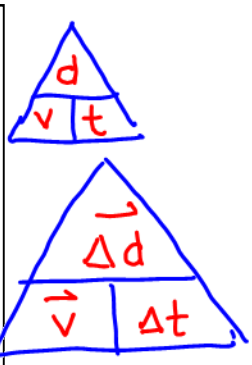
Average Velocity
Science 10 Notes

Ch8 Physics

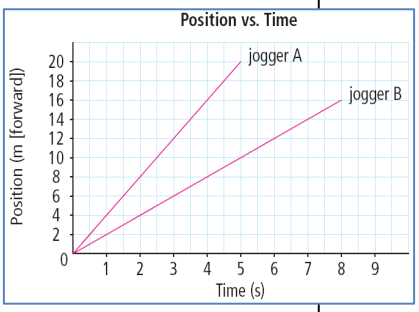
Speed and Velocity

- Speed: (v) a scalar quantity measured as km/h m/s
  - The distance an object travels divided by the time interval of the travel
- Velocity: ($\vec{v}$) a vector quantity measured as km/h m/s
  - The displacement of an object divided by the time interval.
  - Describes how fast an object's position is changing and in which direction.



Determining Speed/Velocity from a Position Time Graph

- The slope of a position time graph tells us the velocity.
- We can also use the equation: $\vec{v} = \frac{\vec{\Delta d}}{\Delta t}$
- Steeper slopes indicate greater change in displacement for a time interval and greater velocity.



$\frac{\vec{\Delta d}}{\Delta t} = \frac{m}{s}$

Average Velocity ($\vec{v}_{av}$)

- The slope of the line will tell us direction

horizontal slope : stationary
positive slope : motion in + direction
negative slope: motion in − direction.

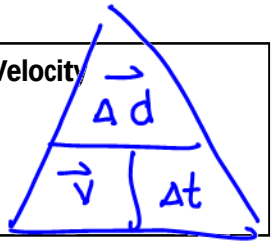
- It is very hard to have perfect, uniform motion
- An average velocity worries only about the start and end points
- Average velocity can be determined between any two points

0-6 s
$\vec{v} = \frac{\vec{\Delta d}}{\Delta t} = \frac{2m}{6s} = 0.33\ m/s$

0-10 s
$\vec{v} = \frac{\vec{\Delta d}}{\Delta t} = \frac{2m}{10s} = 0.2\ m/s$

Solving Problems Involving Time, Displacement and Velocity

- You may be familiar with the triangle:
  - Just use the vector measurements



What is the average velocity for a dog that takes 4.0s to run forward 14m? $\vec{v} = \frac{\vec{\Delta d}}{\Delta t} = \frac{+14m}{4s} = +3.5\,m/s$ or $3.5\,m/s\ [F]$	A boat travels 280m [E] in 120s. What is the boat's average velocity? $\vec{v} = \frac{\vec{\Delta d}}{\Delta t} = \frac{+280m}{120s} = +2.33\,m/s$ or $2.33\,m/s\ [E]$
What is the displacement of a bicycle that travels 8.0m/s [N] for 15s? $\vec{\Delta d} = \vec{v} \cdot \Delta t$ $= +8\,m/s \cdot 15s$ $\vec{\Delta d} = +120\,m$ or $120m\ [N]$	A person, originally starting at the starting line, runs west at 6.5m/s. What is the runner's displacement after 12s? $\vec{\Delta d} = \vec{v} \cdot \Delta t$ $= -6.5m/s \times 12s$ $= -78\,m$ or $78m\ [S]$
How long will it take cat walking north at +0.80m/s to travel 12m [N]? $\Delta t = \frac{\vec{\Delta d}}{\vec{v}} = \frac{+12m}{+.80\,m/s}$ $= 15s$	A car is driving at 15m/s forward. How long will it take to pass through an intersection that is 11m long? $\Delta t = \frac{\vec{\Delta d}}{\vec{v}} = \frac{+11m}{+15m/s}$ $= .73s$

Converting m/s and km/h

note: 1km = 1000m and 1h = 3600s

- We think about speed/velocity as a fraction.
- Multiply by conversion factors that are fancy "1"s
- Arrange units so that they cancel out.

Example: convert 90 km/h into m/s.

$$\frac{90\,km}{h} \times \frac{1000m}{km} \times \frac{h}{3600s} = 25\frac{m}{s}$$

$$25\frac{m}{s} \times \frac{km}{1000\,m} \times \frac{3600s}{h} = 90\,km/h.$$

* $\frac{km}{h} \rightarrow \frac{m}{s}$ divide by 3.6

$\frac{m}{s} \rightarrow \frac{km}{h}$ multiply by 3.6

p 156 - 159 workbook.