

Distance and Displacement

18 Free-Response Questions

Organic Chemistry Tutor

1. An object moves from position $X_1 = -8$ m to $X_2 = 12$ m and then to position $X_3 = -20$ m. (a) What is the total distance traveled by the object? (b) What is the displacement?

3. Megan walks 100 m east and then travels 70 m north followed by 140 m east. Calculate the total distance and the magnitude of her net displacement.

2. Sally travels 50 m west and then 120 m south. (a) How far did Sally travel? (b) What is the magnitude of her net displacement?

4. Jared walks 120 m east, 150 m south, and then 40 m west. Find the total distance traveled by Jared and calculate the magnitude of his net displacement.

5. A car travels a distance of 300 miles in 6 hours. What is the average speed of the car?

7. A bus travels 400 miles east in 6 hours and then 100 miles west in 2 hours. (a) What is the average speed of the bus for the entire trip? (b) Calculate the average velocity.

6. Solve each problem: (a) A car travels at an average speed of 40 ft/s. How many miles will it travel in 5 hours? (b) A train is moving at 45 km/hr, how long will it take for the train to travel a distance of 20 miles?

8. A bus travels 200 miles east for 4 hours and then 300 miles north for 5 hours. (a) What is the average speed of the bus for the entire trip? (b) What is the average velocity for the entire trip?

9. A car travels at 30 mph for 2 hours and then 40 mph for 3 hours in the same direction. What is the average speed of the vehicle for the entire trip?

11. A person travels at an average speed of 40 mph going to work and an average speed of 60 mph returning home. What is his average speed and average velocity for the entire trip?

10. A car travels at 80 mph for 1 hour, 40 mph for 3 hours, and then 60 mph for 4 hours in the same direction. What is the average speed of the vehicle for the entire trip?

12. John lives 120 miles from his job. He drives home at 30 mph for the first half of the trip and 40 mph for the second half of the trip with respect to distance. What is his average speed and average velocity for the entire trip?

13. Sally travels 20 miles as part of her exercise routine. She spends half of her time walking at a speed of 2 mph and the other half of the time running at 8 mph. What is Sally's average speed?

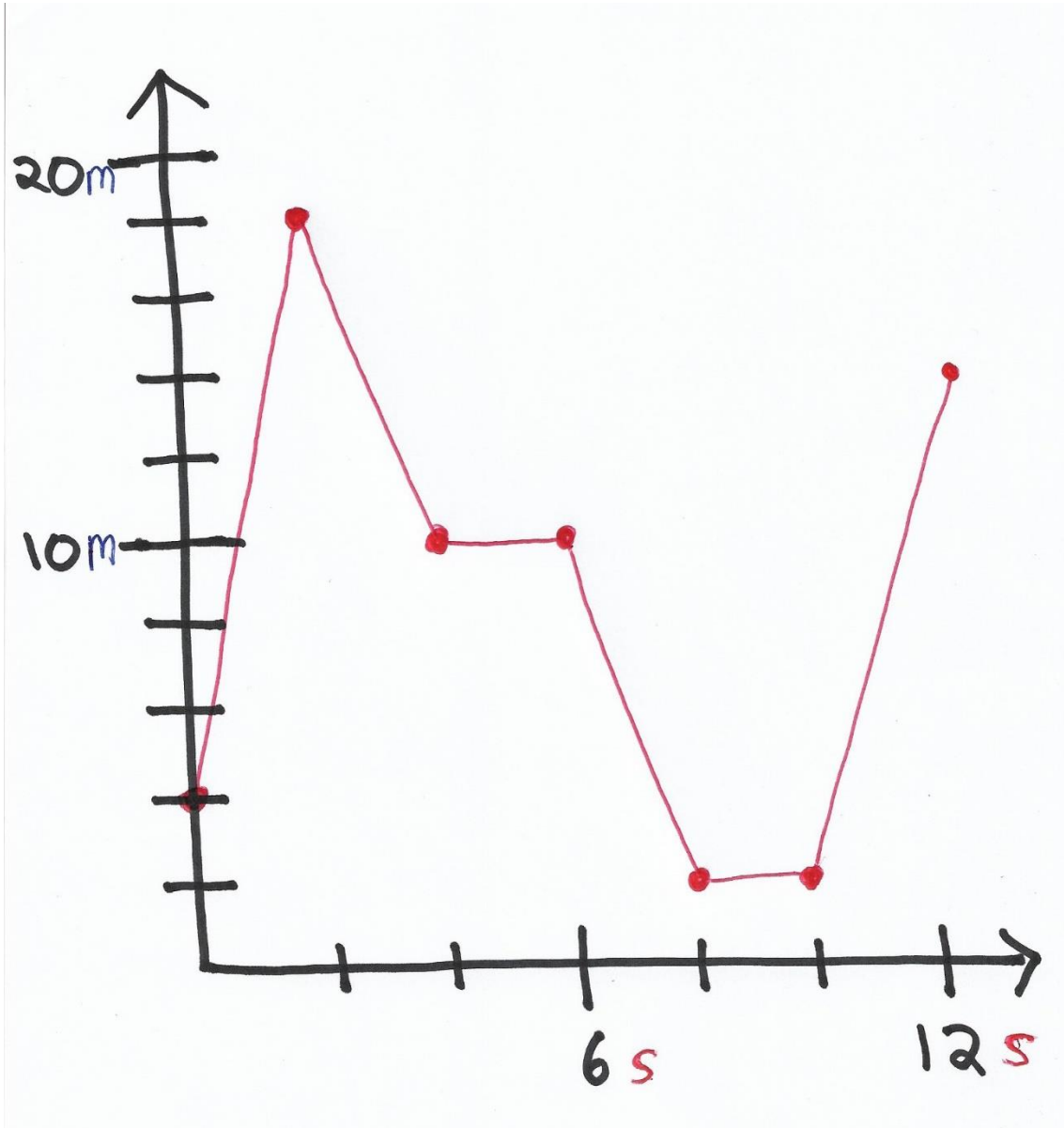
15. Two trains, currently 540 km apart, are traveling toward each other. The average speed of each train is 35 km/hr and 55 km/hr respectively. (a) How long will it take for the two trains to meet and pass each other? (b) How far does each train travel during this time?

14. A particle is initially at $X_0 = 50$ m and moving at a constant velocity of -15 m/s. (a) What is the position of the particle 3 seconds later? (b) What is the particle's displacement at this time? (c) How long will it take for the particle to reach a final position of -55 m?

16. A car travels 10 miles east at 40 mph and then another 20 miles east at 60 mph. What is the average speed of the car over the entire trip?

17. Karen rode on her bike five times around a circular track with a radius of 60m in a time period of 15 minutes. (a) Calculate Karen's average speed in m/s. (b) What is her average velocity during this time period?

18. Consider the position-time graph shown below. (a) What is the total distance traveled during the first 12 seconds? (b) What is the displacement during the first 12 seconds? (c) What is the average velocity during the first 2 seconds? (d) What is the average velocity between $t = 4$ s and $t = 6$ s? (e) What is the average velocity and average speed between $t = 6$ s and $t = 8$ s?



Answers:

- 1a. 52 m
- 1b. -12 m
- 2a. 170 m
- 2b. 130 m
- 3. Distance = 310 m, displacement = 250 m.
- 4a. 310 m
- 4b. 170 m
- 5. 50 mph
- 6a. 136.4 miles
- 6b. 0.715 hours or 42.9 minutes.
- 7a. 62.5 mph
- 7b. 37.5 mph
- 8a. 55.56 mph
- 8b. 40.06 mph @ 56.3° north of east.
- 9. 36 mph
- 10. 55 mph
- 11. Average speed = 48 mph, average velocity = 0 m/s.
- 12. Average speed = 34.3 mph, average velocity = 34.3 mph.
- 13. 5 mph
- 14a. 5 m
- 14b. -45 m
- 14c. 7 seconds
- 15a. 6 hours
- 15b. 210 km and 330 km.
- 16. 51.4 mph
- 17a. 2.09 m/s
- 17b. 0 m/s
- 18a. 42 m
- 18b. 10 m
- 18c. 7 m/s
- 18d. 0 m/s
- 18e. Average velocity = - 4 m/s, average speed = + 4 m/s.