

## Chapter 9 - Mechanics

# Constant Acceleration

### Chapter Overview

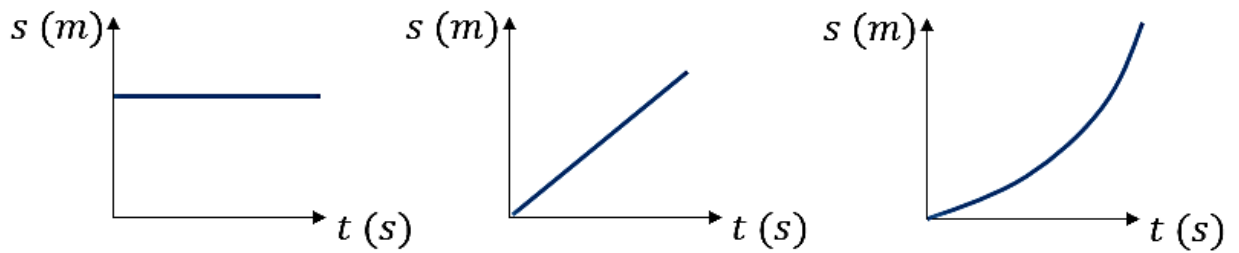
1. Displacement-Time Graphs
2. Velocity-Time Graphs
3. Constant Acceleration Formulae (SUVAT)
4. Vertical Motion Under Gravity

Topics	What students need to learn:		
	Content	Guidance	
<b>7</b> <b>Kinematics</b>	7.1	Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration.	
	7.2	Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph.	Derivation may use knowledge of Sections 7.2 and/or 7.4 Understand and use <i>suvat</i> formulae for constant acceleration in 2D.
<b>7</b> <b>Kinematics</b> <i>continued</i>	7.3	Understand, use and derive the formulae for constant acceleration for motion in a straight line.	Derivation may use knowledge of sections 7.2 and/or 7.4 Understand and use <i>suvat</i> formulae for constant acceleration in 2D.
	7.4	Use calculus in kinematics for motion in a straight line: $v = \frac{dr}{dt}, \quad a = \frac{dv}{dt} = \frac{d^2r}{dt^2}$ $r = \int v \, dt, \quad v = \int a \, dt$	The level of calculus required will be consistent with that in Sections 7 and 8 in Paper 1.



## 1. Displacement-Time Graphs

Describe the motion of each object:



**Velocity** is the rate of change of displacement  
(i.e. gradient of displacement-time graph)

Average Velocity = \_\_\_\_\_

Average Speed = \_\_\_\_\_

**Example** (Exercise 9A Question 2)

Khalid drives from his home to a hotel. He drives for  $2\frac{1}{2}$  hours at an average velocity of  $60 \text{ km h}^{-1}$ . He then stops for lunch before continuing to his hotel. The diagram shows a displacement–time graph for Khalid’s journey.

- a Work out the displacement of the hotel from Khalid’s home.
- b Work out Khalid’s average velocity for his whole journey.

