

Kinematics · supported focus

International Baccalaureate · IB Diploma · Physics · HL

Scope and prerequisites

Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.

Prerequisites: read the stated quantities and units, use arithmetic and the model conditions below. Each lesson develops its own method before independent transfer.

These are original or explicitly fictional teaching examples, not actual measurements or completed assessed learner investigations.

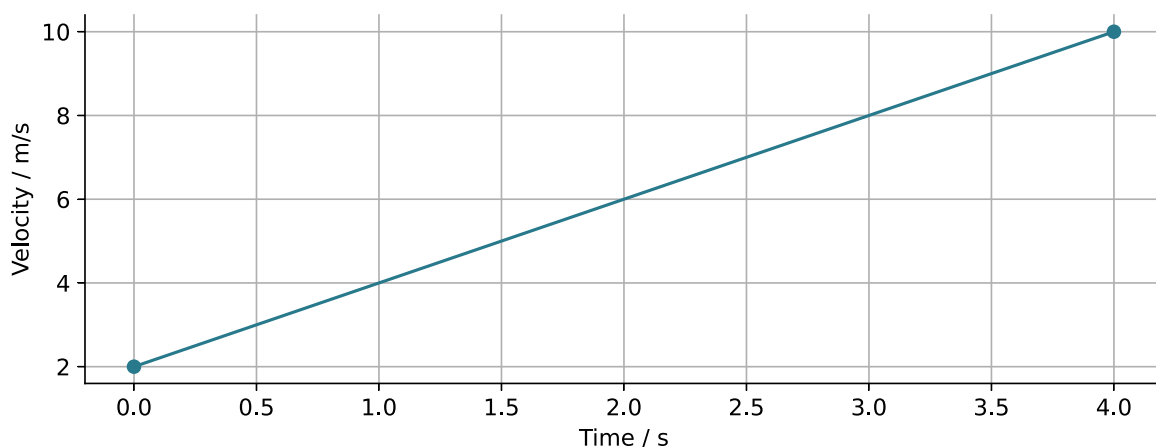
Motion graphs and acceleration

■ What would explain this observation?

- A speedometer gives a reading at one moment. A journey average can hide stops and rapid changes in speed.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- Displacement includes direction; distance counts total path length. **Velocity** is change in displacement per time. **Acceleration** is change in velocity per time.
- velocity: Rate of change of displacement; acceleration: Rate of change of velocity.



■ Choose evidence that can test it

- The gradient of a displacement-time graph is velocity. The area under a velocity-time graph gives displacement. A constant-acceleration formula is valid only when its assumption is justified.
 - Choose a positive direction and state it. Use a light gate or video with a known scale and frame interval for repeatable motion measurements. Avoid assuming hand timing is exact over very short intervals.
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■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: velocity rises uniformly from 2 to 10 metres per second in 4 s. $a = (v-u)/t$.
 $a = (10-2)/4 = 2$ metres per second squared. Displacement is trapezium area: $s = (u+v)t/2 = (2+10) \times 4/2 = 24$ m.

Example:

Velocity changes from 3 to 15 metres per second in 6 s. Find acceleration. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- Negative velocity indicates direction under the chosen sign convention; it does not necessarily mean slowing down.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

A negative velocity always means the object is slowing down. This claim is false: Negative velocity indicates direction under the chosen sign convention; it does not necessarily mean slowing down.

Key:

Motion graphs and acceleration: The gradient of a displacement-time graph is velocity. The area under a velocity-time graph gives displacement. A constant-acceleration formula is valid only when its assumption is justified.