

Acceleration

<http://hyperphysics.phy-astr.gsu.edu/hbase/acca.html>

Acceleration is defined as the rate of change of [velocity](#). Acceleration is inherently a [vector](#) quantity, and an object will have non-zero acceleration if its speed and/or direction is changing. The average acceleration is given by

$$\vec{a}_{average} = \vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

where the small arrows indicate the vector quantities. The operation of subtracting the initial from the final velocity must be done by [vector addition](#) since they are inherently vectors.

The [units](#) for acceleration can be implied from the definition to be meters/second divided by seconds, usually written m/s^2 .

The instantaneous acceleration at any time may be obtained by taking the limit of the average acceleration as the time interval approaches zero. This is the [derivative](#) of the velocity with respect to time:

$$\vec{a}_{instantaneous} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$$