

Chapter 8 Review

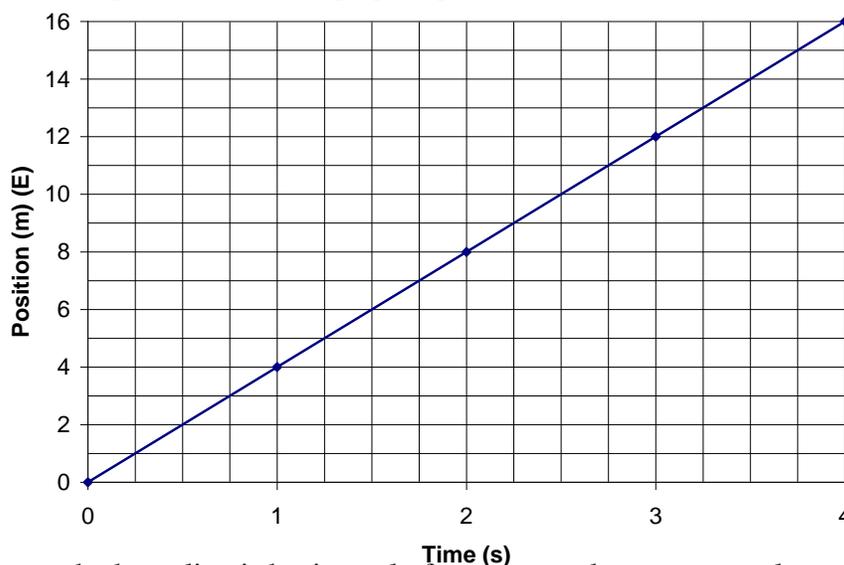
1. **Scalars** are quantities that describe magnitude but do NOT include direction.
2. **Vectors** are quantities that describe magnitude and also include direction.
3. Give 3 examples of scalars and explain why they are not vectors.
 - **Distance, Time, Speed**
 - **All three are not vectors because they do not include direction.**
4. Describe a scenario where a vector quantity would be more appropriate than a scalar quantity.
 - **Answers may vary... Giving directions somewhere. A scalar quantity would not suffice. Telling your friend to walk 2 blocks to get to your house would not help as they would not know which direction to walk in. A vector quantity would provide the direction (2 blocks east.)**
5. A scalar quantity that describes the length of a path between two points or between two locations is called **distance**, which has the SI unit of **metres (m)**.
6. **Position** is a vector quantity that describes a specific point relative to a reference point. The SI unit for this quantity is **metres (m)**.
7. The difference between **initial** time and **final** time is called the time interval. The symbol used to represent time interval or change in time is the Greek letter **Δ (delta)** beside a lowercase t .
8. Time (t) and time interval (Δt) are both **scalar** quantities with the SI unit **seconds (s)**.
9. The position of an object is measured from a reference location or **origin**.
10. Explain how you would determine the time interval for the following scenario:

You decide to drive from your house to the mall and need to stop at the gas station on the way (your house is the origin). You wish to determine the time interval to drive from the gas station to the mall. You arrive at the mall in 15 minutes from when you left your house and it takes you 5 minutes to drive to the gas station from your house.

 - **The time interval is found by subtracting the initial time from the final time. The initial time is 5 minutes as it takes 5 minutes to drive to the gas station. The final time is 15 minutes as you arrive at the mall 15 minutes after leaving your house. $\Delta t = t_f - t_i = 15\text{min} - 5\text{min} = 10\text{min}$. It takes 10min to drive from the gas station to the mall.**
11. **Displacement** describes the straight-line distance and direction from one position to another. If you leave your house, walk around the neighbourhood and return back home, the displacement of your trip is **zero**. The SI unit for displacement is **metres (m)**.
12. Similar to time interval, displacement is calculated by subtracting the **final** position from the **initial** position.
13. It is common to denote east or right as **positive** and to denote west or left as **negative**. It is also common to call **north** and **up** as positive and **south** and **down** as negative.
14. You are walking around downtown. You start 5m west of the local grocery store and end up 8m east of the grocery store. Calculate your displacement. Be sure to include direction as displacement is a vector quantity.
 - **Displacement is calculated by subtracting the initial position from the final position.**
 - **Your initial position is 5m [W] and your final position is 8m [E]. Since west is labelled negative and east is labelled positive, your initial position is -5m and your final position is +8m.**
 - **$\Delta \vec{d} = \vec{d}_f - \vec{d}_i = (+8\text{m}) - (-5\text{m}) = +13\text{m}$ The displacement is **13m [E]**.**

15. Uniform motion describes objects that travel in equal displacements in equal time intervals. Objects in uniform motion technically do not speed up or slow down.
16. Explain why in the physical world around us there is no such thing as uniform motion. Use the example of someone pushing off the boards of an ice rink while on ice skates to support your explanation.
- **In the physical world around us uniform motion doesn't technically exist due to friction and other factors (such as uneven surfaces). If you were wearing ice skates and pushed off the boards of an ice rink you would glide for a while, but eventually come to a stop. Even though the friction on ice is low, it still exists and will eventually bring you to a stop.**
17. When you create a position-time graph you plot the time data on the horizontal (x) axis and the position data on the vertical (y) axis.
18. Uniform motion is represented by a straight line on a position-time graph.
19. What is a best-fit line?
- **A smooth curve or straight line that most closely fits the general shape outlined by points on a graph.**
20. Create a position-time graph using the following data. Does the graph represent uniform motion? How do you know?

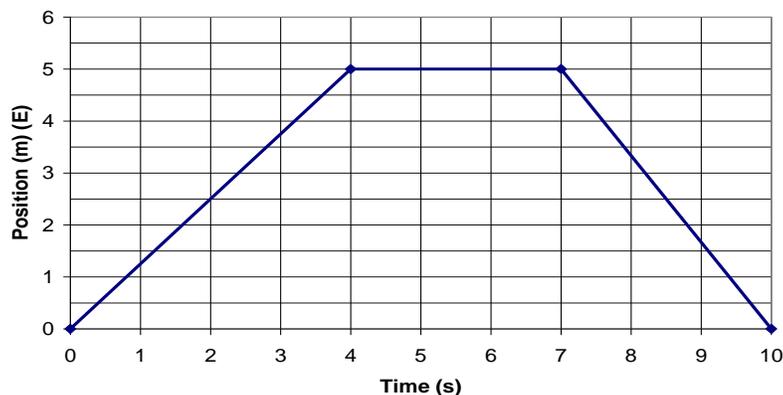
Time (s)	Position (m) (E)
0	0
1	4
2	8
3	12
4	16



- **The graph represents uniform motion since the points make a straight line.**
21. The slope of a graph refers to whether a line is horizontal or goes up or down at an angle.
22. On a position-time graph, negative slopes represent objects that are moving in opposite direction to objects that produce a positive slope.
23. On a position-time graph, positive-slopes slant up to the right, negative slopes slant down to the right, and zero slopes are horizontal.
24. Describe what positive, negative and zero slopes represent on a position-time graph as far as the motion of the object is concerned. Assume that for all graphs the object starts at position 0m at time 0s and that a positive position denotes moving to the right.
- **A positive slope slants up to the right. This means that the position of the object is moving further to the right as time goes by.**
 - **A negative slope slants down to the right. This means that the position of the object is moving further to the left as time goes by.**
 - **A zero slope is horizontal. This means that the position of the object is not changing. The object is at rest as time goes by.**

Use the position-time graph below to answer questions 25-27.

Position vs. Time



25. For each of the time intervals below, describe the motion of the object. Be sure to include direction when necessary.

a) 0s – 4s

The object starts at the origin and moves 5m east in uniform motion over the 4 second interval.

b) 4s – 7s

The object stays at rest 5m east of the origin for this 3 second interval.

c) 7s – 10s

The object starts 5m east of the origin and moves uniformly back (west) to the origin over this 3 second interval.

26. Calculate the displacement for each of the following time intervals.

a) 0s – 4s

$$\Delta \vec{d} = \vec{d}_f - \vec{d}_i = (+5\text{m}) - (0\text{m}) = +5\text{m} \quad \text{The object's displacement is 5m [E].}$$

b) 4s – 7s

$$\Delta \vec{d} = \vec{d}_f - \vec{d}_i = (+5\text{m}) - (+5\text{m}) = 0\text{m} \quad \text{The object's displacement is 0m.}$$

c) 7s – 10s

$$\Delta \vec{d} = \vec{d}_f - \vec{d}_i = (0\text{m}) - (+5\text{m}) = -5\text{m} \quad \text{The object's displacement is 5m [W]}$$

27. What is the total distance that the object traveled over the time interval from 0s – 10s?

The object travelled 5m over the first 4 seconds, 0m over the next 3 seconds, and 5m in the last 3 seconds. (5m + 0m + 5m = 10m). The total distance travelled by the object is 10m.

28. Speed is the distance an object travels during a given time interval divided by the time interval. It is a scalar quantity and has an SI unit of metres per second (m/s).

29. Velocity is the displacement of an object during a given time interval divided by the time interval. It is a vector quantity and has an SI unit of metres per second (m/s).

30. Describe the difference between speed and velocity.

- **Speed is a scalar quantity, while velocity is a vector quantity.**
- **The major difference between the two is that velocity describes the change in position (displacement) over a given time interval, while speed describes the change in distance over a given time interval.**
- **Velocity includes the direction, while speed does not.**

31. Explain how objects travelling the same speed can have different velocities. Provide an example.

Two objects can have the same speed but be moving in different directions; giving them different velocities (the two gondolas from the notes or on page 362 of your textbook.

32. If Person A has a greater displacement than Person B for an equal time interval, then Person A is moving faster than Person B. If a position-time graph is made for each person, the slope of the graph made by Person A would be steeper than that of Person B.

33. Explain how you calculate the slope of a position-time graph.

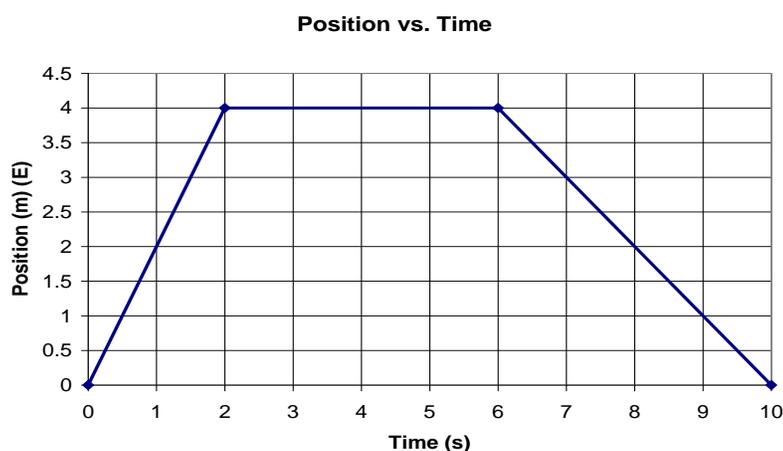
- To calculate the slope of a position-time graph you need to choose a time interval (with a final and initial time.)

- Find the position at the final time and the position at the initial time. To calculate slope you divide the displacement (change in position) for that time interval by the time interval.

$$\text{-SLOPE} = \frac{\text{rise}}{\text{run}} = \frac{\Delta \vec{d}}{\Delta t} = \frac{(\vec{d}_f - \vec{d}_i)}{(t_f - t_i)}$$

34. Average velocity is the rate of change in position for a time interval.

Use the following graph below to answer question 35.



35. For each of the time intervals below, describe and calculate the velocity of the object. Remember that moving east is positive and moving west is negative.

a) 0s – 2s

The object has a positive velocity of 4m/2s or 2m/s [E]

b) 2s – 6s

The object has a zero velocity at it remains at rest.

c) 6s – 10s

The object has a negative velocity of -4m/4s or -1m/s or 1m/s [W]

36. If you want to change metres per second (m/s) to kilometres per hour (km/h) you multiply the metres per second by 3.6. If you want to change kilometres per hour (km/h) to metres per second (m/s) you divide the kilometres per hour by 3.6.

37. Convert the following:

a) 20 m/s to km/h

$$(20\text{m/s}) \times (3.6) = 72\text{km/h}$$

b) 45 km/h to m/s

$$(45\text{km/h}) / (3.6) = 12.5\text{m/s}$$

38. On a position-time graph the slope can be calculated by dividing the change in the y axis value by the change in the x axis value.

39. Calculate the velocities of the following objects:

- a) An object moves 25 m [E] in 5 seconds.

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{25\text{m}}{5\text{s}} = 5\text{m/s[E]}$$

- b) An object moves 10 km [W] in 2 hours.

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{10\text{km}}{2\text{h}} = 5\text{km/h[W]}$$

- c) An object moves 500 metres [E] in 8 minutes.

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{500\text{m}}{(8\text{min} \times 60\text{s/min})} = \frac{500\text{m}}{480\text{s}} = 1.04\text{m/s[E]}$$

40. Calculate the displacement of the following objects:

- a) An object has a velocity of 6 m/s [E] for 8 seconds.

$$\Delta \vec{d} = \vec{v} \times \Delta t = 6\text{m/s} \times 8\text{s} = +48\text{m} = 48\text{m[E]}$$

- b) An object has a velocity of 55 km/h [W] for 2.5 hours.

$$\Delta \vec{d} = \vec{v} \times \Delta t = -55\text{km/h} \times 2.5\text{h} = -137.5\text{km} = 137.5\text{km[W]}$$

- c) An object has a velocity of 0.5 m/s [W] for 2 minutes.

$$\Delta \vec{d} = \vec{v} \times \Delta t = -0.5\text{m/s} \times (2\text{min} \times 60\text{s/min}) = -0.5\text{m/s} \times 120\text{s} = -60\text{m} = 60\text{m[W]}$$

41. Calculate the time of the following scenarios:

- a) An object travels west at 3 m/s. How long would it take the object to travel 15 m [W]?

$$\Delta t = \frac{\Delta \vec{d}}{\vec{v}} = \frac{-15\text{m}}{3\text{m/s}} = 5\text{s}$$

- b) An object travels east at 6 km/h. How long would it take the object to travel 48 km [E]?

$$\Delta t = \frac{\Delta \vec{d}}{\vec{v}} = \frac{48\text{km}}{6\text{km/h}} = 8\text{h}$$

- c) An object travels east at 5 m/s. How many hours would it take the object to travel 22 km [E]?

$$\Delta t = \frac{\Delta \vec{d}}{\vec{v}} = \frac{22000\text{m}}{5\text{m/s}} = 4400\text{s} \quad \text{or} \quad \Delta t = \frac{\Delta \vec{d}}{\vec{v}} = \frac{22\text{km}}{18\text{km/h}} = 1.22\text{h}$$

Vocabulary to Know:

Write a concise definition of each of these terms found in this chapter.

Average velocity:

Best-fit line:

Displacement:

Distance:

Motion diagram:

Position:

Position-time graph:

Scalars:

Speed:

Slope:

- Negative:

- Positive:

- Zero:

Time:

Time interval:

Uniform motion:

Vectors:

Velocity:

Symbols to Know:

Indicate what each of the following symbols represent and whether they are a scalar quantity or a vector quantity.

- d *distance* *scalar*
- \vec{d} *position* *vector*
- $\Delta\vec{d}$ *displacement* *vector*
- t *time* *scalar*
- Δt *time interval* *scalar*
- v *speed* *scalar*
- \vec{v} *velocity* *vector*
- \vec{v}_{av} *average velocity* *vector*