CHAPTER 2: Describing Motion: Kinematics in One Dimension

Problems

2–1 to 2–3 Speed and Velocity

5. (I) A rolling ball moves from $x_1 = 3.4\,\text{cm}$ to $x_2 = -4.2\,\text{cm}$ during the time from $t_1 = 3.0\,\text{s}$ to $t_2 = 6.1\,\text{s}$. What is its average velocity?

7. (II) You are driving home from school steadily at $95\,\text{km/h}$ for 130 km. It then begins to rain and you slow to $65\,\text{km/h}$. You arrive home after driving 3 hours and 20 minutes. (*a*) How far is your hometown from school? (*b*) What was your average speed?

9. (II) A person jogs eight complete laps around a quarter-mile track in a total time of 12.5 min. Calculate (*a*) the average speed and (*b*) the average velocity, in m/s.

11. (II) Two locomotives approach each other on parallel tracks. Each has a speed of $95\,\text{km/h}$ with respect to the ground. If they are initially 8.5 km apart, how long will it be before they reach each other? (See Fig. 2–30).

15. (III) A bowling ball traveling with constant speed hits the pins at the end of a bowling lane 16.5 m long. The bowler hears the sound of the ball hitting the pins 2.50 s after the ball is released from his hands. What is the speed of the ball? The speed of sound is $340\,\text{m/s}$.

2–4 Acceleration

16. (I) A sports car accelerates from rest to $95\,\text{km/h}$ in 6.2 s. What is its average acceleration in m/s^2?

18. (II) At highway speeds, a particular automobile is capable of an acceleration of about $1.6\,\text{m/s}^2$. At this rate, how long does it take to accelerate from $80\,\text{km/h}$ to $110\,\text{km/h}$?

2–5 and 2–6 Motion at Constant Acceleration

21. (I) A car accelerates from $13\,\mathrm{m/s}$ to $25\,\mathrm{m/s}$ in 6.0 s. What was its acceleration? How far did it travel in this time? Assume constant acceleration.

25. (II) A car slows down uniformly from a speed of $21.0\,\mathrm{m/s}$ to rest in 6.00 s. How far did it travel in that time?

26. (II) In coming to a stop, a car leaves skid marks 92 m long on the highway. Assuming a deceleration of $7.00\,\mathrm{m/s^2}$, estimate the speed of the car just before braking.

30. (III) A car is behind a truck going $25\,\mathrm{m/s}$ on the highway. The car's driver looks for an opportunity to pass, guessing that his car can accelerate at $1.0\,\mathrm{m/s^2}$. He gauges that he has to cover the 20-m length of the truck, plus 10 m clear room at the rear of the truck and 10 m more at the front of it. In the oncoming lane, he sees a car approaching, probably also traveling at $25\,\mathrm{m/s}$. He estimates that the car is about 400 m away. Should he attempt the pass? Give details.

42. (II) A stone is thrown vertically upward with a speed of $18.0\,\mathrm{m/s}$. (*a*) How fast is it moving when it reaches a height of 11.0 m? (*b*) How long is required to reach this height? (*c*) Why are there two answers to (*b*)?

45. (III) A rock is dropped from a sea cliff, and the sound of it striking the ocean is heard 3.2 s later. If the speed of sound is $340\,\mathrm{m/s}$, how high is the cliff?

47. (III) A stone is thrown vertically upward with a speed of $12.0\,\mathrm{m/s}$ from the edge of a cliff 70.0 m high (Fig. 2–34). (*a*) How much later does it reach the bottom of the cliff? (*b*) What is its speed just before hitting? (*c*) What total distance did it travel?

***56.** (II) Figure 2–36 is a position versus time graph for the motion of an object along the *x* axis. Consider the time interval from A to B. (*a*) Is the object moving in the positive or negative direction? (*b*) Is the object speeding up or slowing down? (*c*) Is the acceleration of the object positive or negative? Now consider the time interval from D to E. (*d*) Is the object moving in the positive or negative direction? (*e*) Is the object speeding up or slowing down? (*f*) Is the acceleration of the object positive or negative? (*g*) Finally, answer these same three questions for the time interval from C to D.