

Kinematics - Worksheet

10 Free-Response Questions

Organic Chemistry Tutor

1. A bus is traveling at a constant speed of 40 m/s. How many hours will it take to travel a distance of 200 miles? (b) If the bus moved from a position that is 50 miles east of city XYZ to a position that is 90 miles west of city XYZ in 5 hours, then what is the average velocity of the bus during that time interval?

3. A motorcycle speeds up from 24 m/s to 60 m/s and travels a distance of 500 m within that period. (a) What is the average acceleration? (b) How long did it take to reach a speed of 60 m/s?

2. A car accelerates from rest to 48 m/s in 6 seconds. (a) What is the average acceleration of the car? (b) How far did the car travel during this time period? (c) Imagine if the car was initially 800 m west of city XYZ moving east at 20 m/s. At this instant, the car begins to accelerate at a rate of +5 m/s² for 20 seconds. Calculate the final position and displacement of the car.

4. A truck accelerates from 24 m/s at a constant rate of 2.1 m/s² for 15 seconds. (a) How far did it travel during this time period? (b) What is the final speed of the car at the end of the 15 seconds?

5. A van travels at a constant speed of 32 m/s for 5 seconds. It begins to accelerate at a rate of 3 m/s^2 for 7 seconds and then maintains that speed for another 18 seconds. Finally, it slows down to rest in 22 seconds. How far did the van travel during the course of this entire problem?

7. Two trains are 450 miles apart and are traveling in the same direction at speeds of 50 mph and 80 mph. (a) When will the two trains meet? (b) How far will the faster train travel during this time period?

6. Two trains are 800 miles apart. The first train is traveling east at 45 mph and the second train is traveling west at 55 mph. (a) When will the two trains meet? (b) How far will the second train travel during this time period?

8. A bus is traveling east at a constant speed of 28 m/s. A car is 200 m behind the bus and begins to accelerate east at 4 m/s^2 starting from an initial speed of 13 m/s. How long will it take the car to catch up to the bus?

9. A stone is released from rest at the top of an 800 m cliff and falls into the sea. (a) How long does it take to hit the water? (b) How fast is it moving just before it hits the water?

10. The position of a particle along the x-axis is given by the function $X(t) = -100 - 20t + 8t^2$ where t is in seconds and X is in meters. (a) What is the initial position of the particle? (b) What is the initial velocity of the particle? (c) What is the acceleration of the particle? (d) What is the position of the particle at $t = 4\text{s}$? (e) What is the average velocity of the particle from $t = 2\text{s}$ to $t = 4\text{s}$? (f) What is the instantaneous velocity of the particle at $t = 3\text{s}$? (g) When does the particle change direction? (h) When is it moving to the left? (i) What is the displacement of the particle during the first 10 seconds? (j) What is the total distance that the particle travels during the first 10 seconds?

Answers:

- 1a. 2.23 hours
- 1b. -28 mph
- 2a. $+6 \text{ m/s}^2$
- 2b. 144 m
- 2c. Final position = 600 m, displacement = 1400 m.
- 3a. 3.024 m/s^2
- 3b. 11.92 s
- 4a. 596.25 m
- 4b. 55.5 m/s
- 5. 1994.5 m
- 6a. 8 hours
- 6b. 440 miles
- 7a. 15 hours
- 7b. 1200 miles
- 8. 14.43 s
- 9a. 12.778 s
- 9b. 125.2 m/s
- 10a. -100 m
- 10b. -20 m/s
- 10c. $+16 \text{ m/s}^2$
- 10d. -52 m
- 10e. +28 m/s
- 10f. +28 m/s
- 10g. 1.25 s
- 10h. $[0, 5/4 \text{ s})$
- 10i. 600 m
- 10j. +625 m