Topic 2

Motion in One Dimension

QUICK QUIZZES

2.1 **(a)** 200 yd **(b)** 0 **(c)** 0

2.2 **(a)** False. The car may be slowing down, so that the direction of its acceleration is opposite the direction of its velocity.

(b) True. If the velocity is in the direction chosen as negative, a positive acceleration causes a decrease in speed.

(c) True. For an accelerating particle to stop at all, the velocity and acceleration must have opposite signs, so that the speed is decreasing. If this is the case, the particle will eventually come to rest. If the acceleration remains constant, however, the particle must begin to move again, opposite to the direction of its original velocity. If the particle comes to rest and then stays at rest, the acceleration has become zero at the moment the motion stops. This is the case for a braking car—the acceleration is negative and goes to zero as the car comes to rest.

2.3 The velocity-vs-time graph (a) has a constant slope, indicating a constant acceleration, which is represented by the acceleration-vs.-time graph (e).

Graph (b) represents an object whose speed always increases, and does so at an ever-increasing rate. Thus, the acceleration must be increasing, and the acceleration-vs-time graph that best indicates this behaviour is (d).

Graph (c) depicts an object which first has a velocity that increases at a constant rate, which means that the object's acceleration is constant. The motion then changes to one at constant speed, indicating that the acceleration of the object becomes zero. Thus, the best match to this situation is graph (f).

2.4 Choice (b). According to *graph b*, there are some instants in time when the object is simultaneously at two different *x*-coordinates. This is physically impossible.

2.5 **(a)** The *blue graph* of Figure 2.14b best shows the puck's position as a function of time. As seen in Figure 2.14a, the distance the puck has traveled grows at an increasing rate for approximately three time intervals, grows at a steady rate for about four time intervals, and then grows at a diminishing rate for the last two intervals.

(b) The *red graph* of Figure 2.14c best illustrates the speed (distance traveled per time interval) of the puck as a function of time. It shows the puck gaining speed for approximately three time intervals, moving at constant speed for about four time intervals, then slowing to rest during the last two intervals.

(c) The *green graph* of Figure 2.14d best shows the puck's acceleration as a function of time. The puck gains velocity (positive acceleration) for approximately three time intervals, moves at constant velocity (zero acceleration) for about four time intervals, and then loses velocity (negative acceleration) for roughly the last two time intervals.

2.6 Choice (e). The acceleration of the ball remains constant while it is in the air. The magnitude of its acceleration is the free-fall acceleration, $g = 9.80$ m/s^2.

2.7 Choice (c). As it travels upward, its speed decreases by 9.80 m/s during each second of its motion. When it reaches the peak of its motion, its speed becomes zero. As the ball moves downward, its speed increases by 9.80 m/s each second.

2.8 Choices (a) and (f). The first jumper will always be moving with a higher velocity than the second. Thus, in a given time interval, the first jumper covers more distance than the second, and the separation distance