

P9: Motion: Physics Specification

Speed

Speed is a scalar quantity as it does not involve direction. The speed of a moving object is normally changing and so is rarely constant. The speed a person travels at can depend on their age, terrain (is it hilly or flat) fitness and distance travelled. Typically people travel at 1.5m/s when walking, 3m/s when running and 6m/s when cycling. The speed of sound and of the wind may change also. Sound typically travels at 330m/s. The formula to calculate the speed of an object is:

$$\text{Distance Travelled} = \text{Speed} \times \text{Time}$$

Acceleration

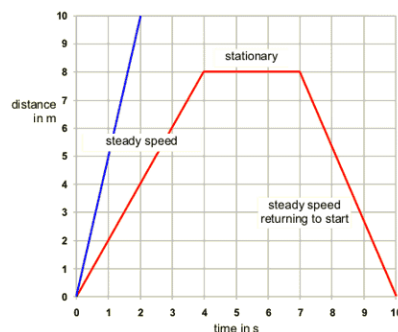
This is a measurement of the rate in which an objects velocity changes. If an object is slowing down than it is said to be decelerating. It can be calculated using the equation:

$$\text{Acceleration} = \text{change in velocity} / \text{time taken.}$$

Be careful when calculating change in velocity. For example if you are told an object from standing accelerates to 12m/s then the change in velocity is 12m/s. However if you are told that the object was moving at 5m/s and accelerates to 12m/s the change in velocity is now 7m/s.

Distance Time Graphs

If an object moves along a straight line, the distance travelled can be represented by a distance–time graph. The speed of an object can be calculated from the gradient of its distance–time graph. If an object is accelerating, its speed at any particular time can be determined by drawing a tangent and measuring the gradient of the distance–time graph at that time.



Velocity

The velocity of an object is its speed in a particular direction. This means velocity is a vector quantity. If you are travelling around a roundabout (in a circle) your speed may be constant, but the velocity will be changing as you are constantly changing direction.

Uniform Acceleration

The following equation applies to uniform acceleration (you are given this one on your data sheet):

$$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$$

Near the Earth's surface any object falling freely under gravity has an acceleration of about 9.8m/s²

Velocity Time Graphs

The acceleration of an object can be calculated from the gradient of a velocity–time graph. The distance travelled by the object can be calculated by measuring the area underneath the line of a velocity time graph.

Quantity	Symbol	Unit
Speed	v	m/s
Distance	s	m
Time	t	s
Change in Velocity	Δv	m/s
Initial Velocity	u	m/s
Final Velocity	v	m/s
Acceleration	a	m/s ²

Drawing a Tangent on a Point of Acceleration of a Distance Time Graph

