Homework Solutions
8/28/2007

Conceptual Questions

1. Yes, if the velocity is constant then the acceleration would be zero.

2. Yes, if the object is at rest then the acceleration could be zero.

3. Yes, it would mean that the car is slowing down.

4. You can ignore the time the light takes to reach you because it is traveling 300,000,000 meters per second so it essentially reaches you instantaneously.

6. If the velocity is zero in a time interval then the displacement must also be zero because velocity is displacement divided by time.

10. The velocities of the two cars are not equal because they are traveling in different directions and velocity is speed in a direction.

14.
    a. speeding up in the east direction
    b. slowing down in the east direction
    c. moving east a constant velocity
    d. slowing down in the west direction
    e. speeding up in the west direction
    f. moving west at a constant velocity
    g. accelerating from rest eastward from a stoplight.
    h. accelerating from rest westward from a stop sign.

Problems

3.

$$t = \frac{d}{v}$$

$$t_A = \frac{120km}{60\frac{km}{hr}} = 2hrs$$

$$t_B = \frac{60km}{30\frac{km}{hr}} + \frac{60km}{90\frac{km}{hr}} = 2hr + 0.67hr = 2.67hrs$$

Boat A wins by 40 minutes. The average velocity for both boats was 0 km/hr as their displacements were both zero.

7. a. $$v = \frac{x_f - x_i}{t_f - t_i} = \frac{4m - 0m}{1s - 0s} = 4\frac{m}{s}$$

b. $$v = \frac{x_f - x_i}{t_f - t_i} = \frac{-2m - 0m}{4s - 0s} = -0.5\frac{m}{s}$$

c. $$v = \frac{x_f - x_i}{t_f - t_i} = \frac{0m - 4m}{5s - 1s} = -1\frac{m}{s}$$

d. $$v = \frac{x_f - x_i}{t_f - t_i} = \frac{0m - 0m}{5s - 0s} = 0\frac{m}{s}$$

14. Defining east as positive and west as negative we set up the following relationships relating position to velocity and time. Since there is no acceleration the $1/2at^2$ component becomes zero. Since their position must be the same when the runners meet, x_a must equal x_b.

$$x_a = -4.0mi + \left(6.0\frac{mi}{hr}\right)t$$

$$x_b = 3.0mi + \left(-5.0\frac{mi}{hr}\right)t$$

$$x_a = x_b$$

$$-4.0mi + \left(6.0\frac{mi}{hr}\right)t = 3.0mi + \left(-5.0\frac{mi}{hr}\right)t$$

$$\left(11.0\frac{mi}{hr}\right)t = 7.0mi$$

$$t = \frac{7.0mi}{\left(11.0\frac{mi}{hr}\right)} = 0.64hr$$

Substituting 0.64hr in for t in each of the original relationships yields the answer for their meeting place. Since the value is negative the meeting place is west of the flagpole.

$$x_a = -4.0mi + \left(6.0\frac{mi}{hr}\right)(0.64hr) = -0.18mi$$

22. a. $$a = \frac{v_f - v_i}{t_f - t_i} = \frac{0\frac{m}{s} - 0\frac{m}{s}}{5s - 0s} = 0\frac{m}{s^2}$$

$$a = \frac{v_f - v_i}{t_f - t_i} = \frac{8\frac{m}{s} - \cdot 8\frac{m}{s}}{15s - 5s} = 1.6\frac{m}{s^2}$$

$$a = \frac{v_f - v_i}{t_f - t_i} = \frac{8\frac{m}{s} - \cdot 8\frac{m}{s}}{20s - 0s} = 0.80\frac{m}{s^2}$$

b. To find the instantaneous accelerations you need to find the slope of the velocity versus time graph. Using the data above we get:

at t=2s, $a = 0\frac{m}{s^2}$

at t=10s, $a = 1.6\frac{m}{s^2}$

at t=18s, $a = 0\frac{m}{s^2}$