Unit 1 Review: Motion in One Dimension

1. A car traveling north at 40 mi/h is on the road at the same time as another car traveling south at 55 mi/h. In the driver's reference frame, how fast does the other driver appear to be going?

   95 mi/h

2. How does distance and displacement differ? Give an example that illustrates the difference.
   Displacement includes direction and distance does not. If someone jogs 20 miles east and then 5 miles west, his displacement is 15 miles even though his distance is 25 miles.

3. How long would it take a motorcycle that can travel 75 m/s to travel a distance of 4.2 km? (Note: one of the distance units needs to be converted. Both units must either be meters or kilometers!)

   56 s

4. What is the difference between a "scalar" and a "vector"? Give examples of each.
   Vector quantities include direction and scalars do not. Velocity is a vector; speed is a scalar.

5. Explain the meaning of the following sentence: "To measure speed you need a frame of reference."
   Speed is always compared to something that is considered stationary. For example if a car drives 60 km/h its speed is measured compared to the ground.

6. How does instantaneous speed and average speed differ? How can you measure each?
   Average speed is how fast an object traveled over an interval of time. It is calculated by taking the distance traveled and dividing by the time it took. Instantaneous speed is how fast an object is moving at one instant of time. A speedometer or a policeman's radar gun could measure it.

7. A certain car travels west 45 miles and then the driver notices that he passed his destination and turns around and goes east 12 miles. All of this takes 48.5 minutes.
   a) Give the car's velocity in miles/hour.

      40.8 mi/h west

   b) Give the car's speed in miles/hour.

      70.5 mi/h

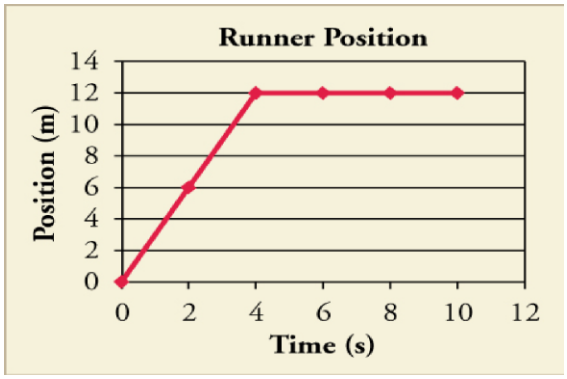
8. In a coordinate system in which motion to the right is positive and motion to the left is negative, what are the distance and displacement of a person who jogs 25 m to the left, 38 m to the right, and then 41 m to the left?

   Distance = 104 m Displacement = -28 m

9. Considering the previous question, if it took the person 21 seconds to accomplish all of the jogging, calculate the person's average speed and average velocity.

   Average speed = 4.95 m/s Average velocity = -1.3 m/s

10. Given the following graph about a runner's position, answer the questions below.

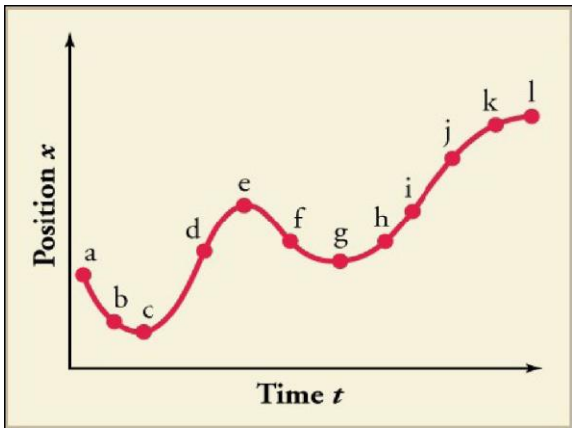


a) During the first ___4___ seconds the runner is moving at ___constant___ speed.
(how many? / increasing OR decreasing OR constant)

b) Is there a time interval during which the runner is not moving? Explain.
Yes, between 4 and 10 seconds. A horizontal line on a position vs. time graph indicates zero speed.

c) What is the speed of the runner at t = 3 seconds? 3 m/s

11. Consider the following graph of a car's position vs. time.



a) True or False: The car is going faster at point d than at point k. True

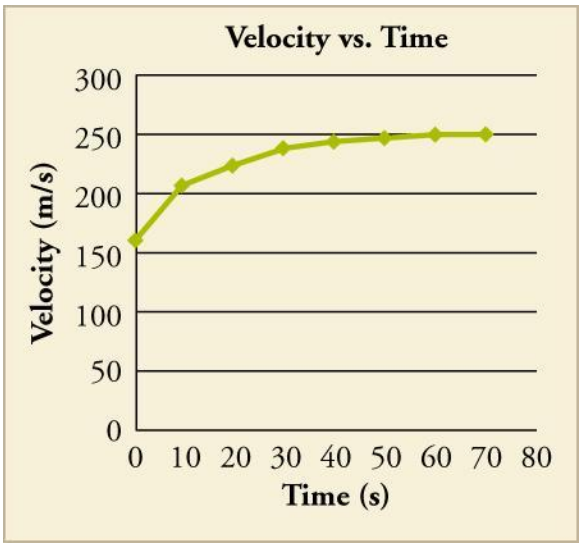
b) List all of the points at which the car has a negative velocity. Explain how a negative velocity is different from a positive velocity.
b and f

c) List all of the points at which the car has a velocity of zero.
c, e, g, l

12. Johnny drops a ball from a height of 2.0m. The ball bounces up to a height of 1.2m and then falls to the ground again. It bounces and then reaches a height of 0.5m where Johnny catches it. Calculate both the displacement and the distance. (Note: you can consider the downward direction negative and the upward direction positive.)

Displacement = 1.5m Distance = 4.9m

13. Use the velocity vs. time graph below to answer the following questions about a race car.



a) Is the car speeding up, slowing down, or moving at constant velocity? Explain.

It is speeding up. At 0 seconds we can see that the velocity is a little over 150 m/s. At 10 s, the velocity is higher, over 200 m/s. The velocity continues to increase until 60 seconds. It is constantly 250 m/s between 60 and 70 seconds.

b) Does the car travel farther between 10 and 20 seconds or between 50 and 60 seconds. Use the graph to explain how you know.

The car travels farther between 50 and 60 seconds. One way to know this is that the area under the curve between 50 and 60 seconds is greater than the area under the curve between 10 and 20 seconds.

14. A bicyclist pedaled at a velocity of 18 km/h west for 35 minutes. Then he turned around and went east at a speed of 25 km/h for 15 minutes.
a) Calculate the average velocity for the entire trip.

5.1 km/h

b) Calculate the average speed for the entire trip.

20.1 km/h