حلول كتاب الوحدة الثانية تمثيل الحركة

تم تحميل هذا الملف من موقع المناهج الإماراتية
موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف العاشر العام ⇦ فيزياء ⇦ الفصل الأول ⇦ حلول ⇦ الملف
تاريخ إضافة الملف على موقع المناهج: 2026-11-22 20:24:24
المزيد من مادة فيزياء:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

التواصل الاجتماعي بحسب الصف العاشر العام					
صفحة المناهج الإماراتية على فيسبوك					
المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات	

المزيد من الملفات بحسب الصف العاشر العام والمادة فيزياء في الفصل الأول	
1	حلول كتاب الوحدة الثانية تمثيل الحركة
2	حل مراجعة نهائية وفق الهيكل الوزاري الجديد منهج انسباير
3	مراجعة نهائية وفق الهيكل الوزاري الجديد منهج انسباير
4	تجميعة أسئلة وفق الهيكل الوزاري الجديد منهج انسباير
5	تجميعة أسئلة القسم الكتابي وفق الهيكل الوزاري الجديد منهج انسباير

تحميل تطبيق المناهج للهواتف الذكية	
تطبيق المناهج على Store App (آبل)	تطبيق المناهج على Play Google (أندرويد)

CHAPTER 2

Representing Motion

Section Review

2.1 Picturing Motion pages 31–33

page 33

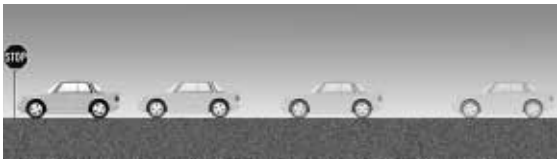
1. **Motion Diagram of a Runner** Use the particle model to draw a motion diagram for a bike rider riding at a constant pace.

2. **Motion Diagram of a Bird** Use the particle model to draw a simplified motion diagram corresponding to the motion diagram in **Figure 2-4** for a flying bird. What point on the bird did you choose to represent it?



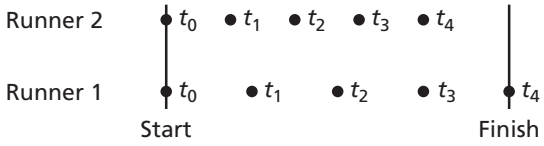
■ **Figure 2-4**

3. **Motion Diagram of a Car** Use the particle model to draw a simplified motion diagram corresponding to the motion diagram in **Figure 2-5** for a car coming to a stop at a stop sign. What point on the car did you use to represent it?



■ **Figure 2-5**

4. **Critical Thinking** Use the particle model to draw motion diagrams for two runners in a race, when the first runner crosses the finish line as the other runner is three-fourths of the way to the finish line.



Section Review

2.2 Where and When? pages 34–37

page 37

5. **Displacement** The particle model for a car traveling on an interstate highway is shown below. The starting point is shown.

Here ● ● ● ● ● ● There

Make a copy of the particle model, and draw a vector to represent the displacement of the car from the starting time to the end of the third time interval.

Here ●⟶ There

6. **Displacement** The particle model for a boy walking to school is shown below.

Home ● ● ● ● ● ● ● ● ● ● School

Make a copy of the particle model, and draw vectors to represent the displacement between each pair of dots.

Home ⟶⟶⟶⟶⟶⟶⟶⟶⟶ School

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7. **Position** Two students compared the position vectors they each had drawn on a motion diagram to show the position of a moving object at the same time. They found that their vectors did not point in the same direction. Explain.

   A position vector goes from the origin to the object. When the origins are different, the position vectors are different. On the other hand, a displacement vector has nothing to do with the origin.

8. **Critical Thinking** A car travels straight along the street from the grocery store to the post office. To represent its motion you use a coordinate system with its origin at the grocery store and the direction the car is moving in as the positive direction. Your friend uses a coordinate system with its origin at the post office and the opposite direction as the positive direction. Would the two of you agree on the car's position? Displacement? Distance? The time interval the trip took? Explain.

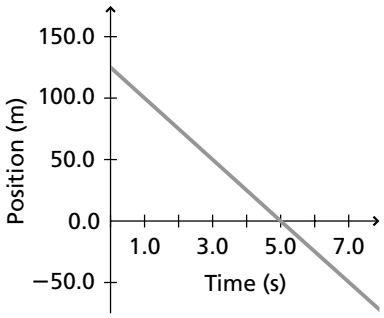
   The two students should agree on the displacement, distance, and time interval for the trip, because these three quantities are independent of where the origin of the coordinate system is placed. The two students would not agree on the car's position, because the position is measured from the origin of the coordinate system to the location of the car.

Practice Problems

2.3 Position-Time Graphs pages 38–42

page 39

For problems 9–11, refer to ***Figure 2-13.***

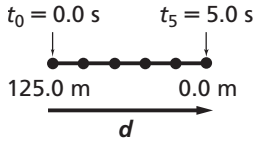


■ **Figure 2-13**

9. Describe the motion of the car shown by the graph.

   The car begins at a position of 125.0 m and moves toward the origin, arriving at the origin 5.0 s after it begins moving. The car continues beyond the origin.

10. Draw a motion diagram that corresponds to the graph.



11. Answer the following questions about the car's motion. Assume that the positive *d*-direction is east and the negative *d*-direction is west.

    a. When was the car 25.0 m east of the origin?

    at 4.0 s

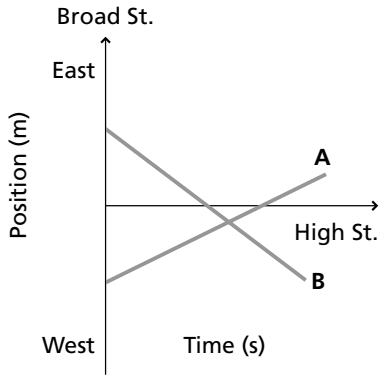
    b. Where was the car at 1.0 s?

    100.0 m

12. Describe, in words, the motion of the two pedestrians shown by the lines in **Figure 2-14.** Assume that the positive direction is east on Broad Street and the origin is the intersection of Broad and High Streets.

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■ **Figure 2-14**

Pedestrian A starts west of High Street and walks east (the positive direction). Pedestrian B begins east of High Street and walks west (the negative direction). Sometime after B crosses High Street, A and B pass each other. Sometime after they pass, Pedestrian A crosses High Street.

13. Odina walked down the hall at school from the cafeteria to the band room, a distance of 100.0 m. A class of physics students recorded and graphed her position every 2.0 s, noting that she moved 2.6 m every 2.0 s. When was Odina in the following positions?

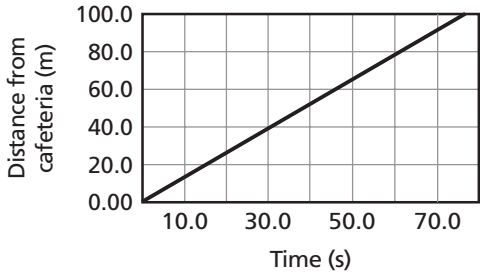
a. 25.0 m from the cafeteria

19 s

b. 25.0 m from the band room

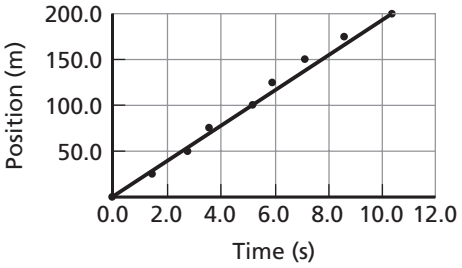
58 s

c. Create a graph showing Odina's motion.



page 41

For problems 14–17, refer to the figure in Example Problem 2.



■ **Example Problem 2 Figure**

14. What event occurred at $t = 0.0$ s?

Runner A passed the origin.

15. Which runner was ahead at $t = 48.0$ s?

runner B

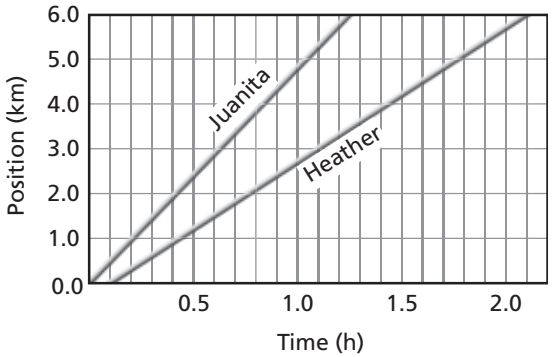
16. When runner A was at 0.0 m, where was runner B?

at −50.0 m

17. How far apart were runners A and B at $t = 20.0$ s?

approximately 30 m

18. Juanita goes for a walk. Sometime later, her friend Heather starts to walk after her. Their motions are represented by the position-time graphs in **Figure 2-16.**



■ **Figure 2-16**

a. How long had Juanita been walking when Heather started her walk?

6.0 min

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b. Will Heather catch up to Juanita? How can you tell?

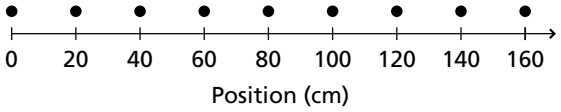
No. The lines representing Juanita's and Heather's motions get farther apart as time increases. The lines will not intersect.

Section Review

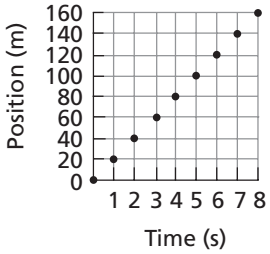
2.3 Position-Time Graphs pages 38–42

page 42

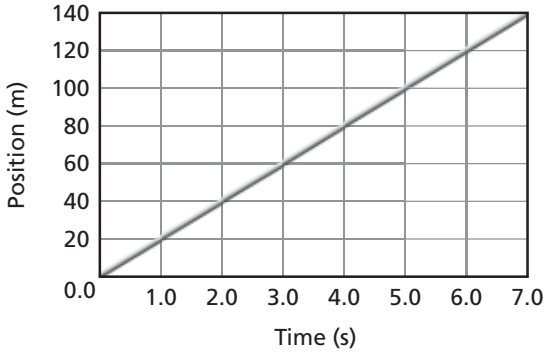
19. Position-Time Graph From the particle model in **Figure 2-17** of a baby crawling across a kitchen floor, plot a position-time graph to represent his motion. The time interval between successive dots is 1 s.



■ **Figure 2-17**



20. Motion Diagram Create a particle model from the position-time graph of a hockey puck gliding across a frozen pond in **Figure 2-18.**



■ **Figure 2-18**



For problems 21–23, refer to Figure 2-18.

21. Time Use the position-time graph of the hockey puck to determine when it was 10.0 m beyond the origin.

0.5 s

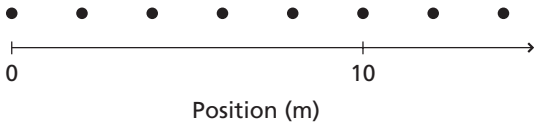
22. Distance Use the position-time graph of the hockey puck to determine how far it moved between 0.0 s and 5.0 s.

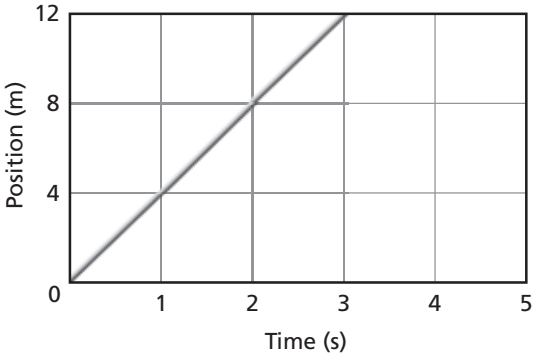
100 m

23. Time Interval Use the position-time graph for the hockey puck to determine how much time it took for the puck to go from 40 m beyond the origin to 80 m beyond the origin.

2.0 s

24. Critical Thinking Look at the particle model and position-time graph shown in **Figure 2-19.** Do they describe the same motion? How do you know? Do not confuse the position coordinate system in the particle model with the horizontal axis in the position-time graph. The time intervals in the particle model are 2 s.





■ **Figure 2-19**

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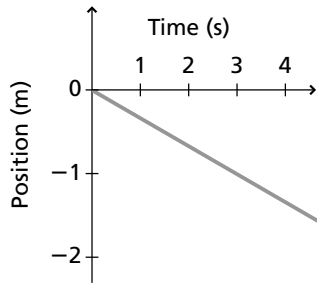
No, they don't describe the same motion. Although both objects are traveling in the positive direction, one is moving more quickly than the other. Students can cite a number of different specific examples from the graph and particle model to back this up.

Practice Problems

2.4 How Fast? pages 43–47

page 45

25. The graph in **Figure 2-22** describes the motion of a cruise ship during its voyage through calm waters. The positive *d*-direction is defined to be south.



■ **Figure 2-22**

a. What is the ship's average speed?

Using the points (0.0 s, 0.0 m) and (3.0 s, −1.0 m)

$$\overline{v} = \left|\frac{\Delta d}{\Delta t}\right| = \left|\frac{d_2 - d_1}{t_2 - t_1}\right| = \left|\frac{-1.0\text{ m} - 0.0\text{ m}}{3.0\text{ s} - 0.0\text{ s}}\right| = |-0.33\text{ m/s}| = 0.33\text{ m/s}$$

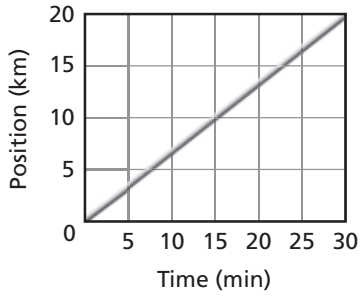
b. What is its average velocity?

The average velocity is the slope of the line, including the sign, so it is −0.33 m/s or 0.33 m/s north.

26. Describe, in words, the motion of the cruise ship in the previous problem.

The ship is moving to the north at a speed of 0.33 m/s.

27. The graph in **Figure 2-23** represents the motion of a bicycle. Determine the bicycle's average speed and average velocity, and describe its motion in words.



■ **Figure 2-23**

Because the bicycle is moving in the positive direction, the average speed and average velocity are the same. Using the points (0.0 min, 0.0 km) and (15.0 min, 10.0 km),

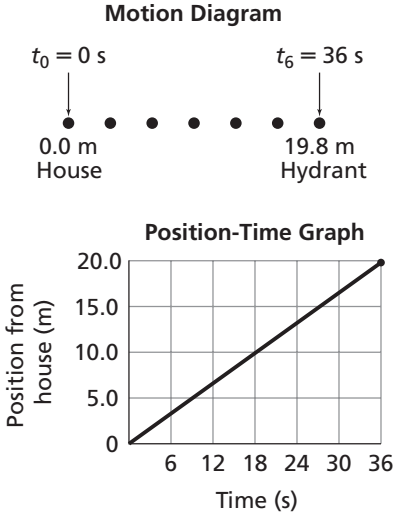
$$\overline{v} = \left|\frac{\Delta d}{\Delta t}\right| = \left|\frac{d_2 - d_1}{t_2 - t_1}\right| = \left|\frac{10.0\text{ km} - 0.0\text{ km}}{15.0\text{ min} - 0.0\text{ min}}\right| = 0.67\text{ km/min}$$

$\overline{v}$ = 0.67 km/min in the positive direction

The bicycle is moving in the positive direction at a speed of 0.67 km/min.

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28. When Marilyn takes her pet dog for a walk, the dog walks at a very consistent pace of 0.55 m/s. Draw a motion diagram and position-time graph to represent Marilyn's dog walking the 19.8-m distance from in front of her house to the nearest fire hydrant.



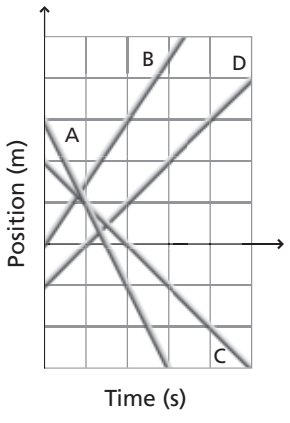
Section Review

2.4 How Fast? pages 43–47

page 47

For problems 29–31, refer to ***Figure 2-25.***

29. Average Speed Rank the position-time graphs according to the average speed of the object, from greatest average speed to least average speed. Specifically indicate any ties.



■ **Figure 2-25**

For speed use the absolute value, therefore A, B, C = D

$\text{Slope}_A = -2$

$\text{Slope}_B = \frac{3}{2}$

$\text{Slope}_C = -1$

$\text{Slope}_D = 1$

30. Average Velocity Rank the graphs according to average velocity, from greatest average velocity to least average velocity. Specifically indicate any ties.

B, D, C, A

$\text{Slope}_A = -2$

$\text{Slope}_B = \frac{3}{2}$

$\text{Slope}_C = -1$

$\text{Slope}_D = 1$

31. Initial Position Rank the graphs according to the object's initial position, from most positive position to most negative position. Specifically indicate any ties. Would your ranking be different if you had been asked to do the ranking according to initial distance from the origin?

A, C, B, D. Yes, the ranking from greatest to least distance would be A, C, D, B.

32. Average Speed and Average Velocity Explain how average speed and average velocity are related to each other.

Average speed is the absolute value of the average velocity. Speed is only a magnitude, while velocity is a magnitude and a direction.

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33. Critical Thinking In solving a physics problem, why is it important to create pictorial and physical models before trying to solve an equation?

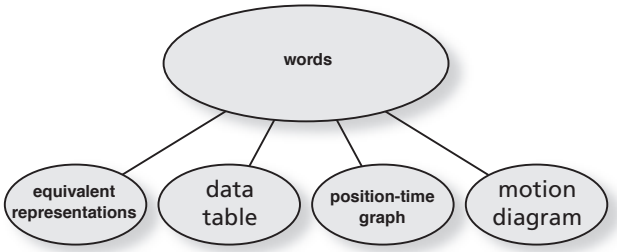
Answers will vary, but here are some of the important points. Drawing the models before writing down the equation helps you to get the problem situation organized in your head. It's difficult to write down the proper equation if you don't have a clear picture of how things are situated and/or moving. Also, you choose the coordinate system in this step, and this is essential in making sure you use the proper signs on the quantities you will substitute into the equation later.

Chapter Assessment

Concept Mapping

page 52

34. Complete the concept map below using the following terms: *words, equivalent representations, position-time graph.*



Mastering Concepts

page 52

35. What is the purpose of drawing a motion diagram? (2.1)

A motion diagram gives you a picture of motion that helps you visualize displacement and velocity.

36. Under what circumstances is it legitimate to treat an object as a point particle? (2.1)

An object can be treated as a point particle if internal motions are not important and if the object is small in comparison to the distance it moves.

37. The following quantities describe location or its change: position, distance, and displacement. Briefly describe the differences among them. (2.2)

Position and displacement are different from distance because position and displacement both contain information about the direction in which an object has moved, while distance does not. Distance and displacement are different from position because they describe how an object's location has changed during a time interval, where position tells exactly where an object is located at a precise time.

38. How can you use a clock to find a time interval? (2.2)

Read the clock at the beginning and end of the interval and subtract the beginning time from the ending time.

39. In-line Skating How can you use the position-time graphs for two in-line skaters to determine if and when one in-line skater will pass the other one? (2.3)

Draw the two graphs on the same set of axes. One inline skater will pass the other if the lines representing each of their motions intersect. The position coordinate of the point where the lines intersect is the position where the passing occurs.

40. Walking Versus Running A walker and a runner leave your front door at the same time. They move in the same direction at different constant velocities. Describe the position-time graphs of each. (2.4)

Both are straight lines that start at the same position, but the slope of the runner's line is steeper.

41. What does the slope of a position-time graph measure? (2.4)

velocity

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42. If you know the positions of a moving object at two points along its path, and you also know the time it took for the object to get from one point to the other, can you determine the particle's instantaneous velocity? Its average velocity? Explain. (2.4)

It is possible to calculate the average velocity from the information given, but it is not possible to find the instantaneous velocity.

Applying Concepts

page 52

43. Test the following combinations and explain why each does not have the properties needed to describe the concept of velocity: $\Delta d + \Delta t$, $\Delta d - \Delta t$, $\Delta d \times \Delta t$, $\Delta t / \Delta d$.

$\Delta d + \Delta t$ increases when either term increases. The sign of $\Delta d - \Delta t$ depends upon the relative sizes of Δd and Δt. $\Delta d \times \Delta t$ increases when either increases. $\Delta t / \Delta d$ decreases with increasing displacement and increases with increasing time interval, which is backwards from velocity.

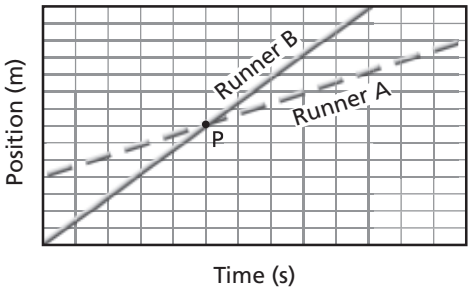
44. **Football** When can a football be considered a point particle?

A football can be treated as a point particle if its rotations are not important and if it is small in comparison to the distance it moves — for distances of 1 yard or more.

45. When can a football player be treated as a point particle?

A football player can be treated as a point particle if his or her internal motions are not important and if he or she is small in comparison to the distance he or she moves — for distances of several yards or more.

46. **Figure 2-26** is a graph of two people running.



■ **Figure 2-26**

a. Describe the position of runner A relative to runner B at the *y*-intercept.

Runner A has a head start by four units.

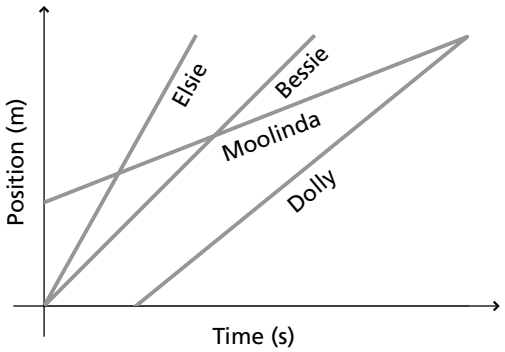
b. Which runner is faster?

Runner B is faster, as shown by the steeper slope.

c. What occurs at point P and beyond?

Runner B passes runner A at point P.

47. The position-time graph in **Figure 2-27** shows the motion of four cows walking from the pasture back to the barn. Rank the cows according to their average velocity, from slowest to fastest.

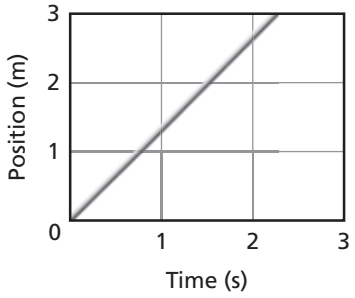


■ **Figure 2-27**

Moolinda, Dolly, Bessie, Elsie

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48. **Figure 2-28** is a position-time graph for a rabbit running away from a dog.



■ **Figure 2-28**

a. Describe how this graph would be different if the rabbit ran twice as fast.

The only difference is that the slope of the graph would be twice as steep.

b. Describe how this graph would be different if the rabbit ran in the opposite direction.

The magnitude of the slope would be the same, but it would be negative.

Mastering Problems

2.4 How Fast?

page 53

Level 1

49. A bike travels at a constant speed of 4.0 m/s for 5.0 s. How far does it go?

$$d = vt$$
$$= (4.0\ \text{m/s})(5\ \text{s})$$
$$= 20\ \text{m}$$

50. **Astronomy** Light from the Sun reaches Earth in 8.3 min. The speed of light is 3.00×10^8 m/s. How far is Earth from the Sun?

$$d = vt$$
$$= (3.00\times10^8\ \text{m/s})(8.3\ \text{min})\left(\frac{60\ \text{s}}{1\ \text{min}}\right)$$
$$= 1.5\times10^{11}\ \text{m}$$

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Level 2

51. A car is moving down a street at 55 km/h. A child suddenly runs into the street. If it takes the driver 0.75 s to react and apply the brakes, how many meters will the car have moved before it begins to slow down?

$$d = vt$$
$$= (55\ \text{km/h})(0.75\ \text{s})\left(\frac{1000\ \text{m}}{1\ \text{km}}\right)\left(\frac{1\ \text{h}}{3600\ \text{s}}\right)$$
$$= 11\ \text{m}$$

52. Nora jogs several times a week and always keeps track of how much time she runs each time she goes out. One day she forgets to take her stopwatch with her and wonders if there's a way she can still have some idea of her time. As she passes a particular bank, she remembers that it is 4.3 km from her house. She knows from her previous training that she has a consistent pace of 4.0 m/s. How long has Nora been jogging when she reaches the bank?

$$d = vt$$
$$t = \frac{d}{v} = \frac{(4.3\ \text{km})\left(\frac{1000\text{m}}{1\ \text{km}}\right)}{4.0\ \text{m/s}}$$
$$= 1075\ \text{s}$$
$$= (1075\ \text{s})\left(\frac{1\ \text{min}}{60\ \text{s}}\right)$$
$$= 18\ \text{min}$$

Level 3

53. **Driving** You and a friend each drive 50.0 km. You travel at 90.0 km/h; your friend travels at 95.0 km/h. How long will your friend have to wait for you at the end of the trip?

$$d = vt$$
$$t_1 = \frac{d}{v} = \frac{50.0\ \text{km}}{90.0\ \text{km/h}}$$
$$= 0.556\ \text{h}$$
$$t_2 = \frac{d}{v} = \frac{50.0\ \text{km}}{95.0\ \text{km/h}}$$
$$= 0.526\ \text{h}$$
$$t_1 - t_2 = (0.556\ \text{h} - 0.526\ \text{h})\left(\frac{60\ \text{min}}{1\ \text{h}}\right)$$
$$= 1.8\ \text{min}$$

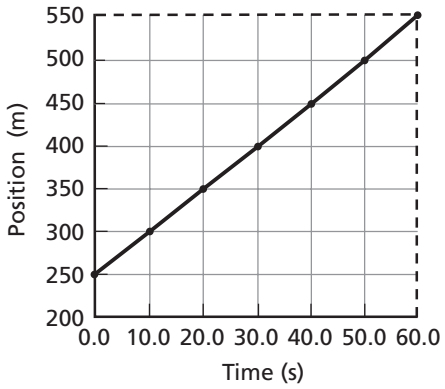
Mixed Review

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Level 1

54. **Cycling** A cyclist maintains a constant velocity of +5.0 m/s. At time $t = 0.0$ s, the cyclist is +250 m from point A.

a. Plot a position-time graph of the cyclist's location from point A at 10.0-s intervals for 60.0 s.



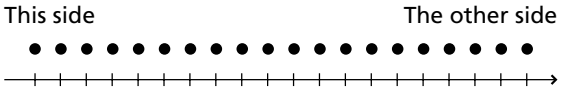
b. What is the cyclist's position from point A at 60.0 s?

550 m

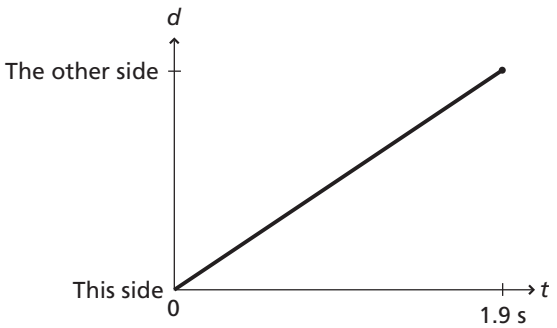
c. What is the displacement from the starting position at 60.0 s?

550 m − 250 m = 3.0×10^2 m

55. **Figure 2-29** is a particle model for a chicken casually walking across the road. Time intervals are every 0.1 s. Draw the corresponding position-time graph and equation to describe the chicken's motion.



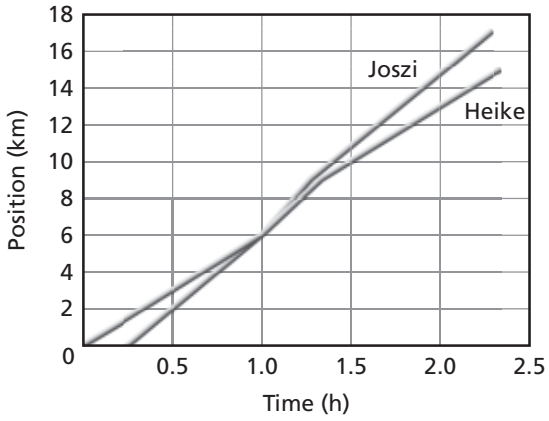
■ **Figure 2-29**



56. **Figure 2-30** shows position-time graphs for

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Joszi and Heike paddling canoes in a local river.



■ **Figure 2-30**

a. At what time(s) are Joszi and Heike in the same place?

1.0 h

b. How much time does Joszi spend on the river before he passes Heike?

45 min

c. Where on the river does it appear that there might be a swift current?

from 6.0 to 9.0 km from the origin

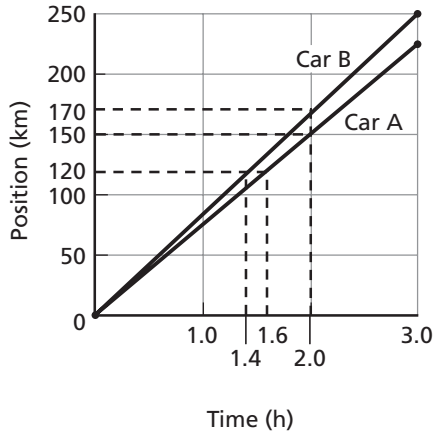
Level 2

57. Driving Both car A and car B leave school when a stopwatch reads zero. Car A travels at a constant 75 km/h, and car B travels at a constant 85 km/h.

a. Draw a position-time graph showing the motion of both cars. How far are the two cars from school when the stopwatch reads 2.0 h? Calculate the distances and show them on your graph.

$$d_A = v_A t$$
$$= (75 \text{ km/h})(2.0 \text{ h})$$
$$= 150 \text{ km}$$

$$d_B = v_B t$$
$$= (85 \text{ km/h})(2.0 \text{ h})$$
$$= 170 \text{ km}$$

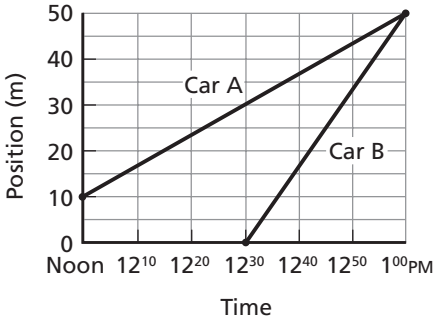


b. Both cars passed a gas station 120 km from the school. When did each car pass the gas station? Calculate the times and show them on your graph.

$$t_A = \frac{d}{v_A} = \frac{120 \text{ km}}{75 \text{ km/h}} = 1.6 \text{ h}$$

$$t_B = \frac{d}{v_B} = \frac{120 \text{ km}}{85 \text{ km/h}} = 1.4 \text{ h}$$

58. Draw a position-time graph for two cars traveling to the beach, which is 50 km from school. At noon, Car A leaves a store that is 10 km closer to the beach than the school is and moves at 40 km/h. Car B starts from school at 12:30 P.M. and moves at 100 km/h. When does each car get to the beach?



Both cars arrive at the beach at 1:00 P.M.

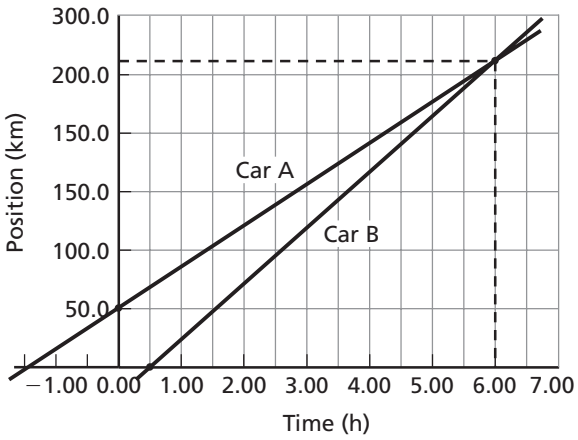
Level 3

59. Two cars travel along a straight road. When a stopwatch reads $t = 0.00$ h, car A is at $d_A = 48.0$ km moving at a constant 36.0 km/h. Later, when the watch reads $t = 0.50$ h, car B is at $d_B = 0.00$ km moving

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at 48.0 km/h. Answer the following questions, first, graphically by creating a position-time graph, and second, algebraically by writing equations for the positions d_A and d_B as a function of the stopwatch time, t.

a. What will the watch read when car B passes car A?



Cars pass when the distances are equal, $d_A = d_B$

$d_A = 48.0\text{ km} + (36.0\text{ km/h})t$

and $d_B = 0 + (48.0\text{ km/h})(t - 0.50\text{ h})$

so $48.0\text{ km} + (36.0\text{ km/h})t = (48.0\text{ km/h})(t - 0.50\text{ h})$

$(48.0\text{ km}) + (36.0\text{ km/h})t = (48.0\text{ km/h})t - 24\text{ km}$

$72\text{ km} = (12.0\text{ km/h})t$

$t = 6.0\text{ h}$

b. At what position will car B pass car A?

$d_A = 48.0\text{ km} + (36.0\text{ km/h})(6.0\text{ h})$

$= 2.6\times10^2\text{ km}$

c. When the cars pass, how long will it have been since car A was at the reference point?

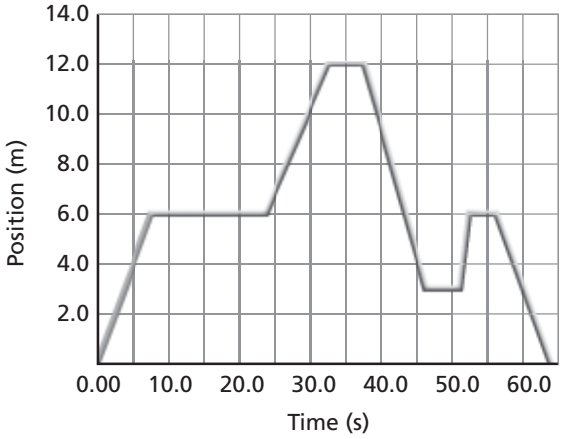
$d = vt$

so $t = \frac{d}{v} = \frac{-48.0\text{ km}}{36.0\text{ km/h}} = -1.33\text{ h}$

Car A has started 1.33 h before the clock started.

$t = 6.0\text{ h} + 1.33\text{ h} = 7.3\text{ h}$

60. **Figure 2-31** shows the position-time graph depicting Jim's movement up and down the aisle at a store. The origin is at one end of the aisle.



■ **Figure 2-31**

a. Write a story describing Jim's movements at the store that would correspond to the motion represented by the graph.

Answers will vary.

b. When does Jim have a position of 6.0 m?

from 8.0 to 18.0 s, 53.0 to 56.0 s, and at 43.0 s

c. How much time passes between when Jim enters the aisle and when he gets to a position of 12.0 m? What is Jim's average velocity between 37.0 s and 46.0 s?

$t = 33.0\text{ s}$

Using the points (37.0 s, 12.0 m) and (46.0 s, 3.00 m)

$\overline{v} = \frac{d_f - d_i}{t_f - t_i} = \frac{3.00\text{ m} - 12.0\text{ m}}{46.0\text{ s} - 37.0\text{ s}}$

$= -1.00\text{ m/s}$

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Thinking Critically

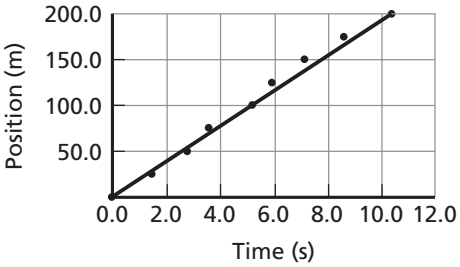
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61. Apply Calculators Members of a physics class stood 25 m apart and used stopwatches to measure the time which a car traveling on the highway passed each person. Their data are shown in **Table 2-3.**

Table 2-3

Position v. Time	
Time (s)	**Position (m)**
0.0	0.0
1.3	25.0
2.7	50.0
3.6	75.0
5.1	100.0
5.9	125.0
7.0	150.0
8.6	175.0
10.3	200.0

Use a graphing calculator to fit a line to a position-time graph of the data and to plot this line. Be sure to set the display range of the graph so that all the data fit on it. Find the slope of the line. What was the speed of the car?



The slope of the line and the speed of the car are 19.7 m/s.

62. Apply Concepts You plan a car trip for which you want to average 90 km/h. You cover the first half of the distance at an average speed of only 48 km/h. What must your average speed be in the second half of the trip to meet your goal? Is this reasonable? Note that the velocities are based on half the distance, not half the time.

720 km/h; No

Explanation:
Assume you want to travel 90 km in 1 h. If you cover the first half of the distance at 48 km/h, then you've gone 45 km in 0.9375 h (because $t = \frac{d}{v}$). This means you have used 93.75% of your time for the first half of the distance leaving 6.25% of the time to go the remaining 45 km.

$$v = \frac{45 \text{ km}}{0.0625 \text{ h}}$$

$$= 720 \text{ km/h}$$

63. Design an Experiment Every time a particular red motorcycle is driven past your friend's home, his father becomes angry because he thinks the motorcycle is going too fast for the posted 25 mph (40 km/h) speed limit. Describe a simple experiment you could do to determine whether or not the motorcycle is speeding the next time it is driven past your friend's house.

There are actually several good possibilities for answers on this one. Two that should be among the most popular are briefly described here. 1) Get several people together and give everyone a watch. Synchronize the watches and stand along the street separated by a consistent distance, maybe 10 m or so. When the motorcycle passes, have each person record the time (at least to an accuracy of seconds) that the motorcycle crossed in front of them. Plot a position time graph, and compute the slope of the best-fit line. If the slope is greater than 25 mph, the motorcycle is speeding. 2) Get someone with a driver's license to drive a car along the street at 25 mph in the same direction as you expect the motorcycle to go. If the motorcycle gets closer to the car (if the distance between them decreases), the motorcycle is speeding. If the distance between them stays the same, the motorcycle is driving at the speed limit. If the distance increases, the motorcycle is driving less than the speed limit.

64. Interpret Graphs Is it possible for an

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object's position-time graph to be a horizontal line? A vertical line? If you answer yes to either situation, describe the associated motion in words.

It is possible to have a horizontal line as a position-time graph; this would indicate that the object's position is not changing, or in other words, that it is not moving. It is not possible to have a position-time graph that is a vertical line, because this would mean the object is moving at an infinite speed.

Writing in Physics

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65. Physicists have determined that the speed of light is 3.00×10^8 m/s. How did they arrive at this number? Read about some of the series of experiments that were done to determine light's speed. Describe how the experimental techniques improved to make the results of the experiments more accurate.

Answers will vary. Galileo attempted to determine the speed of light but was unsuccessful. Danish astronomer Olaus Roemer successfully measured the speed of light in 1676 by observing the eclipses of the moons of Jupiter. His estimate was 140,000 miles/s (225,308 km/s). Many others since have tried to measure it more accurately using rotating toothed wheels, rotating mirrors and the Kerr cell shutter.

66. Some species of animals have good endurance, while others have the ability to move very quickly, but for only a short amount of time. Use reference sources to find two examples of each quality and describe how it is helpful to that animal.

Answers will vary. Examples of animals with high endurance to outlast predators or prey include mules, bears, and coyotes. Animals with the speed to quickly escape predators or capture prey include cheetahs, antelopes and deer.

Cumulative Review

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67. Convert each of the following time measurements to its equivalent in seconds. (Chapter 1)

a. 58 ns

5.8×10^{-8} s

b. 0.046 Gs

4.6×10^{7} s

c. 9270 ms

9.27 s

d. 12.3 ks

1.23×10^{4} s

68. State the number of significant digits in the following measurements. (Chapter 1)

a. 3218 kg

4

b. 60.080 kg

5

c. 801 kg

3

d. 0.000534 kg

3

69. Using a calculator, Chris obtained the following results. Rewrite the answer to each operation using the correct number of significant digits. (Chapter 1)

a. 5.32 mm + 2.1 mm = 7.4200000 mm

7.4 mm

b. 13.597 m × 3.65 m = 49.62905 m^2

49.6 m^2

c. 83.2 kg − 12.804 kg = 70.3960000 kg

70.4 kg

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