KS4 Physics: Velocity

Numeracy

Equations
A car travels 500 m in 50 s, then 1,500 m in 75 s. Calculate its average speed for the whole journey?

First calculate total distance travelled (s), then calculate total time taken, (t):
500 + 1,500 = 2,000 m
50 + 75 = 125 s

Then rearrange to find
$s = v \times t \rightarrow v = s \div t \rightarrow v = 2{,}000 \div 125 \rightarrow 16 m/s$

A car takes 8.0 s to accelerate from rest to 28 m/s. Calculate the average acceleration of the car?

change in velocity, $= (28 - 0) = 28$ m/s

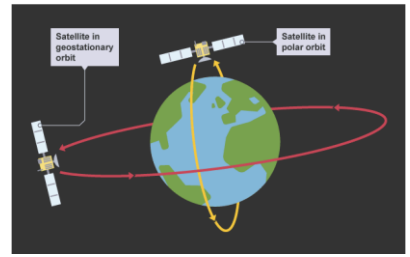
$a = \Delta v \div t \rightarrow a = 28 \div 8 \rightarrow a = 3.5 m/s^2$

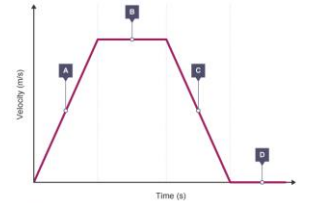
Key Facts

- In a s-t graph, the gradient of the line is equal to the speed of the object. The greater the gradient (steeper the line) the faster the object is moving.
- The speed of an object can be calculated from the gradient of a distance-time graph.
- The weight of an object does not change as it falls.
- A skydiver does not go upwards when the parachute opens, even though this can appear to happen

Keywords/ Definitions

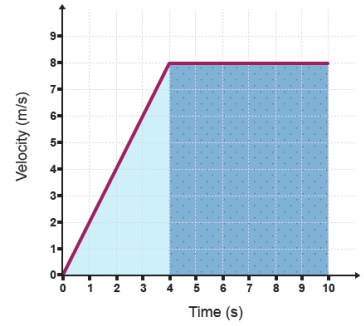
Keyword	Meaning
Scalar	A physical quantity that has magnitude (size) only. Eg energy, temperature, mass, distance.
Vector	A physical quantity that has both magnitude (size) and direction. Eg force, velocity, displacement, acceleration
Terminal Velocity	The maximum speed of an object, reached when the forces moving the object are balanced by its frictional forces.
Tangent	A straight line that just touches a point on a curve. A tangent to a circle is perpendicular to the radius which meets the tangent.
Initial Velocity	The speed, in a particular direction, of a body before it accelerates
Final Velocity	The speed, in a particular direction, of a body after it accelerates (after it changes speed or direction).
Acceleration	The rate of change in speed (or velocity) is measured in metres per second squared. Acceleration = change of velocity ÷ time taken.
Centripetal force	Force, needed for circular motion, which acts towards the centre of a circle.

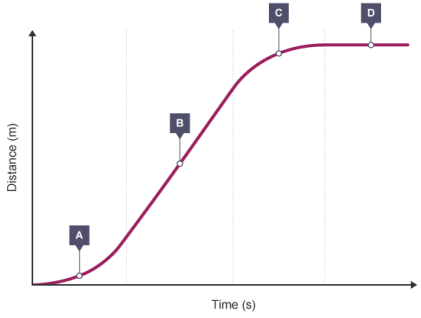




The table shows what each section of the graph represents:

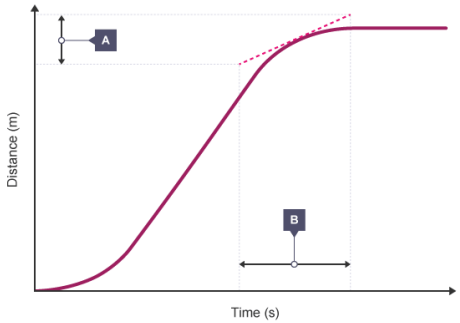
Section of graph	Gradient	Velocity	Acceleration
A	Positive	Increasing	Positive
B	Zero	Constant	Zero
C	Negative	Decreasing	Negative
D (v = 0)	Zero	Stationary (at rest)	Zero





The table shows what each section of the graph represents:

Section of graph	Gradient	Speed
A	Increasing	Increasing
B	Constant	Constant
C	Decreasing	Decreasing
D	Zero	Stationary (at rest)



As the diagram shows, after drawing the tangent, work out the change in distance (A) and the change in time (B).

$$\text{Gradient} = \frac{\text{vertical change (A)}}{\text{horizontal change (B)}}$$