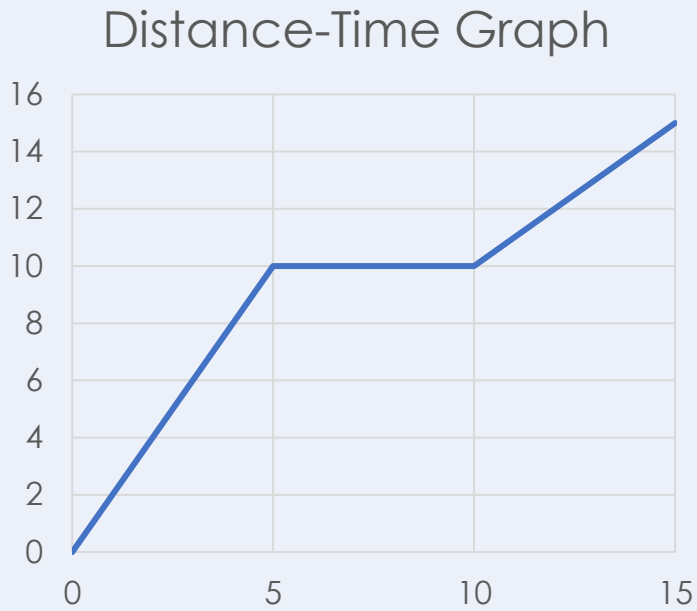
Velocity-Time Graphs

Answer the following questions:

1. What goes on the x –axis and the y –axis of a distance-time graph?
   Time goes on the x –axis and distance goes on the y –axis.
2. What is represented by a horizontal line on a distance-time graph?
   A stationary object (not moving, speed = 0 m/s)
3. State the equation to calculate speed.
   $$Speed = \frac{Distance}{Time}$$
4. Explain the difference between speed and velocity.
   Velocity is speed in a given direction.
5. Define acceleration.
   The rate of change of velocity.



Do Now

20/10/2025

Velocity-Time Graphs

P3.1.9

Science Mastery

P3.1.1 Prior Knowledge Review
P3.1.2 Scalars and Vectors
P3.1.3 Resultant Vectors
P3.1.4 Resolving Vectors
P3.1.5 Newton's Third Law
P3.1.6 Newton's First Law
P3.1.7 Acceleration
P3.1.8 Acceleration Investigation

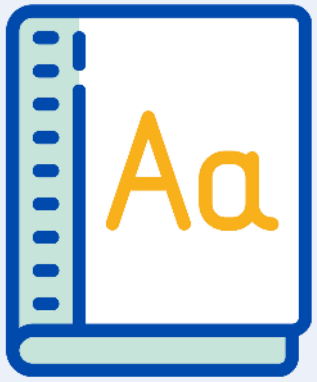
Maths in Science Lesson 17
- **P3.1.9 Velocity-Time Graphs**

P3.1.10 Velocity-Time Graphs 2
P3.1.11 Acceleration Problems

Following this lesson, students will be able to:

- Describe motion using velocity-time graphs.
- Calculate acceleration from a velocity-time graph.
- Calculate the area beneath the graph to determine distance travelled.

Key Words:



velocity **acceleration** **slope**

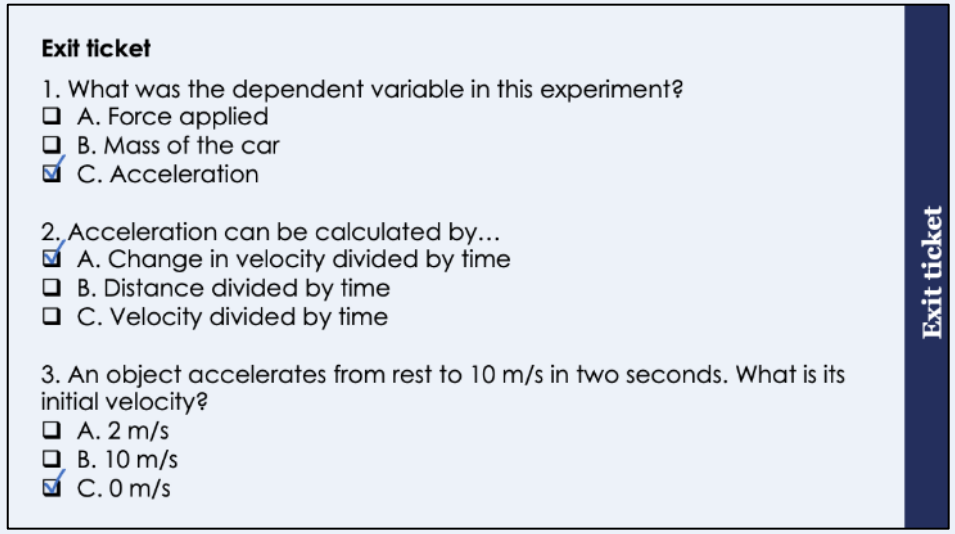
gradient **area** **distance**

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the previous lesson's exit ticket.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.

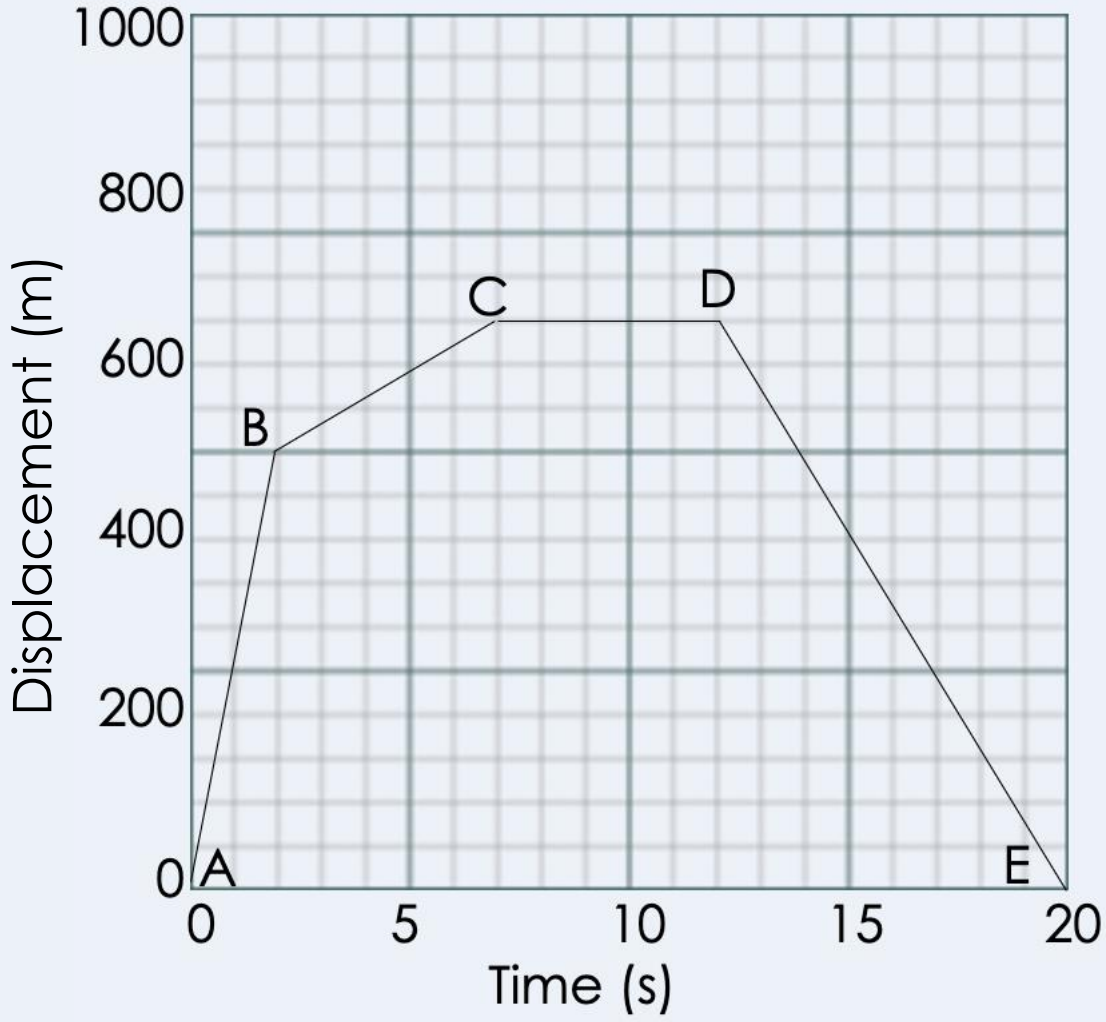


Distance/Displacement-Time Graphs Review

Describe the motion shown by this displacement-time graph.

Describe what each of the following features of a displacement-time graph represents:

- A horizontal line
- A line returning to the x –axis
- A straight line
- The gradient (steepness of the slope)

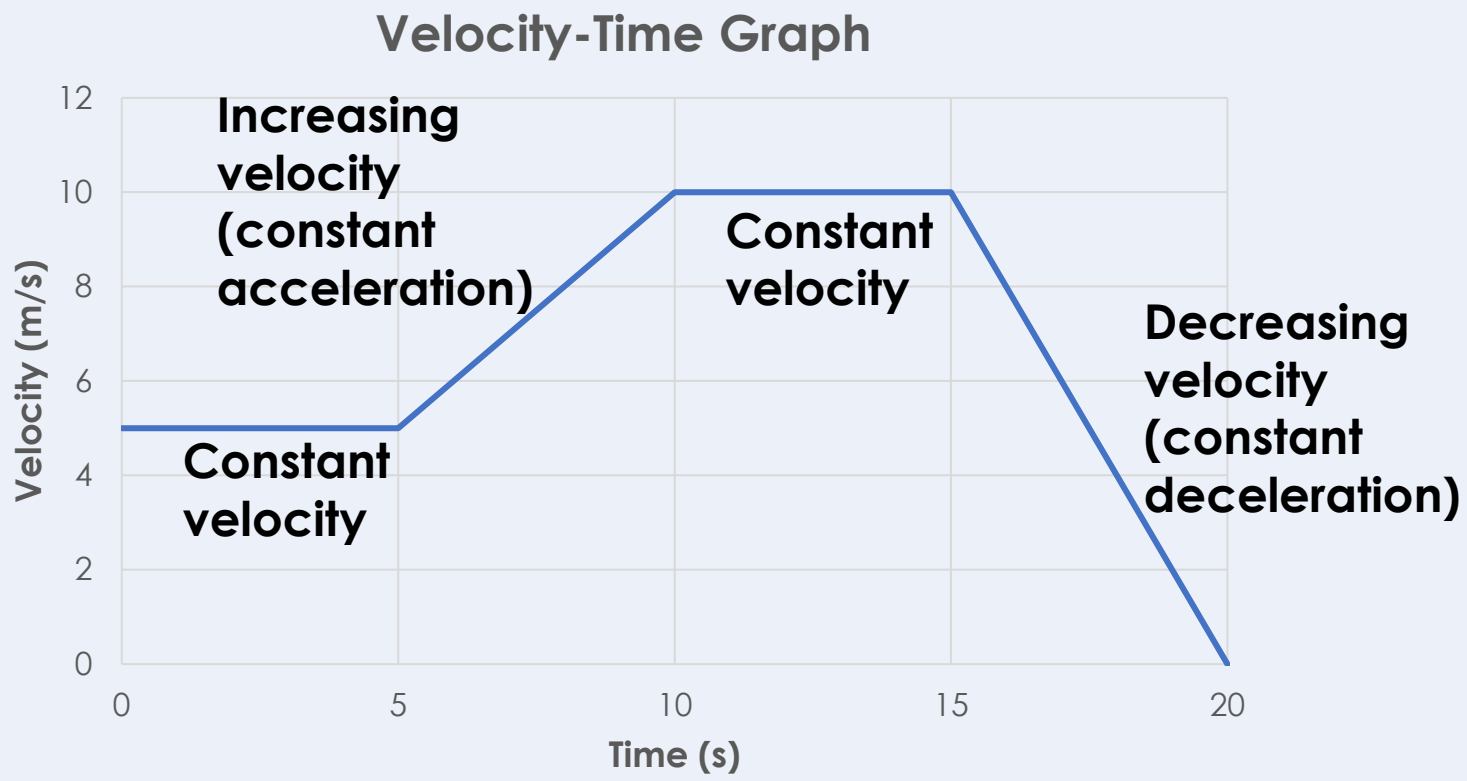


Talk Task

Velocity-Time Graphs

Velocity-Time graphs can be used as well as distance-time graphs to describe the motion of an object.

Time is recorded on the x axis and velocity is recorded on the y axis.



Velocity-Time Graphs

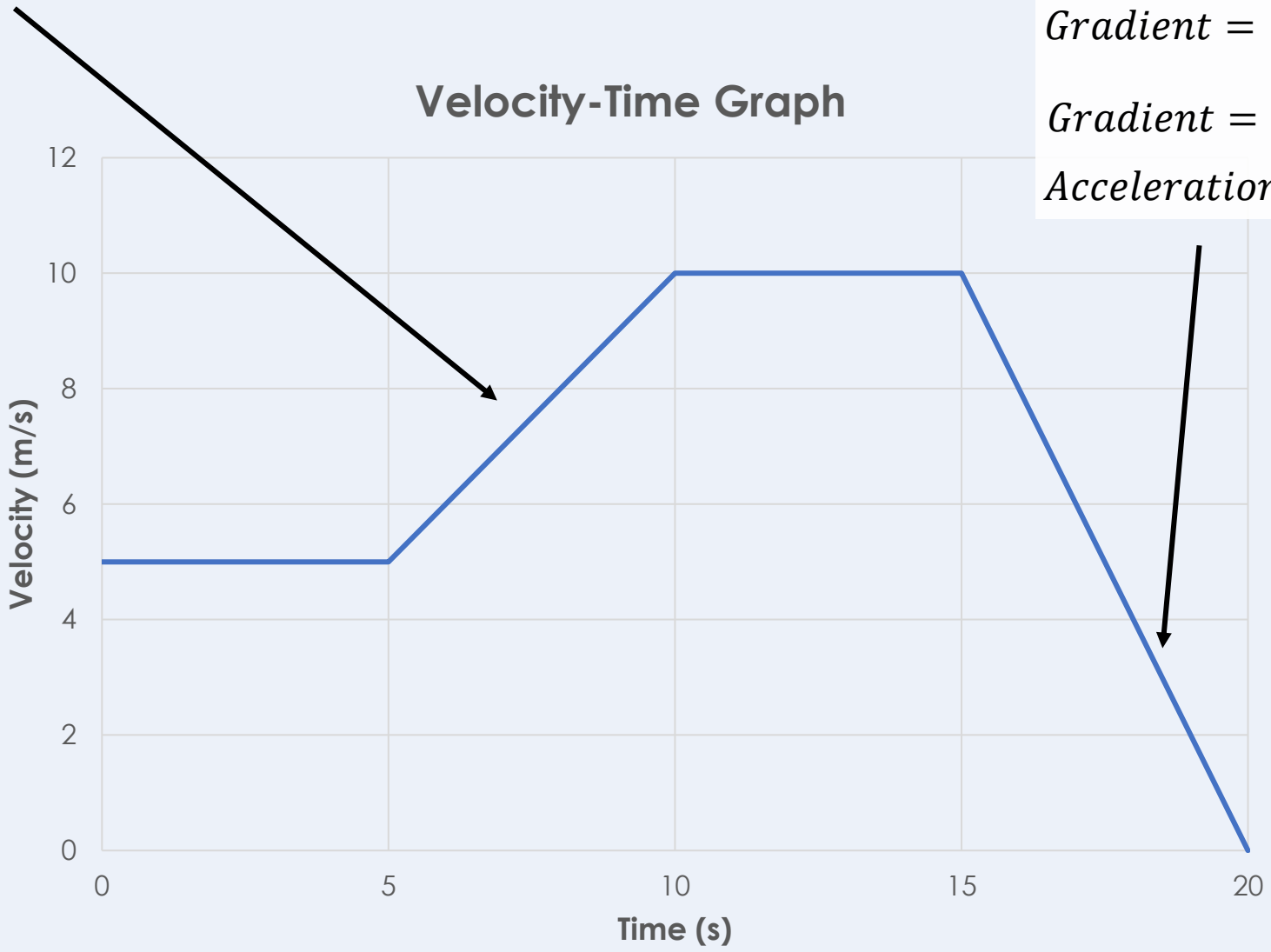
$$Gradient = \frac{Change\ in\ y}{Change\ in\ x}$$

$$Gradient = \frac{10 - 5}{10 - 5}$$

$$Gradient = \frac{5}{5}$$

$$Gradient = 1$$

$$Acceleration = 1\ m/s^2$$



$$Gradient = \frac{Change\ in\ y}{Change\ in\ x}$$

$$Gradient = \frac{0 - 10}{20 - 15}$$

$$Gradient = \frac{-10}{5}$$

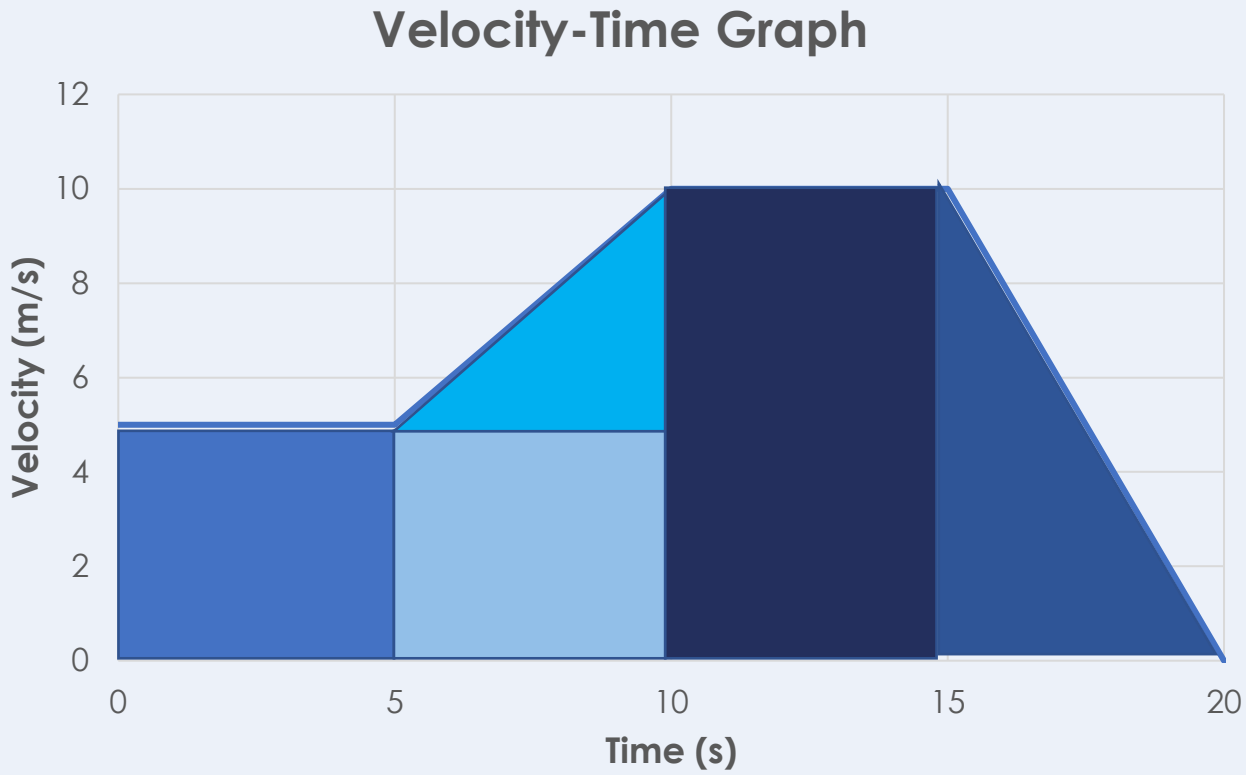
$$Gradient = -2$$

$$Acceleration = -2\ m/s^2$$

Velocity-Time Graphs

The **distance** travelled can be determined by calculating the **area under the graph.**

This may involve splitting the area under the graph into rectangles and triangles.



Determine if the following statements are true or false for a <u>Velocity-Time Graph</u>:

1. Velocity goes on the x axis and time goes on the y axis **False**
2. A horizontal line means that an object is stationary **False**
3. A positive gradient means that an object is accelerating **True**
4. A negative gradient means that an object is returning to its original position **False**

Check for understanding

Which statements do you agree with?

I think that negative acceleration values are incorrect

I think that velocity and acceleration are the same

Distance can only be calculated with a separate distance-time graph

I think that the gradient of a line can indicate the acceleration

Talk Task

Drill

1. On a distance-time graph what does the gradient show?
2. On a distance-time graph what does the horizontal line show?
3. On a distance-time graph a downwards line that reaches the X axis shows...
4. On a velocity-time graph what does a positive gradient show?
5. On a velocity-time graph what does a negative gradient show?
6. On a velocity-time graph what does a horizontal line show when it is above the y-axis?
7. On a velocity-time graph a horizontal line at 0 on the y-axis shows...
8. How do you calculate acceleration on a velocity time graph?
9. If a gradient on a velocity time graph is calculated to be negative, what does this tell you about the acceleration?
10. What are the units for acceleration?

Check for understanding

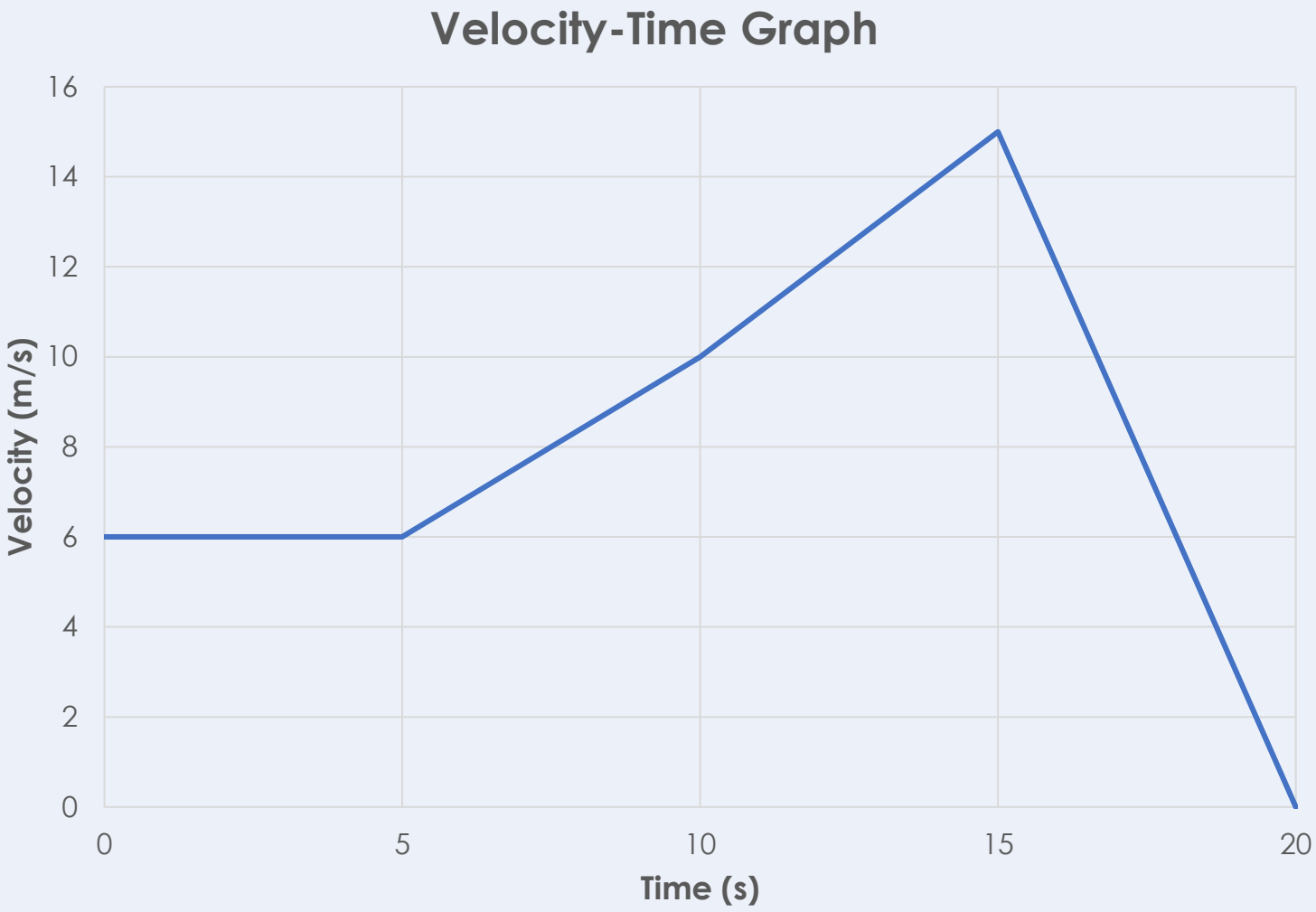
Drill answers

1. The gradient on a distance-time graph shows the velocity.
2. The horizontal line on a distance-time graph tells you that the object is stationary. Like
3. A downwards line that reaches the x-axis on distance-time graph shows that the object has returned to its original position.
4. A positive gradient on a velocity-time graph shows acceleration.
5. A negative gradient on a velocity-time graph shows deceleration.
6. A horizontal line that reads a number more than 0 on the y-axis of a velocity-time graph shows constant velocity.
7. A horizontal line at 0 on the y-axis of a velocity-time graph tells you that the object is stationary.
8. You can calculate the acceleration on a velocity-time graph by finding the gradient.
9. If the gradient on a velocity-time graph is negative, then this shows deceleration.
10. The units for acceleration are m/s^2.

Check for understanding

I: Interpreting velocity-time graphs

Calculate the acceleration between 10 and 15 seconds.



$$\text{Gradient} = \frac{\text{Change in y}}{\text{Change in x}}$$

$$\text{Gradient} = \frac{15 - 10}{15 - 10}$$

$$\text{Gradient} = \frac{5}{5}$$

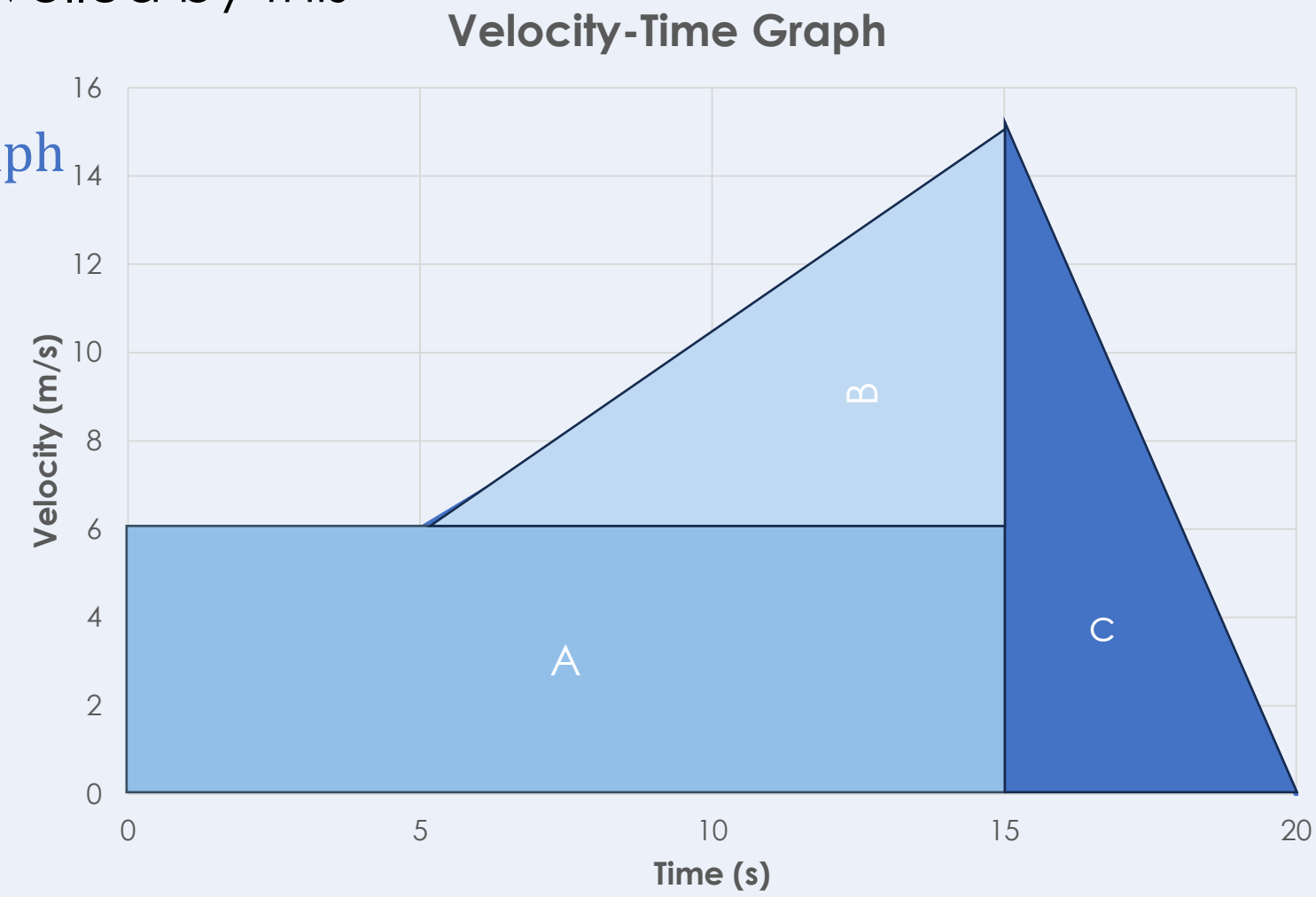
$$\text{Gradient} = 1$$

$$\underline{\text{Acceleration} = 1\ \text{m/s}^2}$$

Apply

We: Interpreting velocity-time graphs

Calculate the distance travelled by this object.



$$\text{Distance} = \text{area under the graph}$$

$$\text{Distance} = A + B + C$$

$$\text{Distance} = (6 \times 15) + (0.5 \times 9 \times 10) + (0.5 \times 15 \times 5)$$

$$\text{Distance} = 90 + 45 + 37.5$$

$$\text{Distance} = 172.5\ \text{m}^2$$

Apply

You: Interpreting velocity-time graphs

Use calculations to show that the object is accelerated at the same rate as it decelerated.

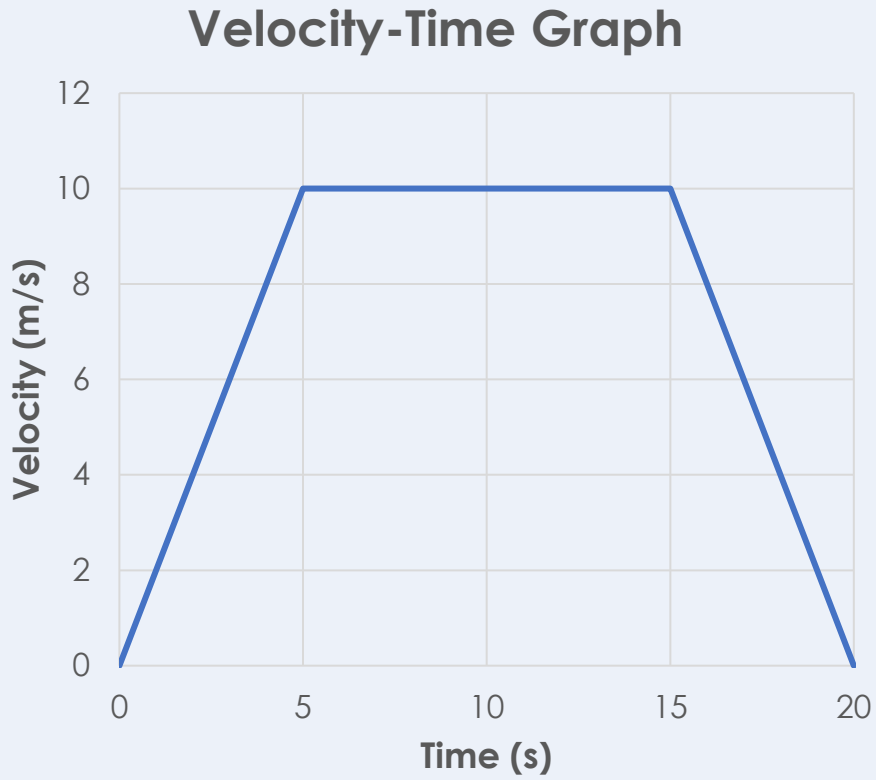
$$\text{Gradient} = \frac{\text{Change in y}}{\text{Change in x}}$$

$$\text{Gradient} = \frac{10 - 0}{5 - 0}$$

$$Gradient = \frac{10}{5}$$

$$Gradient = 2$$

$$\underline{\text{Acceleration} = 2\ \text{m/s}^2}$$



$$\text{Gradient} = \frac{\text{Change in y}}{\text{Change in x}}$$

$$\text{Gradient} = \frac{0 - 10}{20 - 5}$$

$$\text{Gradient} = -\frac{10}{5}$$

$$\text{Gradient} = -2$$

$$\underline{\text{Acceleration} = -2\ \text{m/s}^2}$$

The numbers for acceleration are the same but the second value is negative, showing deceleration.

Apply

Answer the questions below.

1. What does a horizontal line represent on a velocity-time graph?

- [x] A. Constant velocity
- [ ] B. A stationary object
- [ ] C. Increasing velocity

2. What can be calculated from the area under a velocity-time graph?

- [x] A. Distance travelled
- [ ] B. Average velocity
- [ ] C. Total time taken

3. What does a negative gradient represent on a velocity-time graph?

- [ ] A. An object stopping
- [ ] B. An object returning to its original position
- [x] C. An object slowing down

Exit ticket

Feedback

Lesson P3.1.9	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!