Velocity-Time Graphs 2

Answer the following questions:
1. What values are on the x –axis and the y –axis of a velocity-time graph?
   Time is on the x –axis and velocity is on the y –axis.
2. What is represented by a horizontal line on a velocity-time graph?
   An object travelling with constant velocity.
3. What is represented by a negative gradient on a velocity-time graph?
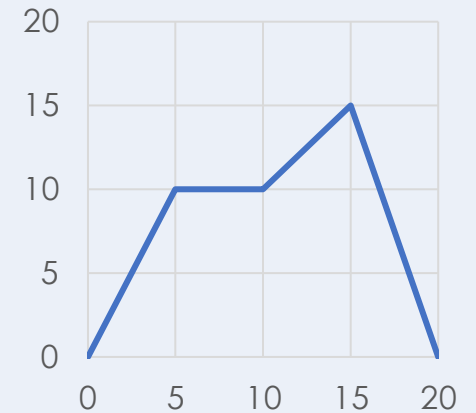   **Slowing down/decreasing velocity/deceleration**
4. Describe how to calculate the distance travelled using a velocity-time graph.
   The distance travelled is the area under the graph.
5. State the equation that links speed, distance and time.
   $$Speed = \frac{Distance}{Time}$$
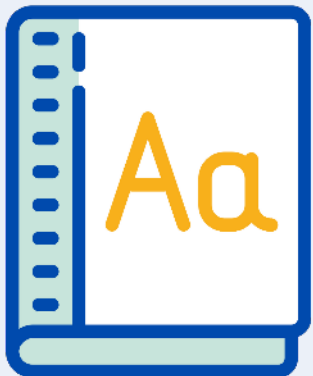
Velocity-Time Graph

Velocity-Time Graphs 2

P3.1.10

Science
Mastery

Following this lesson, students will be able to:

- Describe motion using velocity-time graphs

- Calculate the gradient of the line to determine the acceleration of an object

- Use a tangent to a curve to determine acceleration at a point

Key Words:

| curve | gradient | tangent |

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.

Exit ticket

1. What does a horizontal line represent on a velocity-time graph?
- ☑ A. Constant velocity
- ☐ B. A stationary object
- ☐ C. Increasing velocity

2. What can be calculated from the area under a velocity-time graph?
- ☑ 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
- ☑ C. An object slowing down

Exit ticket

Velocity-Time Graphs

A **negative velocity** shows that the object is travelling in the **opposite direction.**
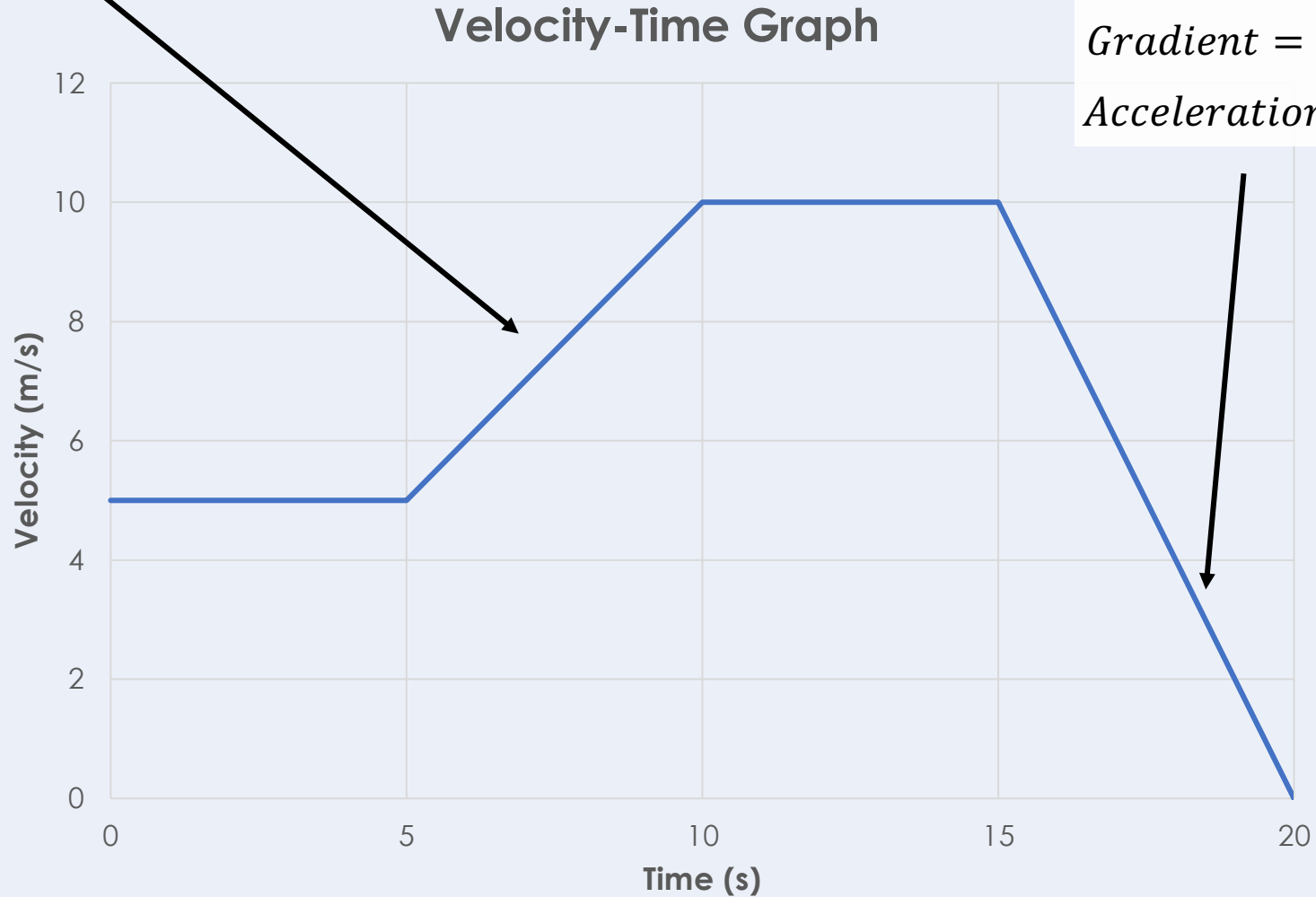

Velocity-Time Graph
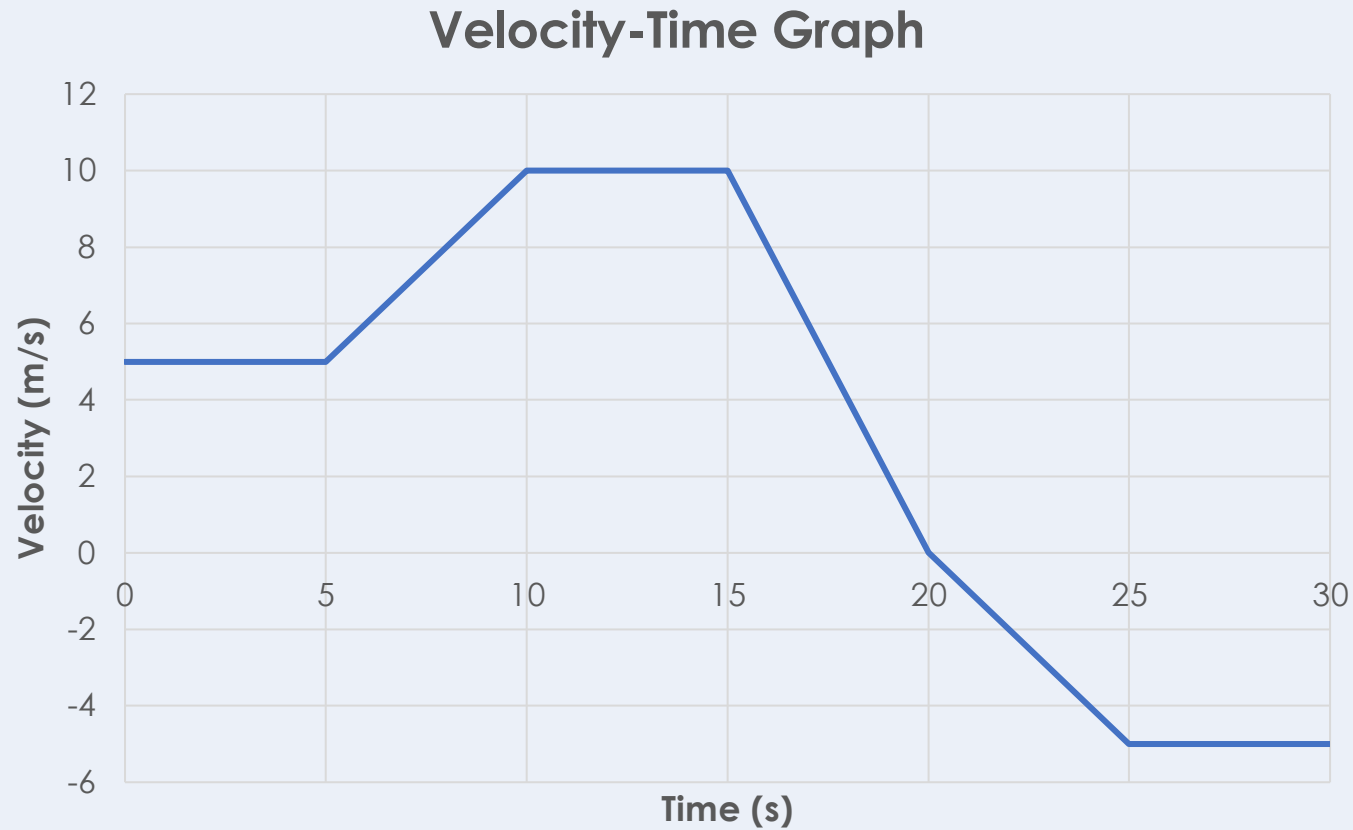
Velocity-Time Graphs

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

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

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

$$Gradient = 1$$

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

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

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

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

$$Gradient = -2$$

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

Velocity-Time Graph

Velocity-Time Graphs

A **curved line** on a velocity-time graph indicates that the **acceleration is changing.**

The acceleration at a specific point in time can be calculated by drawing a **tangent** to the curve and calculating the gradient of the tangent.
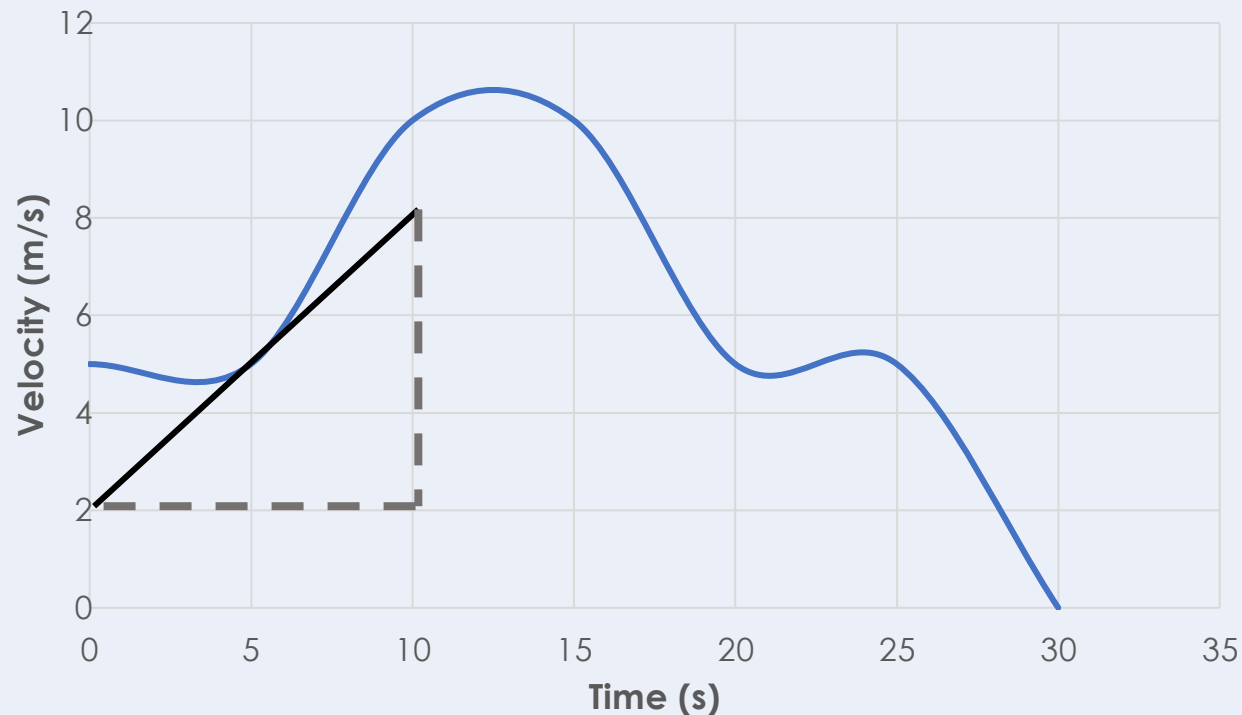
$$Gradient = \frac{Change\ in\ y}{Change\ in\ x}$$

$$Gradient = \frac{8-2}{10-0}$$

$$Gradient = \frac{6}{10}$$
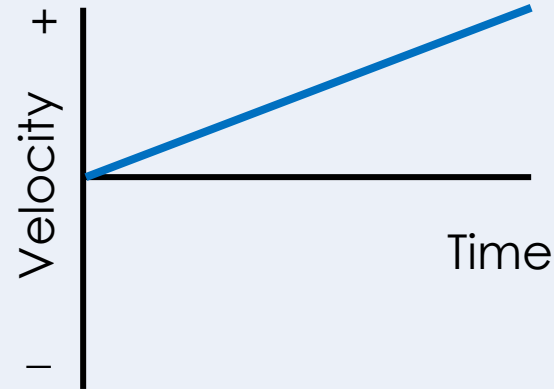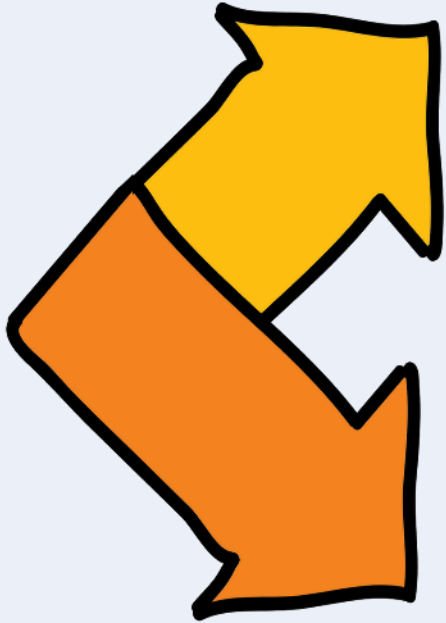
$$Gradient = 0.6$$

$$Acceleration = 0.6\ m/s^2$$

Quick Quiz:

1. What does a curved line represent on a velocity-time graph?
   It shows the acceleration is changing.

2. What does it mean for an object to have a negative velocity?
   The object is travelling in the opposite direction.

3. What can be calculated from the gradient of a velocity-time graph?
   Acceleration

Can you explain the difference between these two velocity-time graphs?

What does the gradient represent on a velocity-time graph?
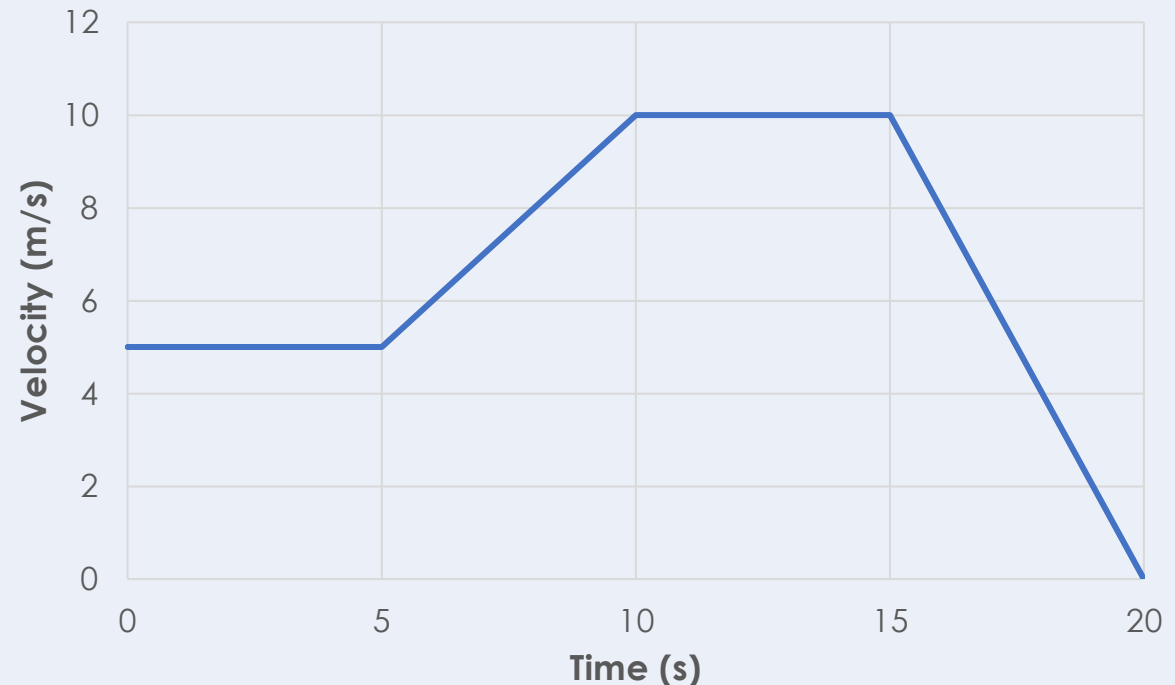
Are the gradients constant?
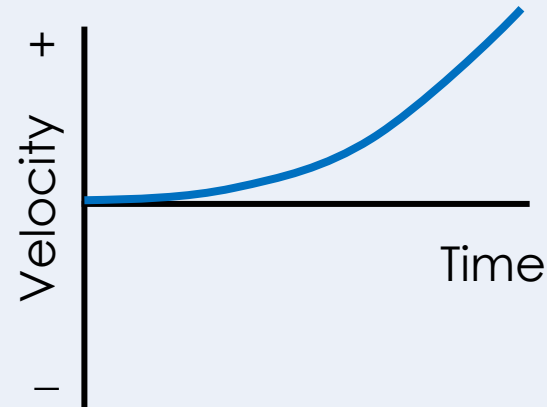
*What does it mean that they both have positive values for velocity?*

Drill

1. How can you tell that an object is travelling in the opposite direction on a velocity-time graph?
2. On the graph, what is the acceleration between 0-5s?
3. On the graph, what is the acceleration in the last 5s?
4. What does a curved line on a velocity-time graph tell you?

Drill answers

1. Is the velocity is negative then an object is travelling in the opposite direction.
2. $0m/s^2$
3. $\dfrac{10-0}{15-20} = \dfrac{10}{-5} = -2m/s2$
4. A curved line on a velocity time graph shows you that acceleration is changing.
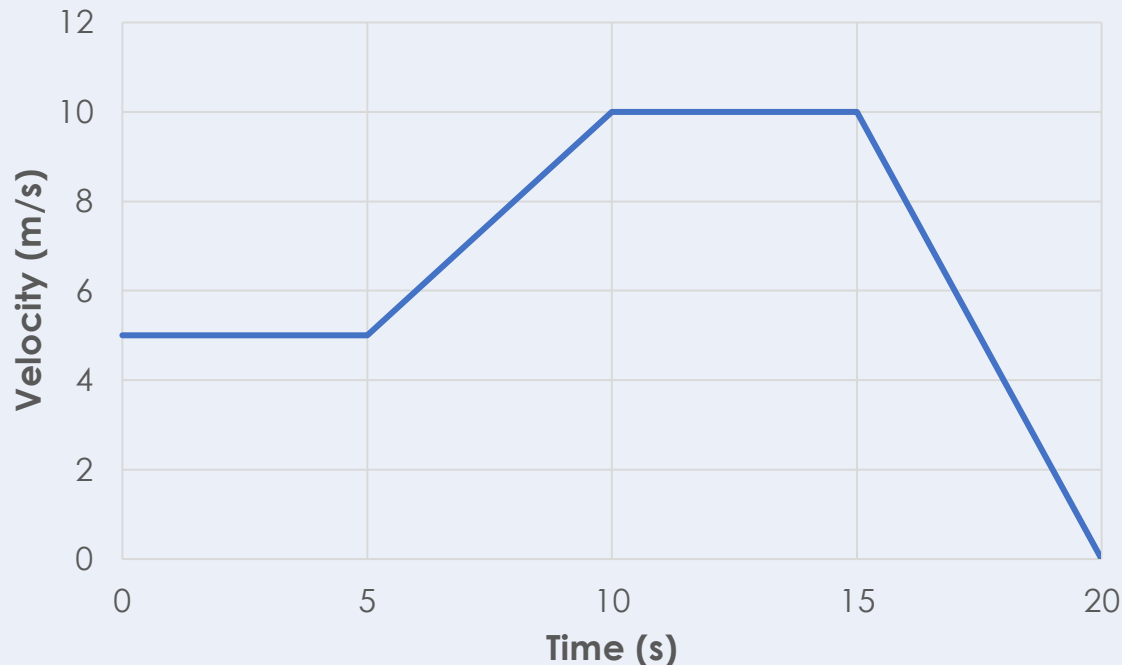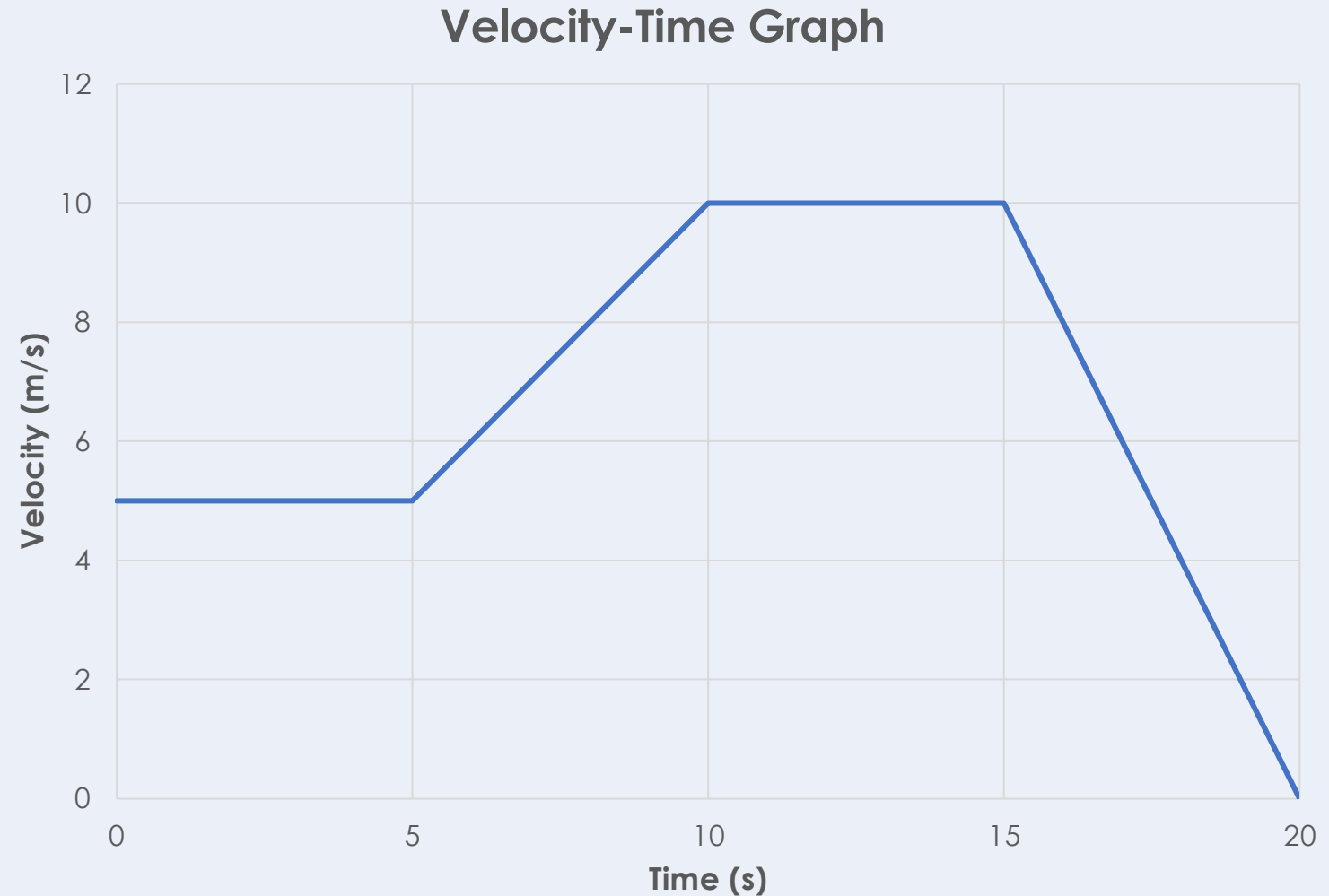
Balanced and Unbalanced Forces

We can use a velocity-time graph to determine if the forces acting on an object are **balanced** or **unbalanced**.

Which parts of the graph show balanced forces?

Which parts of the graph show unbalanced forces?

Explain your answers.

Velocity-Time Graph

Answer the questions below.

1. What can be calculated from the gradient of a velocity-time graph?
❑ A. Distance travelled
☑ B. Acceleration
❑ C. Velocity

2. What does a curved line represent on a velocity-time graph?
❑ A. Constant velocity
❑ B. Constant acceleration
☑ C. Changing acceleration

3. Which of these would not have a negative value for acceleration?
❑ A. An object speeding up in the opposite direction
❑ B. An object slowing down
☑ C. A stationary object

Lesson P3.1.10	
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!