KNOWLEDGE

Physics Topic P9
Forces in action - Motion

ORGANISER

Section 1: Key terms

Displacement	The **distance** an object moves in a given **direction**. A **vector** quantity.
Velocity	The **speed** of an object in a **given direction**. A **vector**.
Acceleration	The **change** of an object's **velocity per second**.
Deceleration	A negative acceleration, the object is slowing down.
Gradient	Change in quantity on the y-axis divided by change in quantity on the x-axis.

Section 2: Distance-time graphs

A distance-time graph **shows** the **distance** of an object from a starting point (plotted on y-axis) **against** the **time** taken (plotted on the x-axis.)

Constant speed - **straight line** that slopes **upwards**.

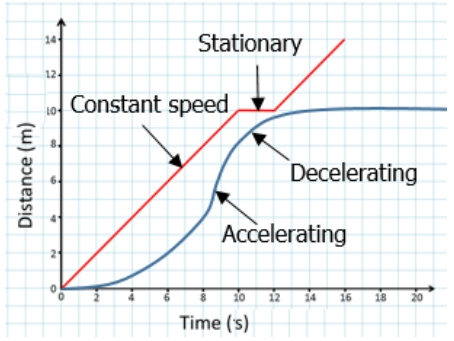
Accelerating - **curved** line getting **steeper**.

Decelerating - curved line getting **less steep**.

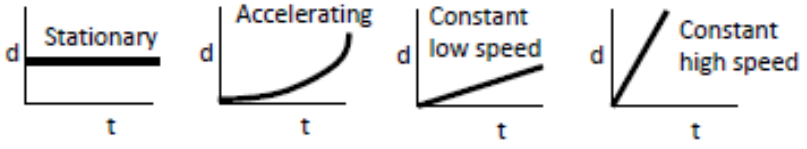
Stationary - **horizontal** line, the **gradient** is **zero**.

The **gradient** represents the object's **speed**.

The **steeper** the gradient, the **greater** the speed.



Slopes of distance-time graphs



Section 3: Velocity-time graphs

A velocity-time graph **shows** the **velocity** of an object (plotted on y-axis) **against** the **time** taken (plotted on the x-axis.) A **motion sensor** linked to a computer can be used to **measure velocity changes**.

Constant velocity (zero acceleration)- **horizontal line**

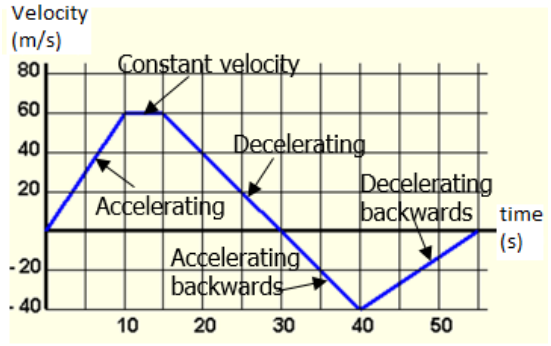
Constant acceleration - **straight line** with velocity **increasing**

Constant deceleration - **straight line** with velocity **decreasing**

Stationary - **horizontal line on x-axis** (velocity = 0)

Moving **backwards** - **below x-axis**

The **steeper** the **gradient** the **greater** the **acceleration**.

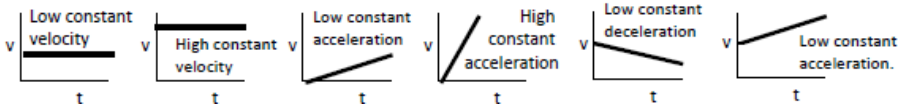


Velocity-time graph

A **positive gradient** represents **acceleration**, a negative gradient represents deceleration.

Area under the graph represents **distance** travelled (HT).

Slopes of velocity-time graphs

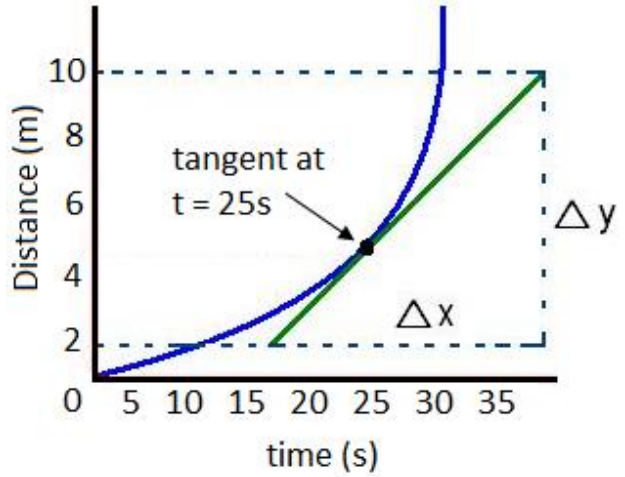


Section 4: Equations to learn

Distance = speed x time s = v x t	Distance – metres (m) Speed – meters per second (m/s) Time – seconds (s)
Acceleration = change in velocity / time taken a = ΔV/t	Acceleration – metres per second (m/s^2) Change in velocity – meters per second (m/s) Time taken – seconds (s)

Section 5: Calculating the gradient (HT)

The distance-time graph for an object moving at **changing speed** is a **curve**. **To find the speed** at a particular instant in time, draw a **tangent** to the line **at that instant** and determine the **gradient** of the tangent.



Calculating the gradient:

$$\text{slope} = \frac{\Delta y}{\Delta x}$$

or

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$