Units, Vectors and Scalars

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Units

Units are very important. Keep track of all your units throughout your calculations. Every answer you give in this class must have units.

Common units we will use:

- Meter (m), Kilometer (km), Nanometer (nm)
- Seconds (s), Minutes (min), Hours (h)
- Kilogram (kg), gram (g)
- Joule (J)
- Meters per second (m/s), Kilometers per hour (km/h)

An important rule in math and physics is that you cannot combine terms unless they have the same dimensions or units. You can only add lengths to lengths and times to time. The following expression does not make sense.

10 meters + 17 seconds = ??????

Which of the following expressions makes sense?

7m + 5m = 12m

8cm - 34kg = Nonsense

77minutes + 3hours = 180mins = 257mins = 4hr 17mins

$\frac{10m}{3s} + 11\,m \cdot s$ = nonsense

Velocity

$\frac{6\,m^2/_s \cdot kg}{11m/s^2} + 4kg \cdot m \cdot s$

$\frac{6}{11} kg m s + 4 kg m \cdot s = 4.54\, kg m \cdot s$

$\frac{\frac{m^2}{s} \cdot kg}{m/s^2} = \frac{m^2}{s} \cdot kg \cdot \frac{s^2}{m} = kg \cdot m \cdot s$

Scalars and Vectors

These are two forms of variables that we use in physics.

Scalar is a variable that only has a measure of magnitude (ie. distance, speed, mass, energy)

v = 30.0 m/s (a speed of 30.0 m/s)

Vector is a variable that has both a magnitude as well as a direction (ie. displacement, velocity, force, momentum)

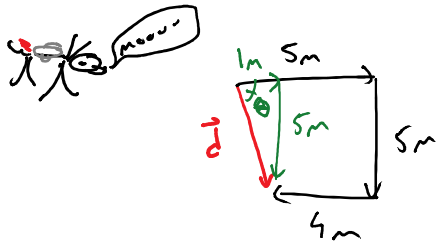
$\vec{v}$ = 30.0 m/s East (a velocity of 30.0m/s east)

Often to differentiate between a vector and a scalar we use the arrow over top of the scalar equivalent.

Examples:

1. A flying cow walks 5 meters east, then 5 meters south, then 4 meters west. Find the total distance the cow has

walked and the displacement from where it began.



$d_T = 5 + 5 + 4$

$= 14m$

$\vec{d}^2 = 5^2 + 1^2$

$\vec{d} = \sqrt{26}$

$|\vec{d}| = 5.1m$

$\tan\theta = \frac{5}{1}$

$\theta = \tan^{-1}[5]$

$\theta = 77°$

$\vec{d} = 5.1m$ @ $77°$ South of East