Average Speed

Average speed is the total distance traveled by an object divided by the total time for the trip.

$$v_{av} = \frac{d}{t}$$ ← defining equation

v_{av} -> average speed (m/s, km/h)
d -> distance (m, km)
t -> time (s, h)

$v_{av} = \frac{d}{t}$ [d]

$t \, v_{av} = d$

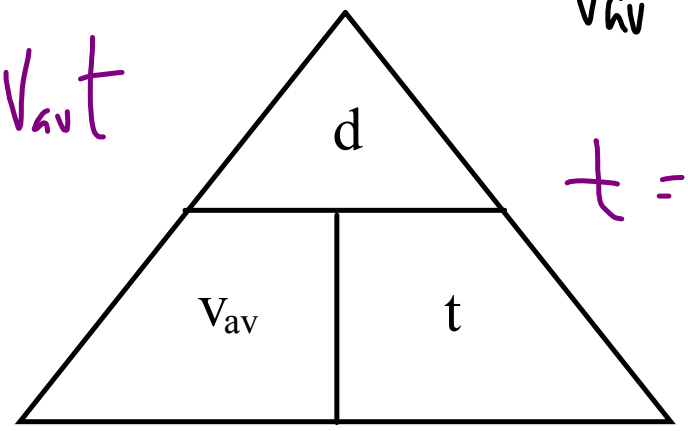
$d = t \, v_{av}$

t $v_{av} = \frac{d}{t}$ [t]

$t \, v_{av} = d$

$\frac{t \, v_{av}}{v_{av}} = \frac{d}{v_{av}}$

$t = \frac{d}{v_{av}}$



$d = v_{av} t$

$t = \frac{d}{v_{av}}$

$v_{av} = \frac{d}{t}$

Problem Solving Strategy

1. Read the problem.
2. Draw a sketch. (optional)
3. Identify the variable of the quantity you are looking for.
4. List the variables and values of given quantities.
5. Perform conversions if necessary.
6. Choose a defining equation.
7. Rearrange the equation if necessary.
8. Substitute values and units.
9. Round the final answer to the appropriate number of SDs and include an appropriate unit. Perform conversions if necessary.
10. Write a word statement.

Problem Solving Template

Looking For:	Sketch:
Given:	Solution:
Defining Equation:	
Word Statement:	

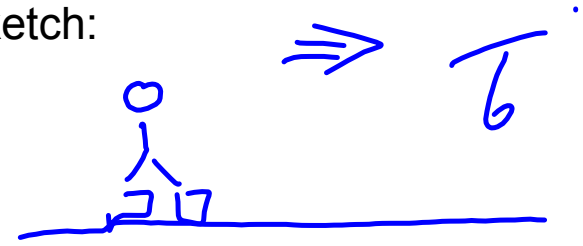
Sample Problem #1

Billy skates to school, a total distance of 4.5 km. He has to slow down twice to cross busy streets, but overall the journey takes him 0.62 h. What was Billy's average speed during the trip?

Looking For:

v_{av} (1)

Sketch:



Given:

$d = 4.5\ km$

$t = 0.62\ h$ (1)

Defining Equation:

$v_{av} = \frac{d}{t}$ (1)

Solution:

$v_{av} = \frac{d}{t}$ (1)

$v_{av} = \frac{4.5\ km}{0.62\ h}$ (1) ÷ certainty (2 SD)

$v_{av} = 7.3\ \frac{km}{h}$ (1) (2 SD)

The average speed was 7.3 km/h. (1)

7.3 km/h

Sample Problem #2

You are riding in the dome car of the Cariboo Dayliner, and you see signs every 10 km. Determine the speed of the train in km/h if the time between signs is 390.6 s.

Looking For:	Sketch:
Given:	Solution:
Defining Equation:	

92 km/h

Sample Problem #3

Kyra is trying to predict the time required to ride her bike to the nearby beach. She knows that the distance is 45 km and, from other trips, that she can usually average about 20 km/h, including slowing down for climbing hills. Predict how long the trip will take.

Looking For:	Sketch:
t (1)	
Given: $d = 45\ km$ (1) $v_{av} = 20\ \frac{km}{h}$	**Solution:** $v_{av} = \frac{d}{t}$ $t = \frac{d}{v_{av}}$ (1) $t = \frac{45\ km}{20\ \frac{km}{h}}$ (1) $t = 2.3\ h$ (1) The time was 2.3 h. (1)
Defining Equation: $v_{av} = \frac{d}{t}$ (1)	

$\frac{km}{\frac{km}{h}} = km \times \frac{h}{km}$

2.3 h

Sample #3.

$t = ?$

$d = 45\ km$

$v_{av} = 20\ \frac{km}{h}$

$v_{av} = \frac{d}{t}$

$t = \frac{d}{v_{av}}$

$t = \frac{45\ km}{20\ \frac{km}{h}}$

$t = 2.3\ h$

WS. →

Worksheet - Speed, Distance and Time

Understanding Concepts - Page 358: #3-6, 8

Worksheet - Speed, Time, Distance

1. 2 m/s
2. 5.0 m/s
3. 2.0 m/s
4. 43.89 m/s
5. $64 \frac{km}{h}$
6. 5 s
7. 1.3×10^{2} s
8. 10.7 s
9. 5×10^{1} m
10. 1×10^{1} m
11. 8.8×10^{2} m

Challenge

$2.0 \frac{m}{s}$ faster

Understanding Concepts - Page 358: #3-6, 8

#3 a) 5.2 km/h

b) 14 km/h

c) 7.6 km

d) 4.8 h

#4. 225 km

#5. Show that 1 m/s = 3.6 km/h

#6. a) 26 m/s

b) 76 km/h

#8. a) 1.77 s

b) 1227.7 km/h -> 1.23 x 10^3 km/h

Topics - SA: Physics #2

1. Plot and label points in the four quadrants.

2. Write the coordinates of a plotted point.

3. Determine the slope of a line using:

$$m = \frac{\text{rise}}{\text{run}} \quad \text{OR} \quad m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. Draw and label a distance vs. time graph.

5. Be able to determine the speed of an object from a distance vs. time graph.

6. Match a graph to a story/interpret a graph.

7. Answer questions about distance vs. time graphs.

8. Solve average speed problems.

Types of Physical Quantities

Physical Quantities

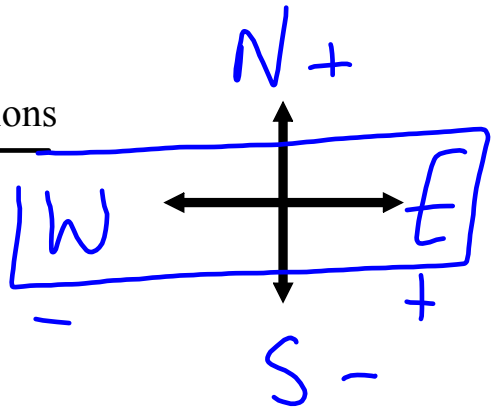
Scalar Quantities	Vector Quantities
size/magnitude (#) (with units)	size/magnitude (#) (with units) and direction
time t 12 s	?
distance d 25 km	
speed v 10 m/s	

Direction

Direction is generally stated relative to a reference point (starting point).

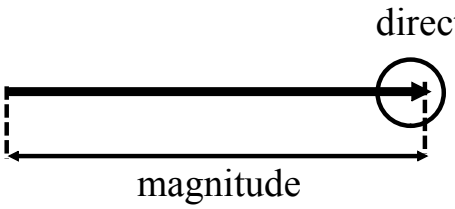
By convention (traditionally):

Positive Directions	Negative Directions
right	left
up	down
north	south
east	west



Representing Vector Quantities

A vector quantity can be represented by an arrow called a vector.



Examples - Page 416

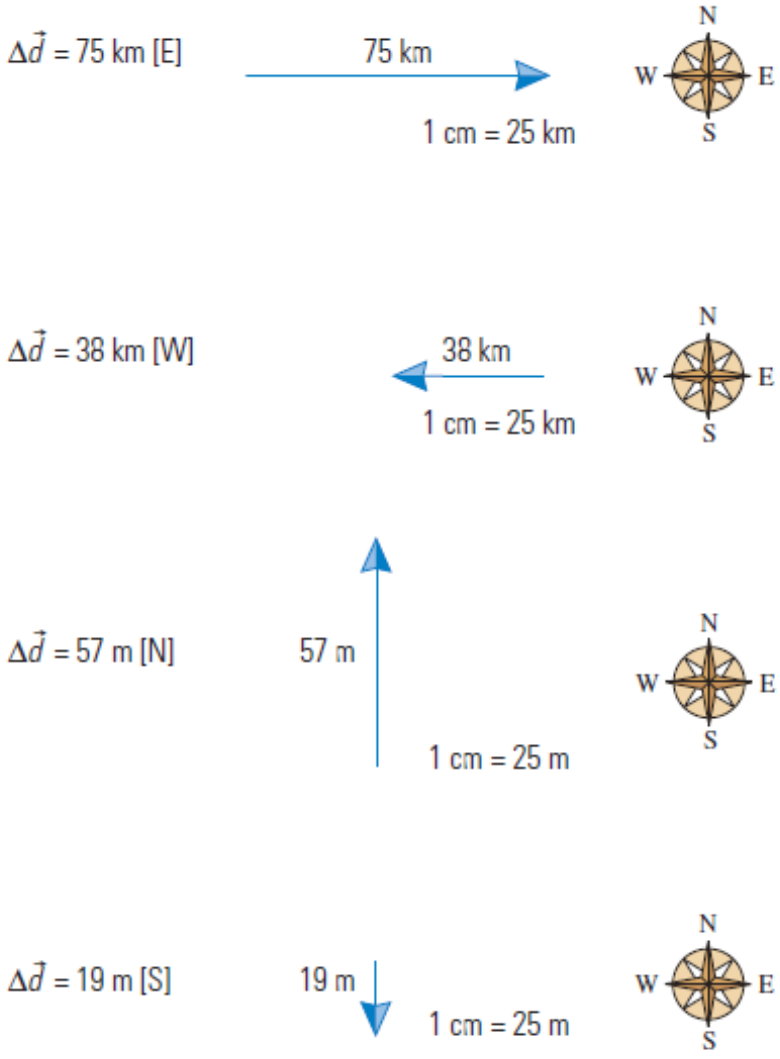


Figure 5
Vector quantities expressed as both symbols and vectors

Position

position - vector quantity
- separation and direction from a reference point

symbol: $\vec{d}$ or **d**
unit: m, cm, km

Displacement

displacement - vector quantity
- change in position

symbol: $\Delta\vec{d}$ or Δ**d**
unit: m, cm, km

$$\Delta\vec{d} = \vec{d}_f - \vec{d}_i$$

$\Delta\vec{d}$ -> displacement

$\vec{d}_i$ -> initial position (starting position)

$\vec{d}_f$ -> final position

100 Acre Wood

http://safeshare.tv/w/xvwcNRNnhE

http://safeshare.tv/w/saVawvCbtW

Reference A

$\vec{d}_i$ = L = ——

$\vec{d}_f$ = J = ——

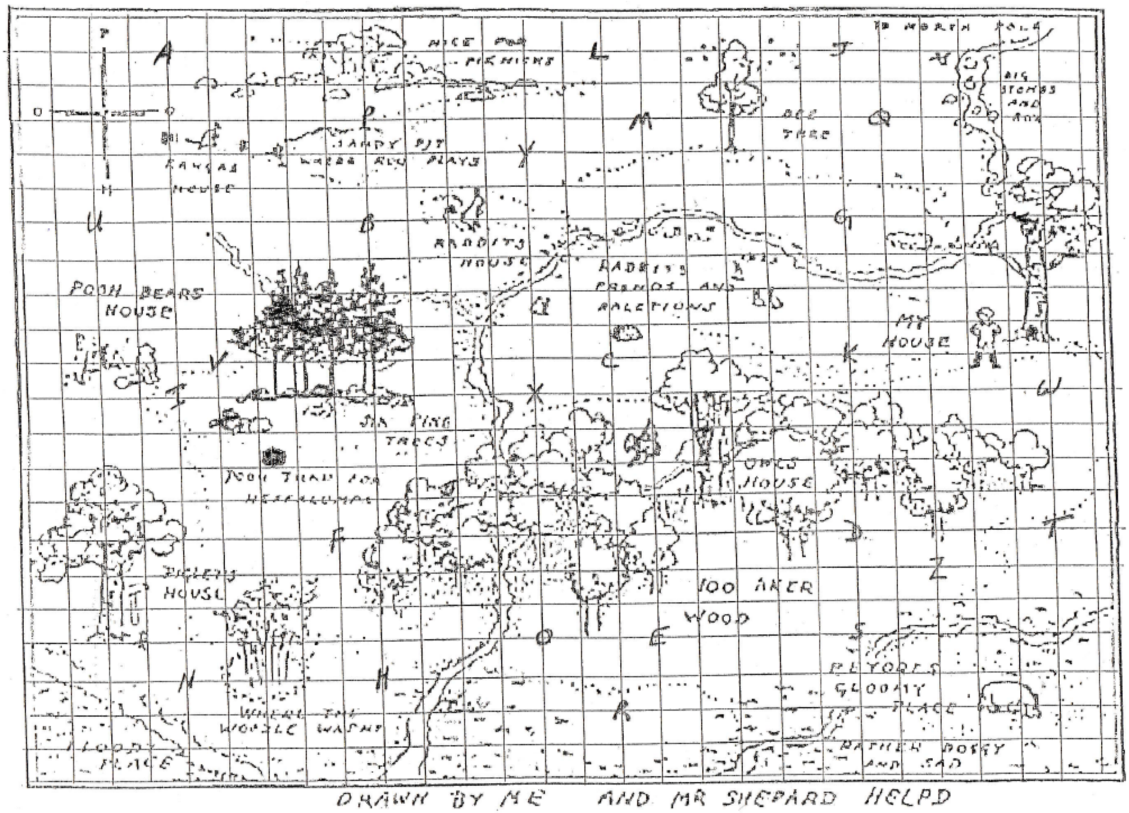
$\Delta\vec{J} = \vec{d_f} - \vec{d_i}$

−7 u

+9 u

+3 u

−9 u



DRAWN BY ME AND MR SHEPARD HELPD

100 Acre Wood

1. $\vec{d_i} = -6\,u$ $\quad \Delta\vec{d} = \vec{d_f} - \vec{d_i}$

   $\vec{d_f} = -13\,u$ $\quad \Delta\vec{d} = -13 - (-6)$

   $\Delta\vec{d} = -7\,u$

2. Ref. K $\quad \Delta\vec{d} = +9\,u$

   D $-5u$

   G $+4u$

3. Ref H $+3u$

4. Ref. W $-9u$

5. Ref. I $+18u$

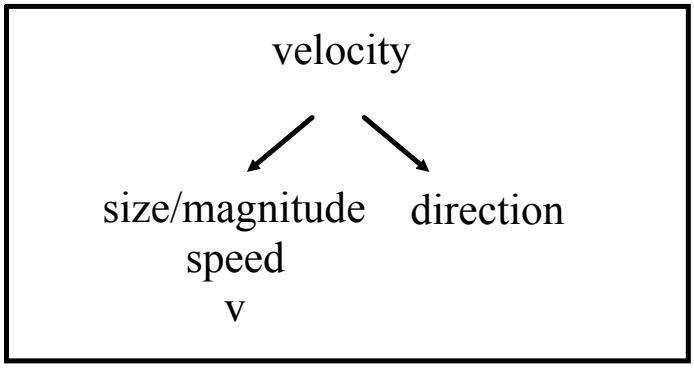
6. Ref. R $-9u$

7. Ref. T $-13u$

Velocity

(Page 432)

Velocity is a vector quantity.



symbol: $\vec{v}$ or **v**

unit: m/s, km/h

An object with constant speed and direction has constant velocity. This type of motion is called uniform motion.

Calculating Velocity

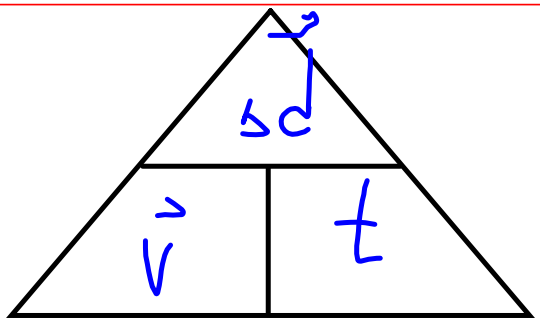
$$\vec{v} = \frac{\vec{\Delta d}}{t}$$

$\vec{v}$ - constant velocity ($\frac{m}{s}$, $\frac{km}{h}$)

$\vec{\Delta d}$ - displacement (m, km)

t - time. (s, h)

Use this formula if the velocity of an object is constant.



Sample Problem 1

A train travels at a constant speed through the countryside and has a displacement 150 km [E] in a time of 1.7 h. What is the velocity of the train?

$\vec{v} = ?$

$\Delta\vec{d} = +150\,km$

$t = 1.7\,h$ (1)

$\vec{v} = \frac{\Delta\vec{d}}{t}$ (1)

$\vec{v} = \frac{+150\,km}{1.7\,h}$ (1)

The velocity is 88 $\frac{km}{h}$, E. (1)

$\vec{v} = +88\,\frac{km}{h}$ (1)

2SD

88 km/h [E]

Attachments

Science 10 - Q Certainty SD Rules etc.docx

Science 10 - Worksheet - Significant Digits.docx

Science 10 - Worksheet - Rearranging Formulas.docx

Science 10 - Worksheet - Rearranging Formulas #2.docx

Science 10 - Worksheet - Motion Graphs - Motion Detector.doc

Science 10 - Worksheet - Position Time Graph.docx

Science 10 - Worksheet - Velocity and Average Velocity.doc

S10 - Distance vs Time Graphs #1.pdf

S10 - Ordered Pairs and Slope.pdf