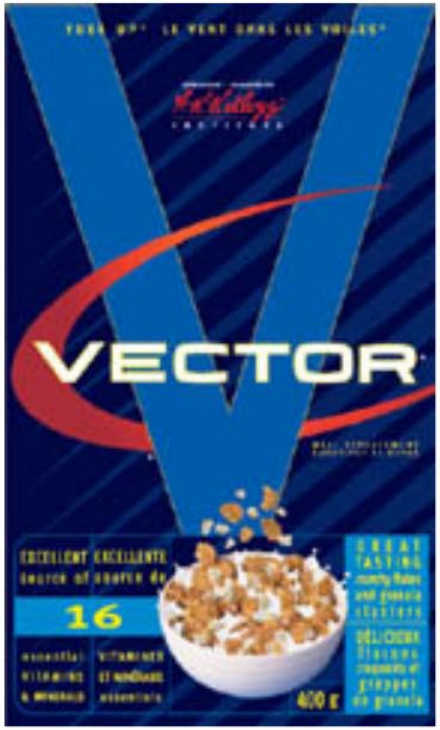
Science 10 Unit B: Physics

Intro to Kinematics: Scalars, Vectors and Uniform Motion



Kinematics

- the study of how things move.

What are some terms that we use to describe, in every day life, how things move?

-
-
-
-
-

Scalar Quantities vs. Vector Quantities

There are two ways to describe motion: using scalars and using vectors.

A) Scalar Quantities: Have magnitude, but not direction.

Scalars tell us:

- "how fast"
- "how far"

magnitude = "how much"

but do not tell us what direction objects are moving in.

ex) Mayerthorpe is 300 km away from Mallaig.

This is a statement of a scalar quantity. It tells us how far (300 km) but not the direction.

ex) ________, the cheetah, ran at 110 km/h.

This is also a scalar statement. It tells how fast, but not the direction the cheetah ran in.

Some Typical Scalars...

Distance - how far an object has moved.

Symbol: d

Speed - how far an object has moved in a period of time.

Symbol: v

Time - ...

Symbol: t

B) Vector Quantities: have both magnitude and direction.

ex) Mayerthorpe is 300 km <u>west</u> of Mallaig.

ex) __________, the cheetah, ran at 110 km/h towards a grizzly bear.

These are now vector statements.

Some Typical Vectors:

Displacement: distance with direction included; the change in position of an object.

Symbol: $\vec{d}$

Velocity: speed with direction included; the rate of change of an object's position.

Symbol: $\vec{v}$

The little arrow on top of the symbols is called a vector arrow. You must place it on top of all vector quantities (until I say not to).

$$\vec{V}$$

With these symbols, we can now introduce our first equation of Science 10!

The Uniform Velocity Formula

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

Where:

$\vec{v}$ = velocity*

$\Delta \vec{d}$ = change in displacement

Δt = change in time

*Note: the Δ is the Greek symbol delta meaning "a change in".

*This is sometimes referred to as "average velocity", $\vec{v}_{ave}$.

Sometimes you are given the change in displacement or time. Sometimes, you will need to work it out.

$$\Delta \vec{d} = \vec{d}_2 - \vec{d}_1$$

$$\Delta t = t_2 - t_1$$

(This probably seems a lot more complicated than it really is...)

ex) _______ starts running at 4:00 pm and finishes at 6:00 pm. What is his/her Δt of running?

ex) ________ the ant is walking down a ruler. He/she starts at the 10 cm mark and walks to the 25 cm mark. What is the ant's $\Delta \vec{d}$?

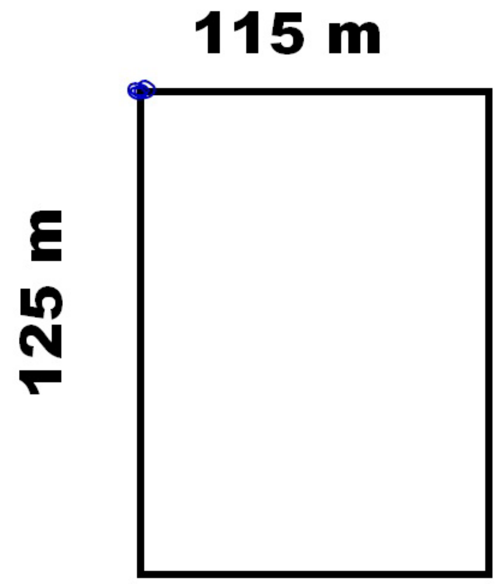
Try this on your own:

ex) ________ walks 275 m east and then turns around and walks 425 m west.

a) What is the distance traveled?

b) What is the displacement?

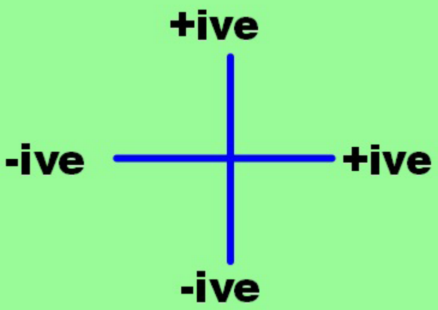
ex) _______ takes his/her pet _______ out for a walk around the block.



a) What is the distance traveled?

b) What is the displacement?

The displacement is zero because the pair end up at their starting point.



"Anytime you draw a diagram, let up and right be +ive and down and left be -ive."

$$\Delta\vec{d} = +115\ m - 125\ m - 115\ m + 125\ m$$
$$= 0\ m$$

Now, let us apply our velocity equation:

ex) A(n) ________ travels south for 3.0 h, after which it's displacement is 2.60 x 10^2 km south from its starting point.

a) What is the average velocity of the object?

$\vec{v}$ **= 87 km/h S.**

b) What is the velocity of the object in m/s?

ex) A sound wave travels 2.0 x 10^1 km [W] in 1.00 minute. What is the velocity of sound (in m/s)?

ex) How long does it take a photon of light to travel 149598000 km (the distance between the sun and earth) if the speed of light is 3.00×10^8 m/s?

ex) What distance could light travel in one year?