SCALAR & VECTOR QUANTITIES (Chapter 11- pages 412-417; 422-423; 432-436)

Scalar Quantity:

a quantity that involves size, but not direction ie. has a magnitude and units.

- Eg. distance, time, speed

Distance:

a measure of the total amount traveled regardless of direction
Indicated by the total area under a speed-time graph

Speed:

a measure of the distance traveled per unit of time (v = d/t)
Indicated by the slope of a distance-time graph

Vector Quantity:

A quantity that involves direction ie. has a magnitude, units and direction.

- Eg. Position, displacement, velocity

Position:

The separation and direction from a reference point
(Eg. The gas station is located 2.5 km west of the school)

Displacement:

a change in position measured from where you start to where you finish
Indicated by the area under a velocity-time graph

Velocity:

- a measure of the change in position (displacement) per unit of time
Indicated by the slope of a position-time graph.

QUANTITY	QUANTITY TYPE	SYMBOL	EXAMPLE
Distance	Scalar	Δd	256 m
Time	Scalar	Δt	8.0 s
Speed	Scalar	v	32 m/s
Position	Vector	$\vec{d}$	256 m [N] (of home)
Displacement	Vector	$\vec{\Delta d}$	256 m [N]
Velocity	Vector	$\vec{v}$	32 m/s [N]

Positive Directions: North, East, Right, Up

Negative Directions: South, West, Left, Down

Calculating Distance and Displacement:

Example: A person walks 2.0 m to the right, then 3.0 m to the left. What is the person's resultant distance and displacement?

Solution: ***Method 1: Use a number line.***

Method 2: Solve algebraically

Problems: For each of the following, find the distance and displacement.

1. A car travels 10 km N , then turns and travels 8 km S .

2. A shopper walks 20 m east, 42 m west and then 14 m east.

3. A jogger runs 2 laps around a 500 m oval track.

4. John starts at a position 6.00 km N , travels 12.00 km S and then 7.00 km N

Practice: p. 417, # 1,5,6,7,13, a-c

RELATING VELOCITY TO DISPLACEMENT AND TIME

Average Velocity:

- The overall rate of change of position from start to finish.
- Average velocity is like average speed plus a direction

Calculations:

Average Velocity = $\frac{\text{total displacement}}{\text{total time}}$		$\vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta \vec{t}}$
Average Speed = $\frac{\text{total distance}}{\text{Total time}}$		$v_{av} = \frac{\Delta d}{\Delta t}$

Sample Problems

1. A car travels 200.0 m E and then 100.0 m W in 10.0 s. What is its average speed? What is the average velocity?

2. A person runs 2 laps around a circular track having a circumference of 205 m in 125 s. What is its average speed? What is the person's average velocity?

3. A soccer player warming up for a game jogs along a track. She jogs 50.0 m N and then jogs 30.0 m back toward her starting point before stopping to talk to her coach. If she jogged for 20.0 s, determine her average speed and her average velocity.

4. A rocket travels at an average velocity of 340 m/s upward for 12s and then downward for 3.5 s at an average velocity of 422 m/s [down].

A. What total distance does the rocket travel?

B. What is the rocket's displacement?

C. What was the average speed of the rocket for the trip?

D. What was the average velocity of the rocket for the trip?

5. A jogger runs 52 m East in 10.0 s and then 39 m West at an average speed of 6.5 m/s. What is the jogger's average speed and average velocity?

Solution: You need to determine the time taken for the second part of the trip: (t = d/v). Then find distance and displacement. Use distance to find average speed, and displacement to find average velocity.