelf in a library or bookstore) and suddenly get up, you can temporarily feel light-headed. What do Newton’s laws of motion have to say about why this happens?

3. Whiplash injuries during an automobile accident are caused by the inertia of the head. If someone is wearing a seatbelt, her body will tend to move with the car seat. However, her head is free to move until the neck restrains it, causing damage to the neck. Brain damage can also occur.

(a) In terms of Newton’s first law (the law of inertia), how does a car headrest help to guard against whiplash in a rear-end collision? (b) The figure shows two sequences of head and neck motion for a passenger in an auto accident. One corresponds to a head-on collision, the other to a rear-end collision. Which is which? Explain

4. When a ball is tossed straight up, it momentarily comes to a stop at the top of its path. Is it in equilibrium during this brief moment? Why or why not?

5. When a car stops suddenly, the passengers tend to move forward relative to their seats. Why? When a car makes a sharp turn, the passengers tend to slide to one side of the car. Why?