

MCEduHub SLS Application User Guide

Updated on 21 Nov 2023





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How to navigate to the MCEduHub App from SLS


Log In to MOE SLS Website

SINGAPORE
Student Learning Space

Help us improve 😊




[Back to Main Login Page](#)

 Users should use their SLS Username and Password to log in.


SLS Username

SLS Password



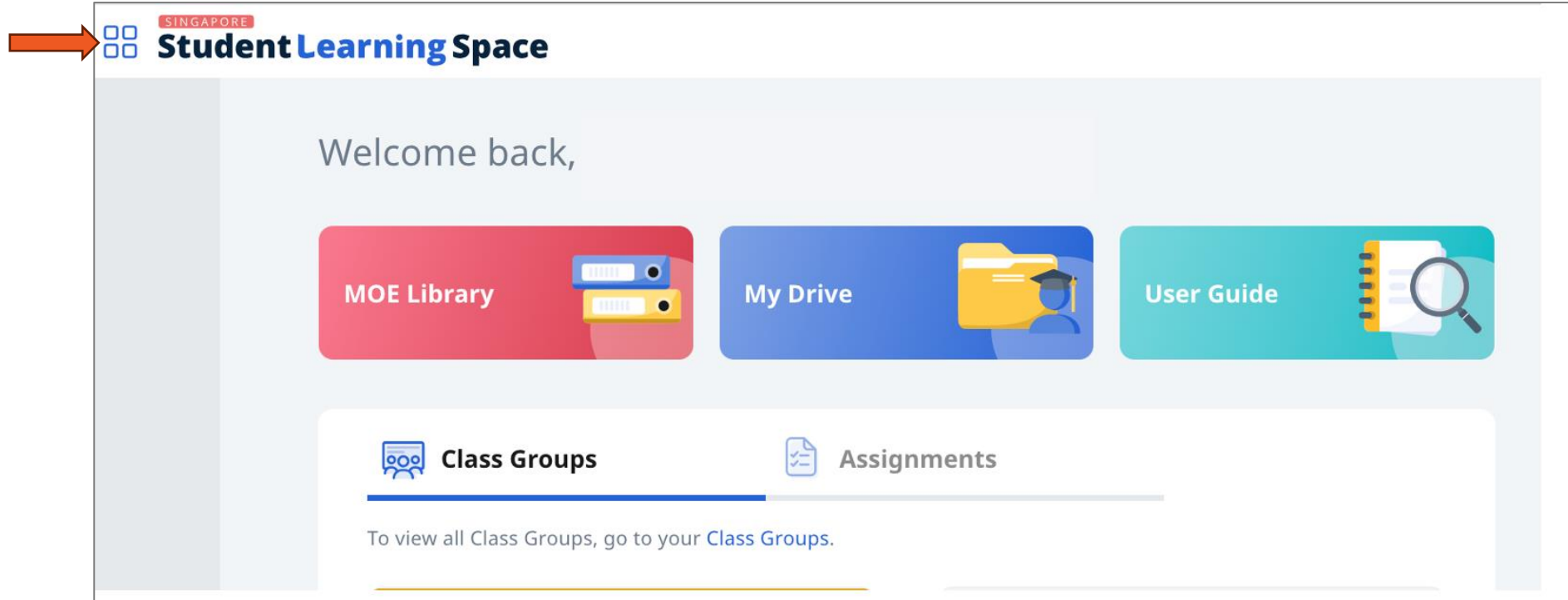
LOGIN


[Forgot Password](#)

 If you have difficulties logging in or would like to apply for a new MIMS account, please refer to [Accounts and Login Troubleshooting](#) for more information.

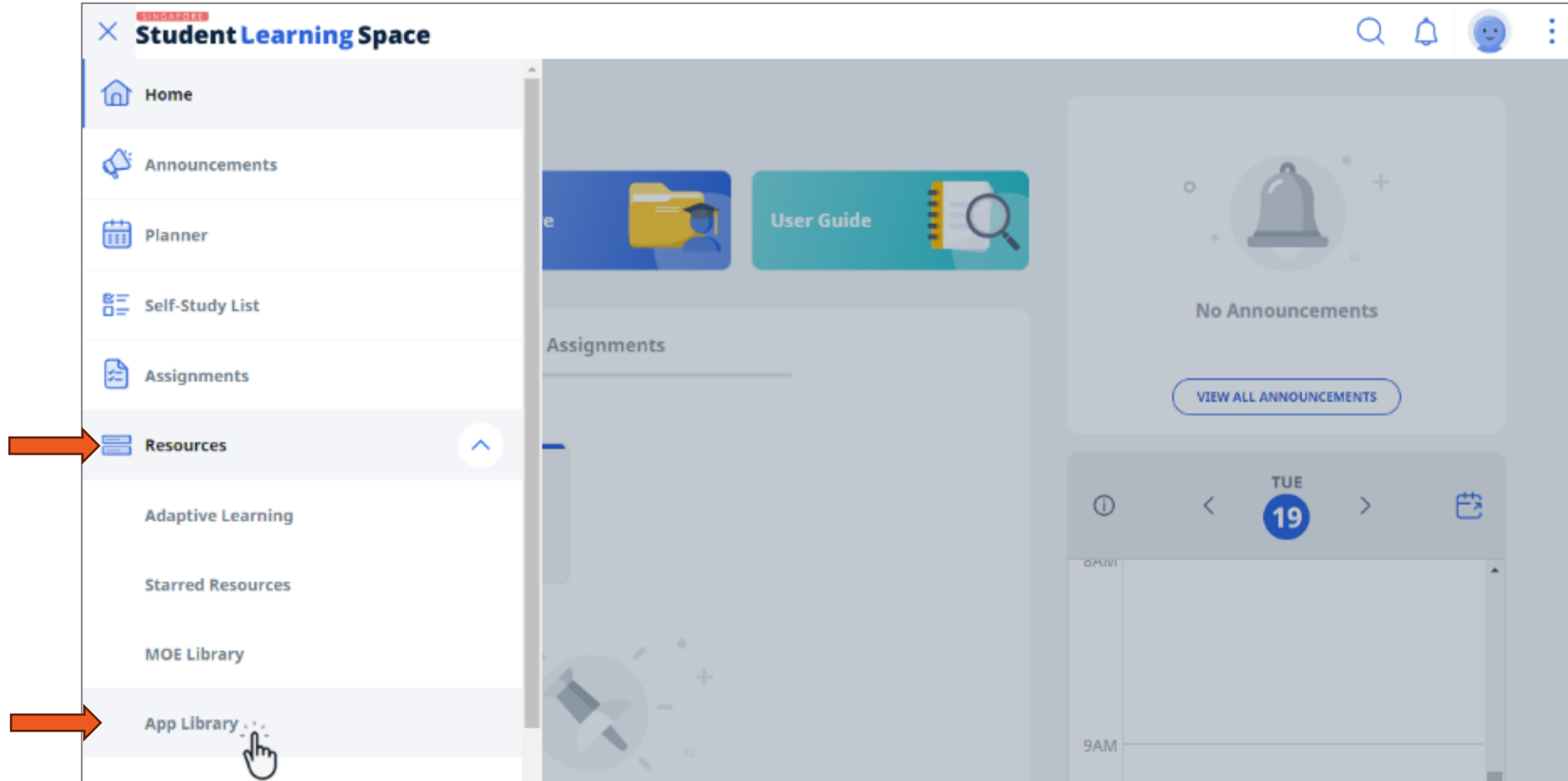
Go to the MOE SLS website at vle.learning.moe.edu.sg and log in using your SLS Username and Password.

Access the SLS Sidebar Menu



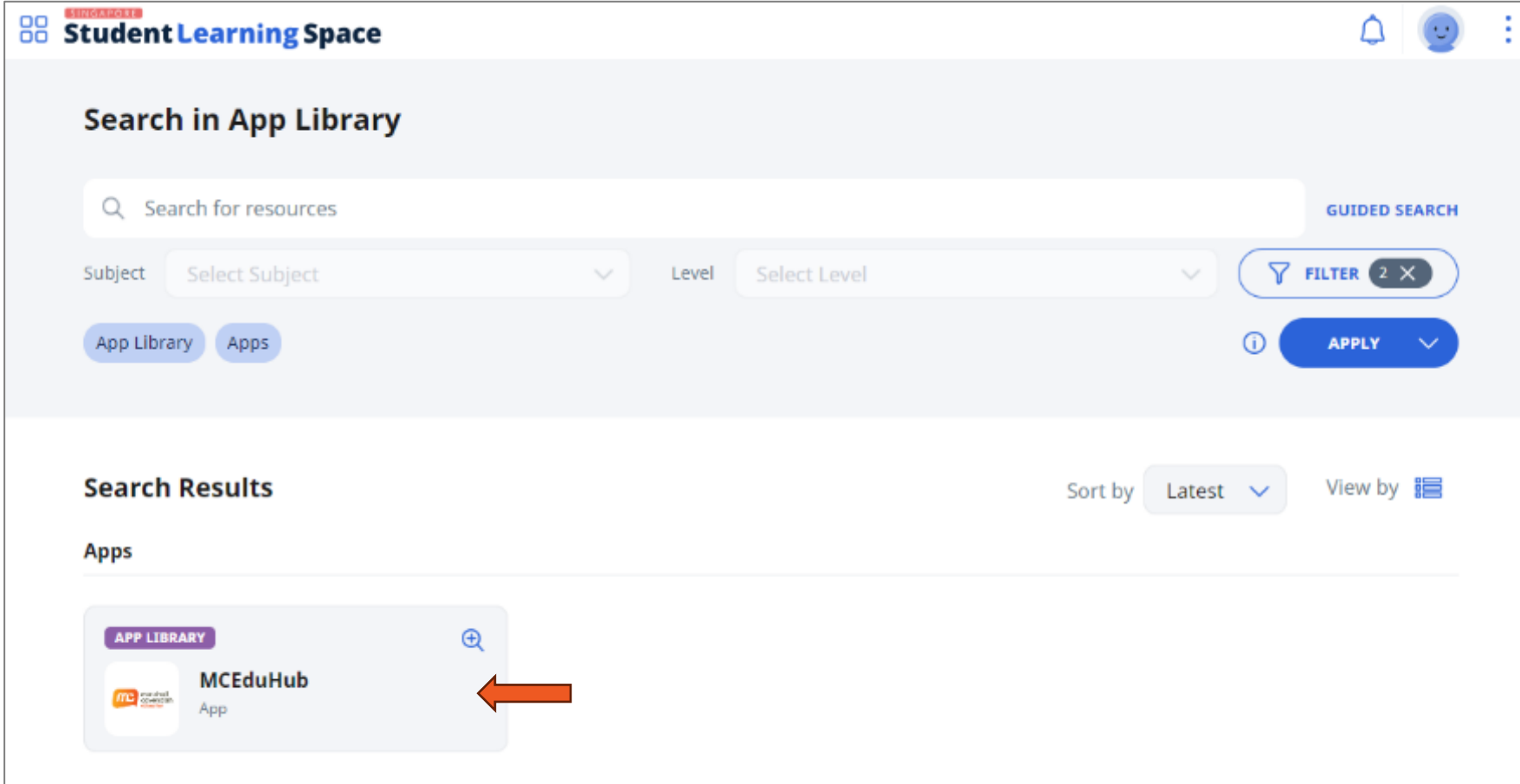
Click on the  icon at the top left-hand corner to access the SLS sidebar menu.

Go to App Library



Expand the menu under "Resources" and select "App Library".

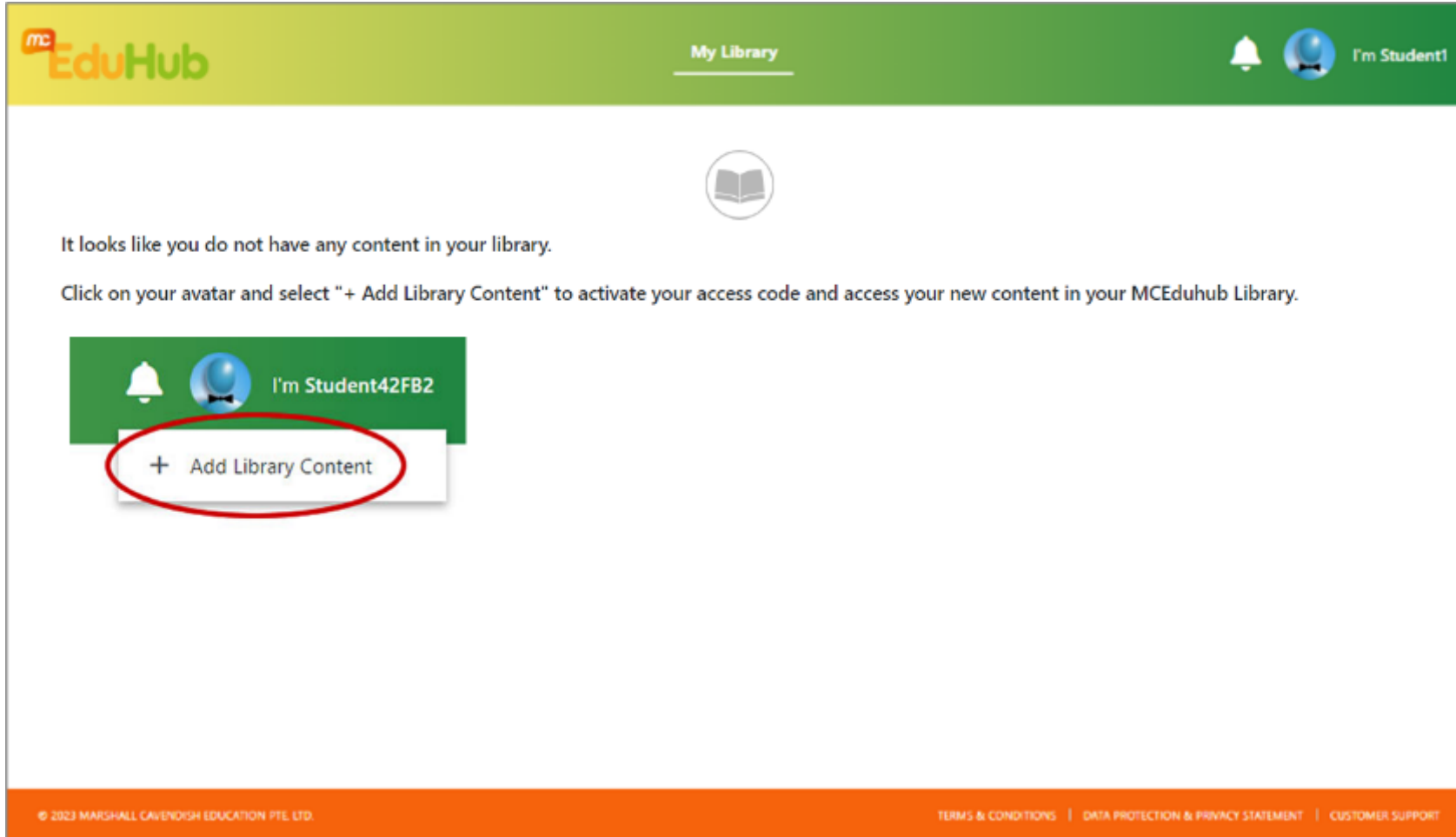
Launch MCEduHub App



The screenshot shows the 'Student Learning Space' interface. At the top, there's a header with the logo and navigation icons. Below it, a 'Search in App Library' section contains a search bar, filters for 'Subject' and 'Level', and buttons for 'App Library', 'Apps', 'FILTER', and 'APPLY'. The 'Search Results' section shows a list of apps, with the 'MCEduHub App' highlighted by a red arrow. The app card includes the 'APP LIBRARY' label, the 'MCEduHub App' title, and a small icon.

Click on the MCEduHub app icon in the list of apps shown below to launch it.

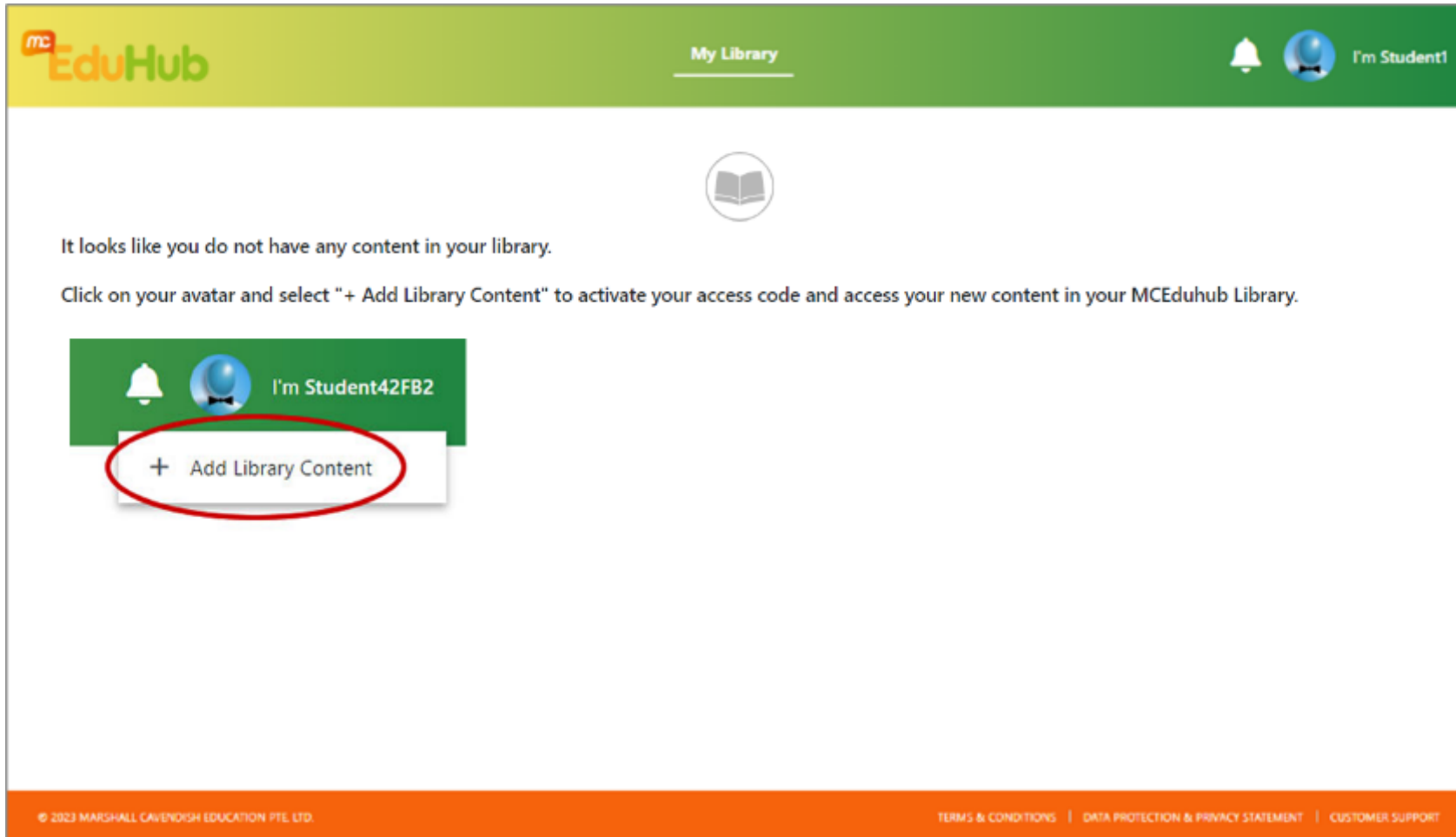
App Opens in a New Tab



MCEduHub App will launch in a new browser tab.

How to redeem your access codes

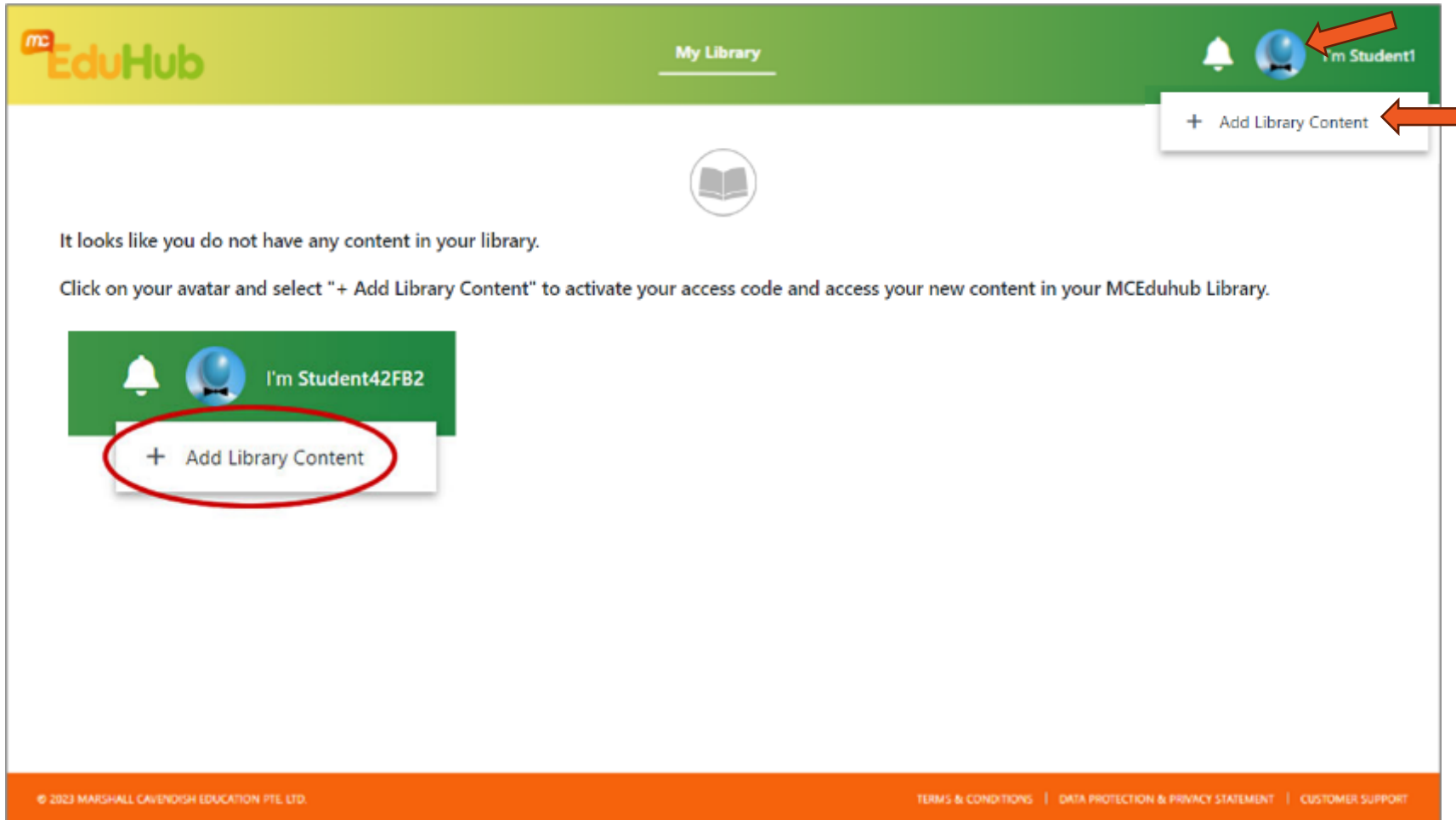
MCEduHub Library



Upon initial login, your MCEduHub Library will be empty.

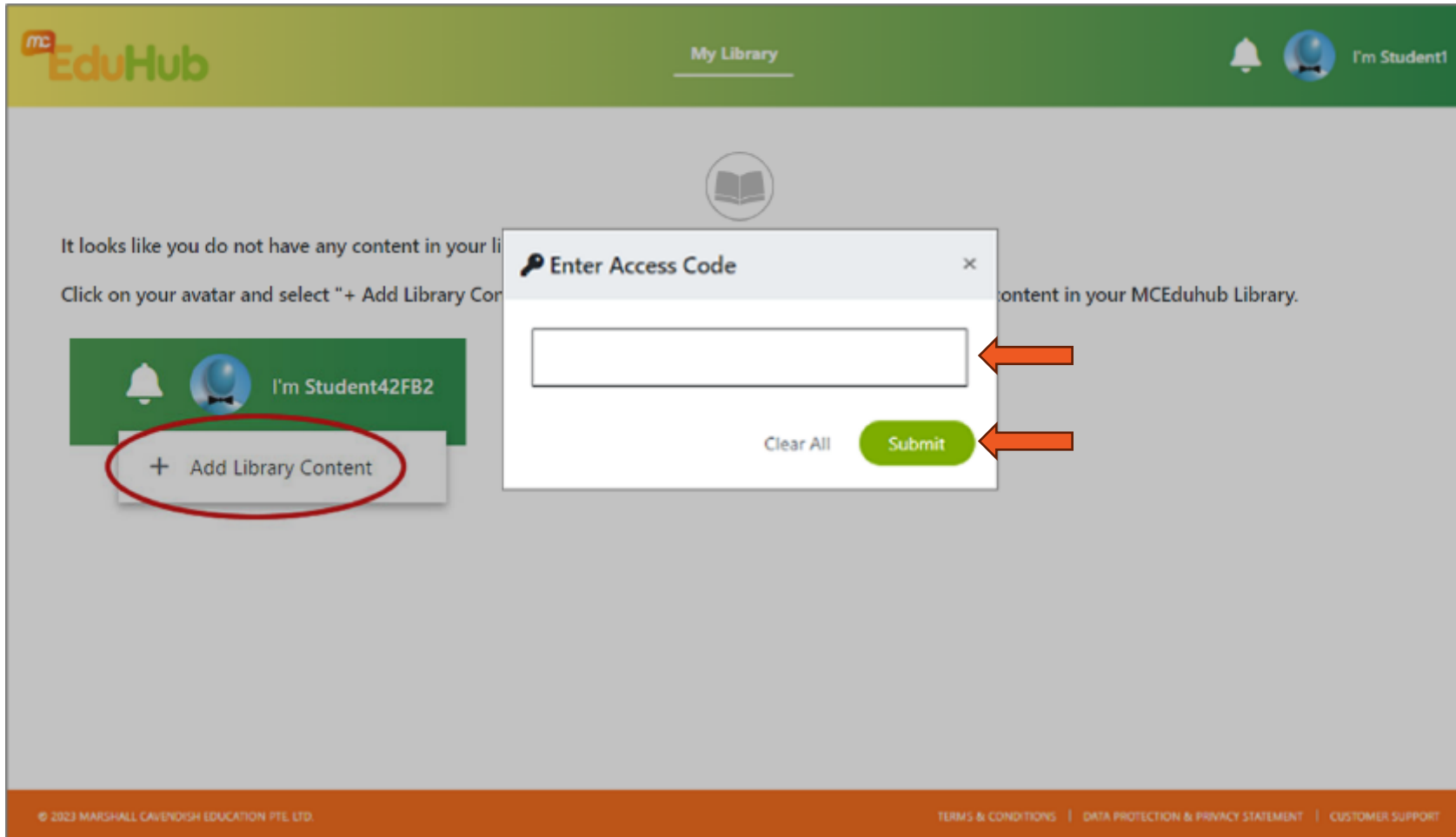
A message will be displayed to show you how to activate your access code.

Add Library Content



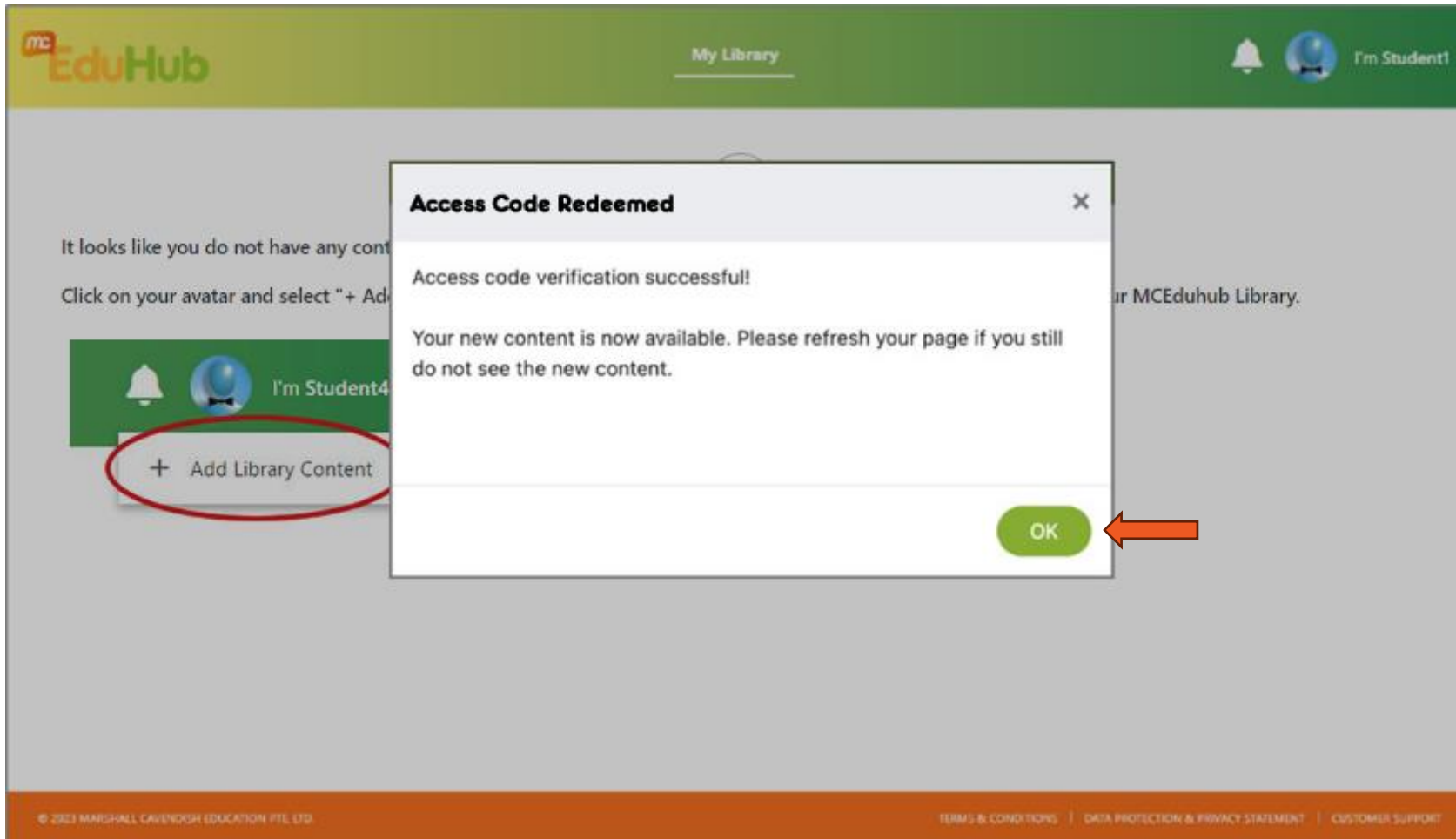
Click on your avatar at the top right-hand corner and select "+Add Library Content"

Enter Access Code



Enter your Access Code in the pop-up and click "Submit".

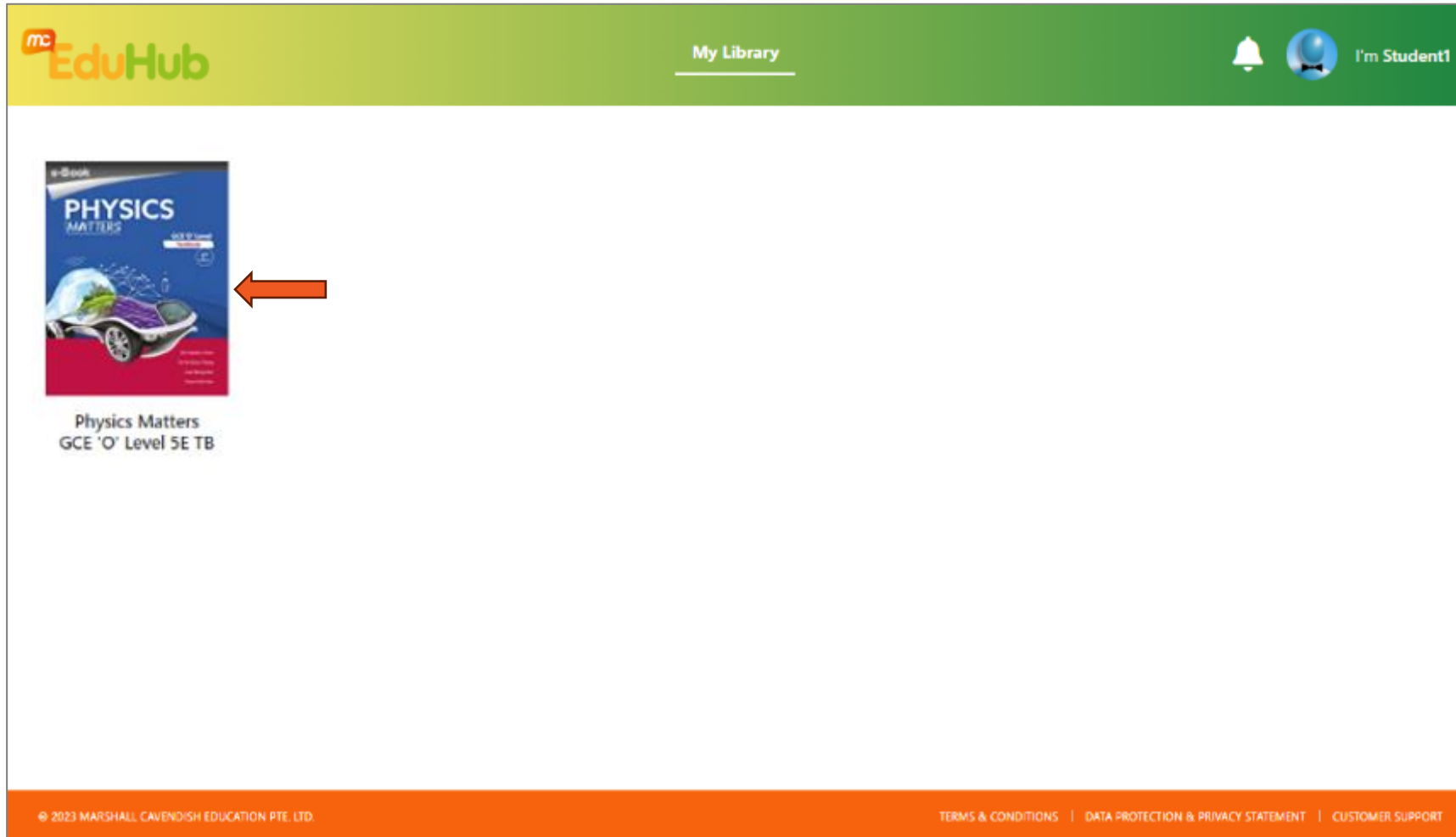
Successful Activation



Upon successful access code activation, a success message will be displayed.

Click "OK" to proceed.

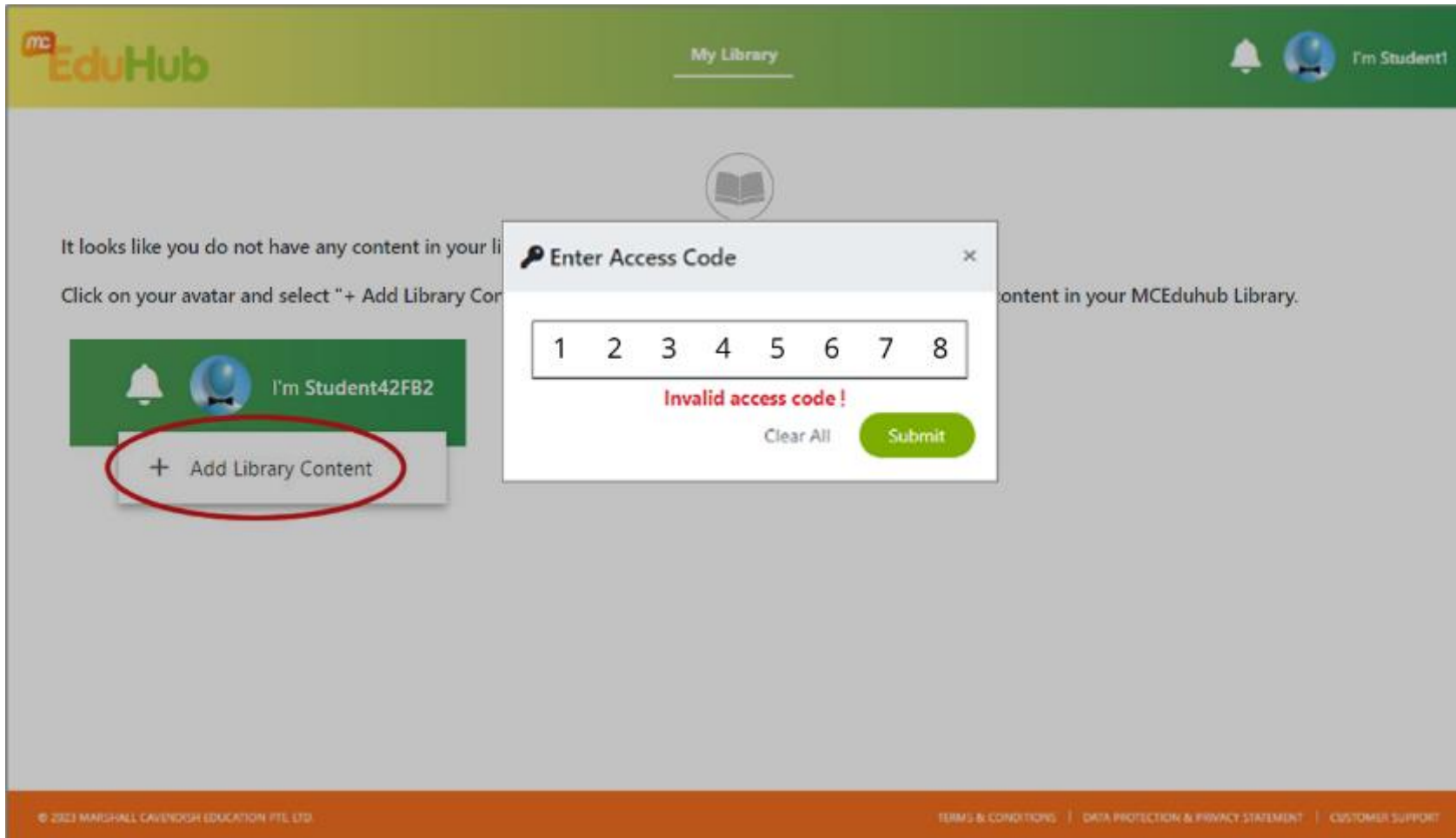
View Available eBooks in MCEduHub Library



All your activated eBook(s) will be shown here and can be accessed for the duration of the subscription period.

Click on the eBook icon to launch the eBook.

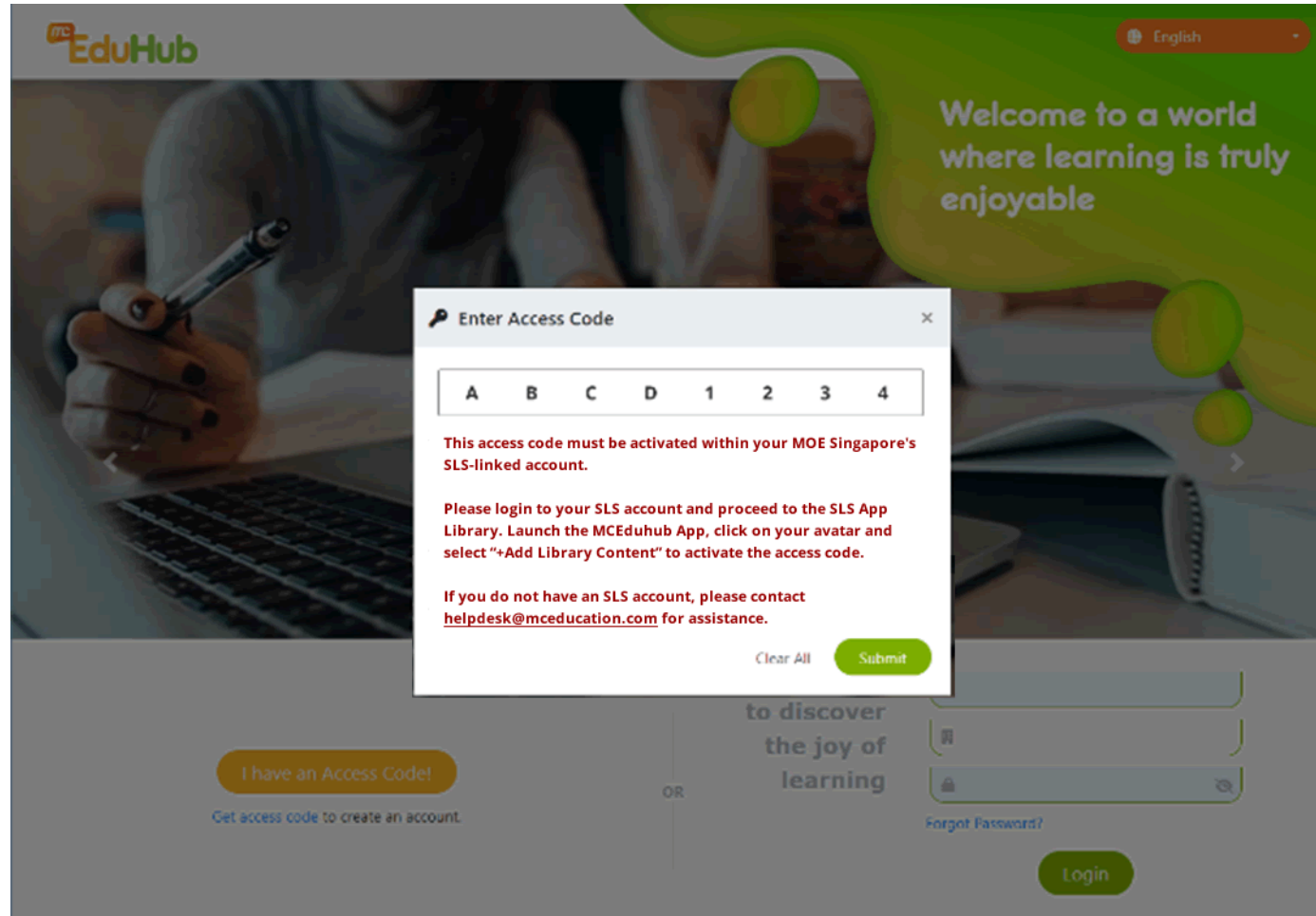
Unsuccessful Activation



If you receive an "Invalid access code!" error, please verify that the correct access code has been entered.

Otherwise, email helpdesk@mceducation.com with the access code so that we may investigate further.

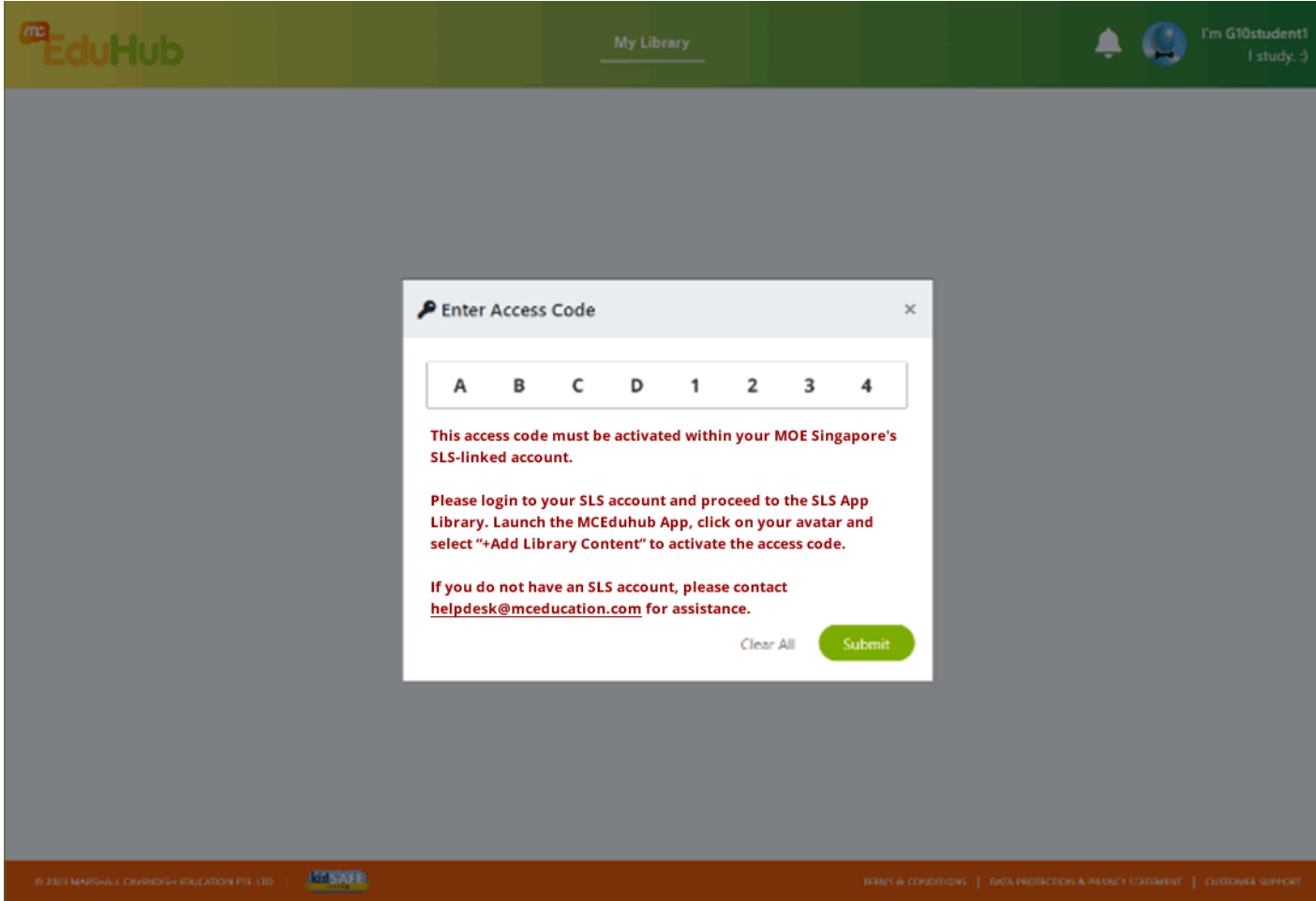
Attempting to Activate SLS-based Access Codes on MCEduHub Login Page



The access codes for eBooks used by MOE schools in Singapore can only be activated in the MCEduHub app in the SLS App Library.

Attempting to activate them directly on the MCEduHub login page will result in this error.

Attempting to Activate SLS-based Access Codes from Non-SLS MCEduHub Account



The screenshot shows the MCEduHub interface with a dark green header. The header contains the 'mc EduHub' logo, a 'My Library' link, a notification bell, a user profile icon, and the text 'I'm G10student1 I study :3'. A modal dialog box titled 'Enter Access Code' is centered on the screen. It features a grid of input fields for letters A, B, C, D and numbers 1, 2, 3, 4. Below the grid, a red error message states: 'This access code must be activated within your MOE Singapore's SLS-linked account.' This is followed by instructions: 'Please login to your SLS account and proceed to the SLS App Library. Launch the MCEduhub App, click on your avatar and select "+Add Library Content" to activate the access code.' A link to 'helpdesk@mceducation.com' is provided for assistance. At the bottom of the dialog are 'Clear All' and 'Submit' buttons. The footer of the page includes copyright information for Marshall Cavendish Education Pte Ltd, a 'McSAFE' logo, and links for 'TERMS & CONDITIONS', 'DATA PROTECTION & PRIVACY STATEMENT', and 'CUSTOMER SUPPORT'.

mc EduHub

My Library

I'm G10student1
I study :3

Enter Access Code

A B C D 1 2 3 4

This access code must be activated within your MOE Singapore's SLS-linked account.

Please login to your SLS account and proceed to the SLS App Library. Launch the MCEduhub App, click on your avatar and select "+Add Library Content" to activate the access code.

If you do not have an SLS account, please contact helpdesk@mceducation.com for assistance.

Clear All Submit

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TERMS & CONDITIONS | DATA PROTECTION & PRIVACY STATEMENT | CUSTOMER SUPPORT

Similarly, if you log in directly to your MCEduHub account and attempt to activate SLS-based access codes, you will receive the same error as shown.

These access codes can only be activated within your SLS-linked account via the MCEduHub app in the SLS App Library.

Launch eBook in MCEduHub Library



In your MCEduHub Library, click on the icon of the eBook that you want to launch.

Navigate using the Page Number or the Next & Previous Buttons

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Which is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100 metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Laurent Marcell	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	41.85	9.57
Emmanuel Kipkoech Korir	Kenya	800	105.66	7.61

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their race. The speed at any instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s .

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s .

Figure 2.2 Average speeds of different objects

Figure 2.2 shows the average speeds of different objects: snail (0.0005 m/s), train (12.5 m/s), cheetah (30 m/s), aeroplane (260 m/s), and rocket (2500 m/s).

You may navigate to the desired page by using the navigation tools in the Toolbar at the bottom of the Content Player:

- (a) Page number box
- (b) Next and Previous arrow buttons

View the Page Thumbnails Feature

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

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Compare this with the cheetah's average running speed shown in Figure 2.2.

Figure 2.2
Average speeds of different objects

Average Speed

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Emmanuel Kipkudat Koki	Kenya	800	105.66	7.61

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Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s .

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s .

Word Alert
Instant: a point in time

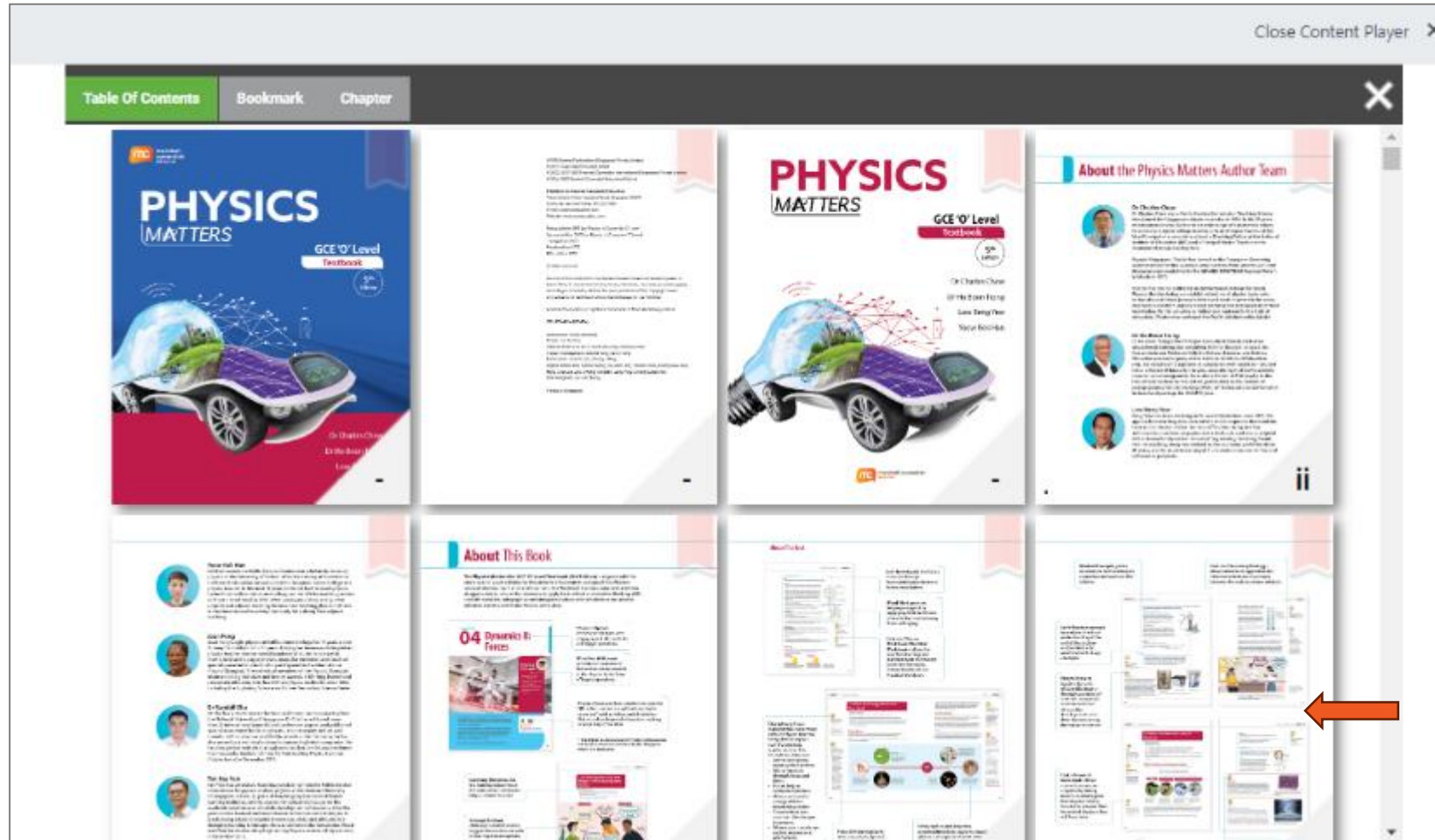
Figure 2.2 illustrates the average speeds of various objects on a scale from 0 to 3000 m/s :

- snail: 0.0005 m/s
- train: 125 m/s
- cheetah: 30 m/s
- airplane: 260 m/s
- rocket: 2500 m/s

Alternatively, you may activate the Page Thumbnails feature to facilitate page navigation.

Click on the  icon at the bottom right of the Tools menu below.

Navigate Using the Page Thumbnails



Scroll through the page thumbnails to locate the correct page.

Click on the correct page thumbnail to jump directly to that page.

How to use the eBook annotation tool

Access the eBook Annotation Tool

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
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Figure 2.1 Who is the real king of speed?

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Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

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Emmanuel Kipkemd Kiprot	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their race. The speed at any instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s .

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s .


Word Alert

Instant: a point in time

Figure 2.2 Average speeds of various objects

Figure 2.2 shows the average speeds of various objects on a scale from 0 to 3000 m/s . The objects and their speeds are:

- snail: 0.0005 m/s
- train: 125 m/s
- cheetah: 30 m/s
- airplane: 280 m/s
- rocket: 2500 m/s

After you have launched the eBook via MCEduHub Library, click on the Annotation icon  in the toolbar below.

Use the Annotation Toolbar

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
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Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

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To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s, $\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.44 \text{ m/s}$

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Leonard Mwaniki	Rwanda	100	9.88	10.12
Aaden de Gasse	Canada	200	19.62	10.2
Simeon Garibay	Bahamas	400	47.85	8.37
Emanuel Agyemang-Nyarko	Kenya	800	101.96	7.84

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their races. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer:

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No. The car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Figure 2.2 Some of the fastest animals on Earth

Figure 2.2 shows a diagram illustrating the speeds of various animals and vehicles. The speeds are listed in a circular arrangement around a central image of a cheetah. The speeds are: snail (0.045 m/s), turtle (0.1 m/s), AMT (1.5 m/s), cheetah (30 m/s), airplane (300 m/s), rocket (2500 m/s).

1) Thin/Thick Pen

2) Freeform or Standard Shapes


3) Pen Colour

To begin annotation:

1) Firstly, select the Pen type
– Thin Pen  / Thick Pen 

2) Then, select the freeform or standard shape required



3) Select the preferred pen colour
colour 

Inline Text Highlighting and Freeform Drawing/Writing

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- 1. State what is meant by speed and velocity.
- 2. Calculate average speed using distance travelled / time taken.
- 3. State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- 4. Interpret given examples of non-uniform acceleration.

Speed

If Usain Bolt were to race against a cheetah in a 100 metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Who is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

For Usain Bolt:

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
100	USA	9.80	10.2	
200	USA	19.62	10.2	
400	USA	43.03	9.32	
800m Sprint Heat	Kenya	800	105.06	7.63

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed – total distance travelled / total time taken

In reality, the athletes did not run at the same speed throughout their races. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?



Answer:



(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No. The car's average speed of 20 m/s is lower than the cheetah's average speed of 20 m/s.

Figure 2.2 Average speeds of various objects or animals

snail 0.0005 m/s, snail 0.0005 m/s, train 12.5 m/s, cheetah 30 m/s, airplane 280 m/s, rocket 2500 m/s

1) Use a combination of the Thick Pen  and Straight Line  to perform Inline Text Highlighting.

2) Use a combination of the Thin Pen  and Freeform Tool  to perform Freeform Drawing or Writing. This is best utilised with a stylus pen on touchscreen devices.

The Textbox, Move & Erase Tools





The screenshot shows a digital textbook page titled "Chapter 2 | Newtonian Mechanics" and "Kinematics | Chapter 2". The main heading is "2.1 What Are Speed, Velocity and Acceleration?". The page includes text, a table of sprinting results, and a diagram of average speeds. Annotations are made using three tools: a Textbox tool (labeled "Textbox"), a Move tool (labeled "Move"), and an Erase tool (labeled "Erase"). A "Close" button is also highlighted with a red circle and labeled "Close".

Table 2.3: Results for men's sprinting events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Leonard Mburu	Rwanda	100	9.88	10.2
Alden de Graaf	Canada	200	19.62	10.2
Simeon Carabin	Bahamas	400	47.85	8.37
Emmanuel Bikafori Kuti	Kenya	800	101.96	7.85

Figure 2.3: Average speeds of different objects or animals

A diagram showing a speed scale from 0 to 2500 m/s. Objects are placed along the scale: snail (0.0001 m/s), turtle (0.0005 m/s), car (10 m/s), train (100 m/s), cheetah (30 m/s), airplane (300 m/s), and rocket (2500 m/s).

- 1) For non-touchscreen devices, you may opt to use the Textbox tool  to ensure text legibility.
- 2) Annotations can be moved using the Move tool  and can be erased using the Erase tool .
- 3) To save your annotations, you must click on the Close icon  at the bottom right-hand of the Annotation Tool.

How to Add a Whiteboard

Add a Whiteboard

The screenshot shows a digital textbook interface. On the left, a sidebar contains navigation icons and a 'Helpful Note' about time units. The main content area is titled '2.1 What Are Speed, Velocity and Acceleration?' and includes 'Learning Outcomes', a 'Speed' section with a cheetah image, and a 'Worked Example 2A' about a car's average speed. On the right, there's a table of running results and a 'Word Alert' for 'instant'. A right-click context menu is open over the 'Speed' section, with 'Add Whiteboard' highlighted by an orange circle and an arrow. The menu also includes 'Add Note', 'Add URL', 'Zoom', and 'Copy Page URL'. At the bottom, a decorative banner shows various objects with their speeds: snail (0.0005 m/s), train (125 m/s), cheetah (30 m/s), airplane (280 m/s), and rocket (2500 m/s). The page number '18' is visible in the bottom center.

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambertucci	Italy	100	9.95	10.0
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Jamaica	400	47.85	8.37
Emmanuel Kipketer	Kenya	800	105.66	7.61

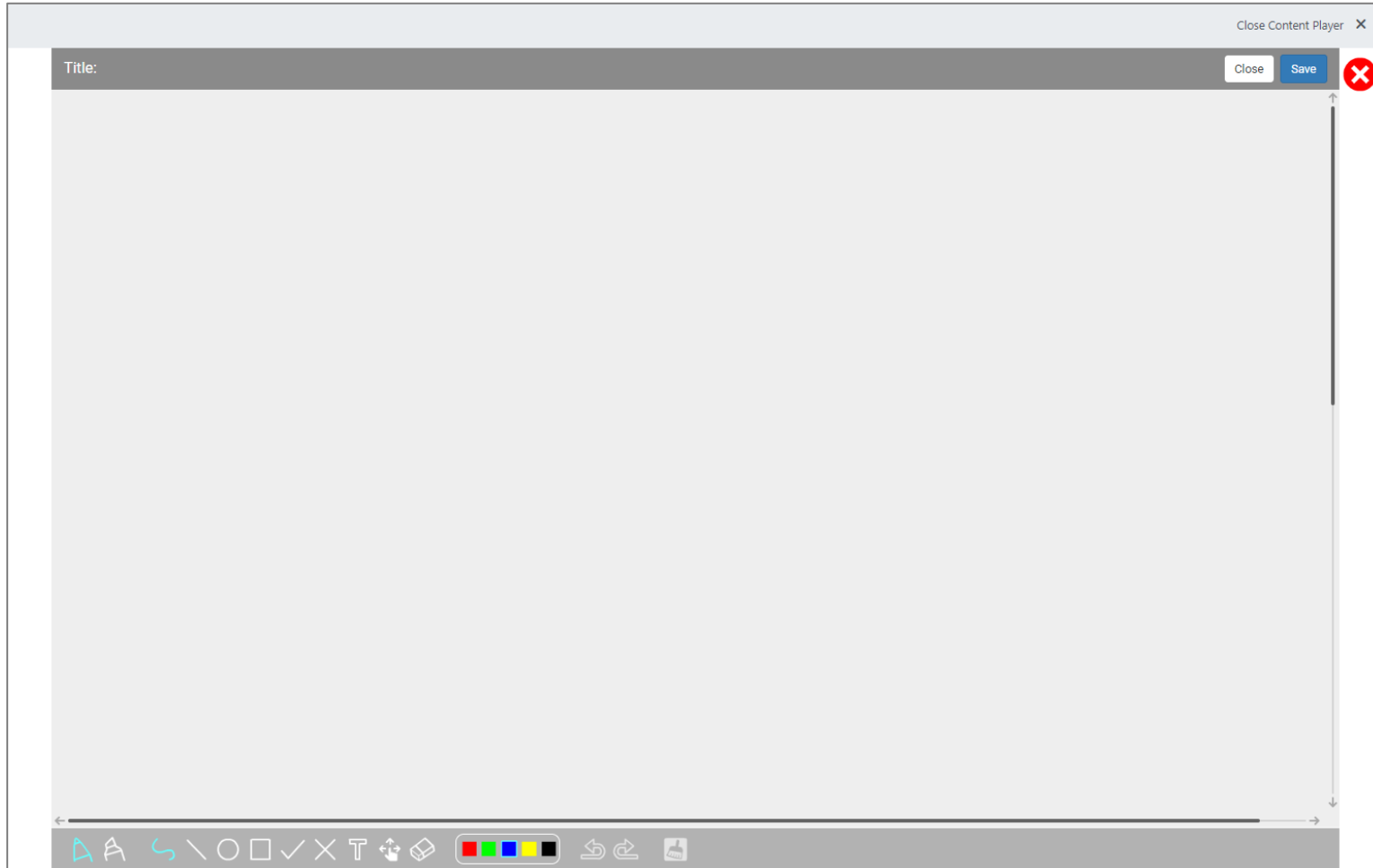
Worked Example 2A
A car travels 6 km in 5 minutes.
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Answer
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(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

On the eBook page, right-click to activate the Options Menu, and then left-click on “Add Whiteboard”.

The Add Whiteboard tool allows teachers to write and draw during lessons just like a normal whiteboard.

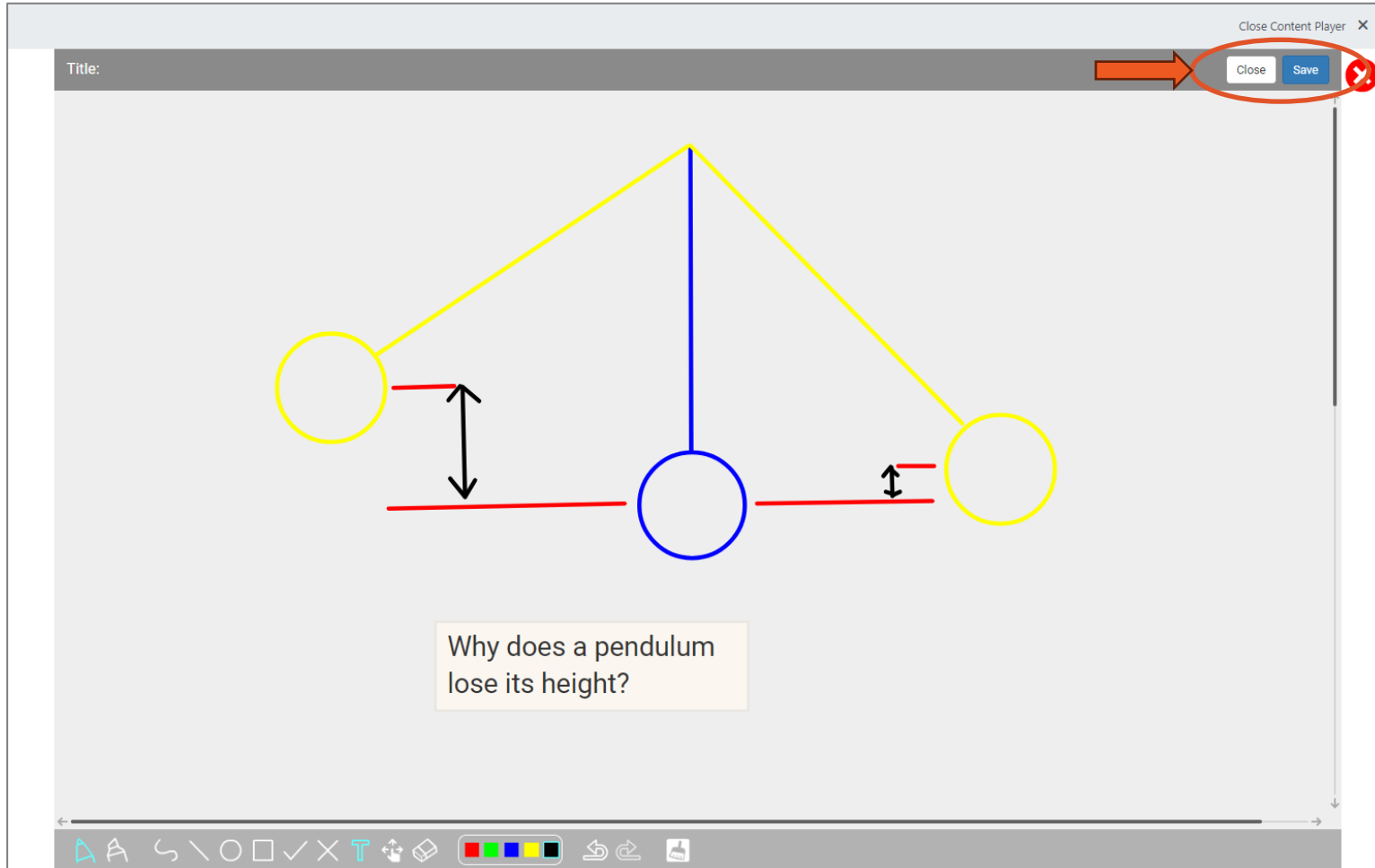
Add a Whiteboard



A full screen whiteboard will be displayed containing the exact same tools as the eBook annotation tools.

You may refer to the section ["How to use the eBook annotation tool"](#) for further details.

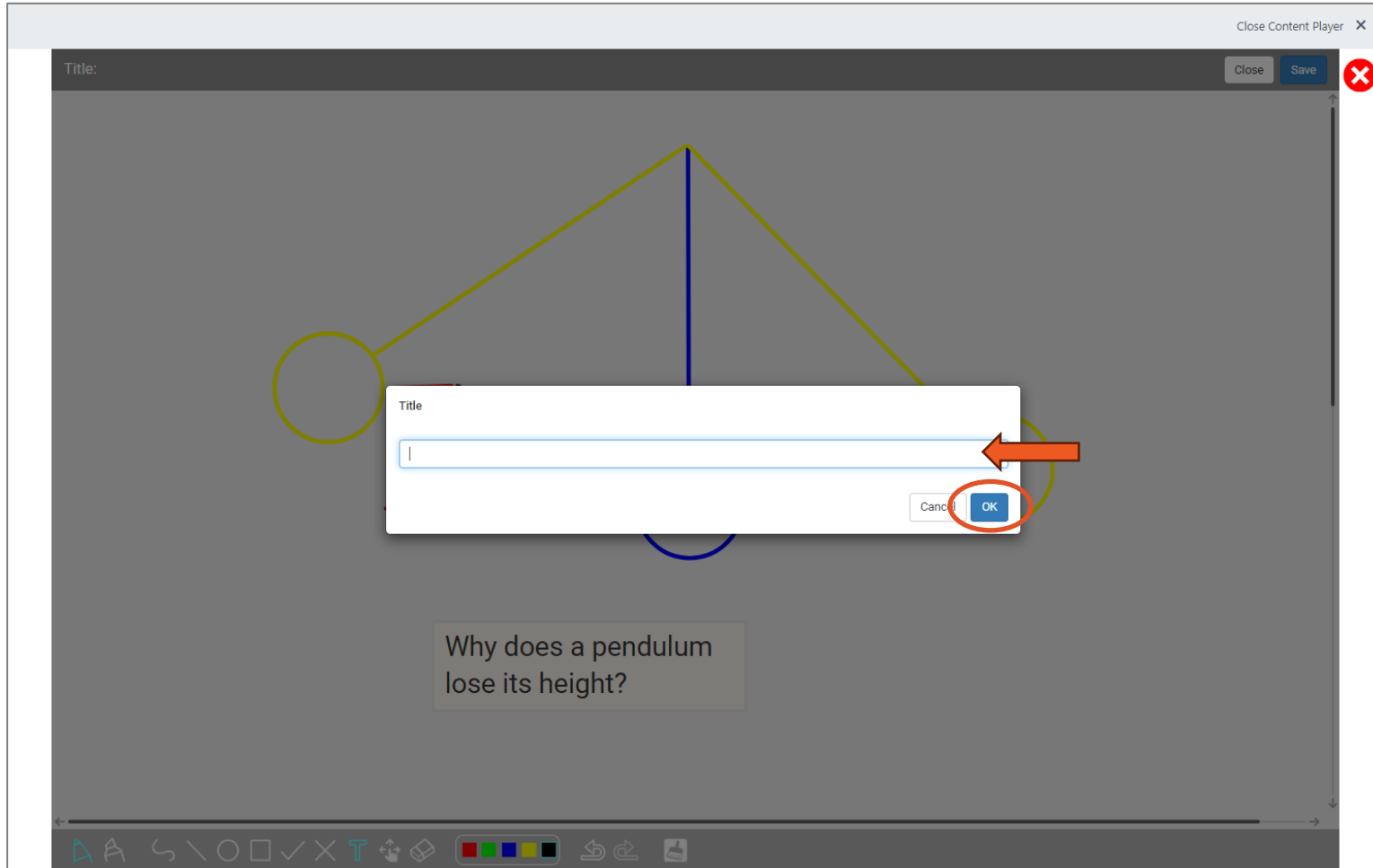
Save or Discard Your Whiteboard



Once you have completed your whiteboard drawing, click "Save" to save the whiteboard onto your eBook page.

Click "Close" to discard it.

Name Your Saved Whiteboard



Enter a title for your whiteboard and click "OK".

Access and Edit Your Saved Whiteboard

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

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If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Which is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (ms⁻¹).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / ms ⁻¹
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Jamaica	400	43.85	9.12
Emmanuel Kipketer	Kenya	800	105.66	7.61

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2

Average speeds of different objects

snail 0.0005 m/s

train 12.5 m/s

cheetah 30 m/s

airplane 200 m/s

rocket 2500 m/s

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Your saved whiteboard(s) will be displayed on the eBook page as a whiteboard icon.

Click on the icon to see a preview of its content and click "Edit" to open the whiteboard in full-screen and to make further changes.

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Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Which is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambert Marcel	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	43.85	9.12
Emmanuel Kipkandie Koei	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes. Calculate its average speed in m/s.

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2 Average speeds of different objects

Figure 2.2 shows a speed comparison chart with the following values:

- snail: 0.0005 m/s
- train: 125 m/s
- cheetah: 30 m/s
- airplane: 280 m/s
- rocket: 2500 m/s

Left-click and hold momentarily on the icon. A delete symbol will appear at the top right-hand corner of the icon.

Click on the delete symbol to delete your saved whiteboard.

How to Add a Note

Add a Note

The screenshot shows an eBook page from a physics textbook. The page title is "2.1 What Are Speed, Velocity and Acceleration?". The page contains text, a table of data, and a diagram. A context menu is open over the page, with the "Add Note" option highlighted by a red circle and an arrow. The menu also includes "Add Whiteboard", "Add URL", "Zoom", and "Copy Page URL".

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.2)?

Figure 2.1 Who is the fastest?

To find out, we will need to compare their speed.

Speed is the distance travelled per unit time. Its unit is m s^{-1} .

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m s}^{-1}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m s^{-1}
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	41.85	9.57
Emmanuel Kipkandie	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their races. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m s^{-1} .

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m s}^{-1}$

(b) No, the car's average speed of 20 m s^{-1} is lower than the cheetah's average speed of 30 m s^{-1} .

Figure 2.2 Average speeds of different objects

The diagram shows a horizontal line with various objects and their average speeds: snail (0.0005 m s^{-1}), train (12.5 m s^{-1}), cheetah (30 m s^{-1}), aeroplane (280 m s^{-1}), and rocket (2500 m s^{-1}). The speeds increase from left to right.

On the eBook page, right-click to activate the Options Menu, and then left-click on "Add Note".

The Add Note tool allows users to add post-it notes in multiple places in the eBook.

Add a Note

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.

Disciplinary Idea
Mass and energy make up the universe.

Helpful Note
A unit of time can be second, a minute or a hour.

Average Speed
Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Leonard Mulder	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.62	10.2
Simeon Gaidarov	Bulgaria	400	51.85	7.72

Figure 2.2
Average speeds of various objects

Figure 2.2 shows a diagram illustrating the average speeds of various objects. The objects and their speeds are: snail (0.0005 m/s), train (125 m/s), cheetah (30 m/s), airplane (200 m/s), and rocket (2500 m/s). The diagram shows a horizontal line with an upward curve, representing increasing speed. The objects are placed along this curve, with their respective speeds indicated in circles.

Speed = distance travelled / time taken

Based on Usain Bolt's 100 metre fastest record time of 9.58 s,
Speed = distance travelled / time taken = 100 m / 9.58 s = 10.4 m/s

Compare this with the cheetah's average running speed shown in Figure 2.2.

Close Content Player X

Close Save

A popup textbox will appear. Type your note and click "Save" to save the note.

Or click "Close" to discard it.

Access and Edit Your Saved Note

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Which is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	43.85	9.12
Emmanuel Kipketer Koei	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

Also, the athletes did not run at the same speed throughout their race. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Example: A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer:

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2 Average speeds of different objects

Figure 2.2 shows a graph of average speeds for various objects. The objects and their speeds are:

- snail: 0.0005 m/s
- train: 125 m/s
- cheetah: 30 m/s
- airplane: 200 m/s
- rocket: 2500 m/s

Your saved note(s) will be displayed on the eBook page as a note icon.

Click on the icon to see a preview of its content and click "Edit" to open the note in full and to make further changes.

Delete Your Saved Note

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Chapter 2 | Newtonian Mechanics

Kinematics | Chapter 2

2.1 What Are Speed, Velocity and Acceleration?

Disciplinary Idea

Maths and science make up the universe.

Kinematics (study of motion) provides us with a vocabulary for describing the motion of matter in the universe such as the 100 m sprint on land or the massed migration of humpback whales in the ocean in search of feeding and breeding grounds.

Helpful Note

A unit of time can be a second, a minute or an hour.

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Who is the real king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Gaze	Canada	200	19.67	10.2
Simeon Garfield	Kenya	400	43.85	9.12
Emmanuel Kiptanui Koei	Kenya	800	105.06	7.61

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

In reality, the athletes did not run at the same speed throughout their races. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Word Alert

Instant: a point in time

Worked Example 2A

A car travels 4 km in 5 minutes. Calculate its average speed in m/s. Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) $\text{Average speed} = \frac{\text{total distance travelled}}{\text{total time taken}} = \frac{4 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No. The car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Figure 2.2 Average speeds of different vehicles

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Left-click and hold momentarily on the icon. A delete symbol will appear at the top right-hand corner of the icon.

Click on the delete symbol to delete your saved note.

How to Add a URL

Add a URL

The screenshot shows a digital textbook page for Chapter 2, Newtonian Mechanics. The page title is '2.1 What Are Speed, Velocity and Acceleration?'. It includes learning outcomes, a disciplinary idea, a speed definition, and a table of average speeds for various vehicles. An options menu is open over the page, with 'Add URL' highlighted by a red circle and an arrow. The menu also includes 'Add Whiteboard', 'Add Note', 'Zoom', and 'Copy Page URL'.

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Disciplinary Idea
Motion and energy make up the universe.

Speed
If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.2)?

Figure 2.1 Who's the fastest?

To find out, we will need to compare their speed.

Speed is the distance travelled per unit time. Its unit is m/s.

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,
Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed
Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambert Marcel	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Jamaica	400	41.85	9.57
Emmanuel Kipketer	Kenya	800	105.66	7.61

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A
A car travels 6 km in 5 minutes.
(a) Calculate its average speed in m/s.
(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer
(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$
(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert
Instant: a point in time

Figure 2.2 Average speeds of different vehicles

Figure 2.2 shows a graph of average speeds for various vehicles. The speeds are: snail (0.0005 m/s), train (12.5 m/s), cheetah (30 m/s), aeroplane (200 m/s), and rocket (2500 m/s).

On the eBook page, right-click to activate the Options Menu, and then left-click on "Add URL".

The Add URL tool allows users to add external web links.

Add a URL

Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Leonard Mulder	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.62	10.2

Figure 2.2 Average speeds of various objects

snail 0.0005 m/s, train 125 m/s, cheetah 30 m/s, aeroplane 200 m/s, rocket 2500 m/s

Web Link

Name / Description

Kahoot!

URL

https://kahoot.com/

Cancel OK

A popup textbox will appear. Enter the name and the URL of the web link and click "OK" to save the URL.

Or click "Cancel" to discard it.

Launch Your Saved URL

Chapter 2 | Newtonian Mechanics

Kinematics | Chapter 2

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?




Figure 2.1 Who's the real king of speed?

Speed is the distance travelled per unit time. Its SI unit is metre per second (ms⁻¹).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,
Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Figure 2.2 Average speeds of different objects

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / ms ⁻¹
Jacobs Lambertucci	Italy	100	9.90	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	43.85	9.12
Emmanuel Kipketer Koei	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. Average speed assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular instant is known as its instantaneous speed.

Worked Example 2A

A car travels 6 km in 5 minutes.
(a) Calculate its average speed in m/s.
(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$
(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2 Average speeds of different objects

Your saved URL(s) will be displayed on the eBook page as a URL icon.

Click on the icon to launch the external site in a new tab.

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Chapter 2 | Newtonian Mechanics

Kinematics | Chapter 2

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?




Figure 2.1 Who is the real king of speed?

Speed

To find out, we will need to compare their speeds. Speed refers to how fast something moves. Speed is the distance travelled per unit time. Its SI unit is metre per second (ms⁻¹).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$


Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Figure 2.2

Average speeds of different objects



Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / ms ⁻¹
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Jamaica	400	41.85	9.57
Emmanuel Kipketer	Kenya	800	105.66	7.61

the speeds shown in Table 2.1 are average speeds. Average speed assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular instant is known as its instantaneous speed.

Worked Example 2A

A car travels 6 km in 5 minutes. Calculate its average speed in m/s. (average speed of a car higher than the cheetah's speed shown in Figure 2.2)

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Left-click and hold momentarily on the icon. A delete symbol will appear at the top right-hand corner of the icon.

Click on the delete symbol to delete your saved note.

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How to use the Zoom tool

Access the Zoom tool

The screenshot shows a digital textbook interface. At the top, it says 'Chapter 2 | Newtonian Mechanics' and 'Kinematics | Chapter 2'. The main content area is titled '2.1 What Are Speed, Velocity and Acceleration?'. It includes 'Learning Outcomes', a 'Speed' section with a cheetah image, and a table of average speeds for various vehicles. A context menu is open over the 'Speed' section, with the 'Zoom' option highlighted by a red circle and an arrow. The menu options are: Add Whiteboard, Add Note, Add URL, Zoom, and Copy Page URL. The bottom of the page features a speed comparison graphic with a snail (0.0005 m/s), a train (12.5 m/s), a cheetah (30 m/s), an airplane (260 m/s), and a rocket (2500 m/s).

Chapter 2 | Newtonian Mechanics

Kinematics | Chapter 2

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?

Figure 2.1 Who's the real?

To find out, we will need to compare their speed.

Speed is the distance travelled per unit time. Its

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Table 2.1 Results for men's running events at the 2020 Tokyo Olympics

Athlete	Country	Event / m	Time / s	Average Speed / m/s
Jacobs Lambertucci	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	43.85	9.12
Emmanuel Kipketer	Kenya	800	105.66	7.61

The speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$

(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2 Average speeds of different objects

snail 0.0005 m/s

train 12.5 m/s

cheetah 30 m/s

airplane 260 m/s

rocket 2500 m/s

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Chapter 2 | Newtonian Mechanics

Kinematics | Chapter 2

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform accelerations.

Speed

If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?




Figure 2.1 Which is the real king of speed?

Speed

Speed is the distance travelled per unit time. Its SI unit is metre per second (ms⁻¹).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Average Speed

Table 2.1 shows the results for men's running events at the 2020 Tokyo Olympics.

Athlete	Country	Event / m	Time / s	Average Speed / ms ⁻¹
Jacobs Lambert Marcel	Italy	100	9.80	10.2
Andre de Groot	Canada	200	19.67	10.2
Steven Gardiner	Bahamas	400	43.85	9.12
Emmanuel Kipkandie	Kenya	800	105.06	7.61

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

In reality, the athletes did not run at the same speed throughout their runs. The speed at one instant may be different from the speed at another instant. The speed of an object at a particular **instant** is known as its **instantaneous speed**.

Worked Example 2A

A car travels 6 km in 5 minutes.

(a) Calculate its average speed in m/s.

(b) Is the average speed of a car higher than the cheetah's speed shown in Figure 2.2?

Answer

(a) Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}} = \frac{6 \times 1000 \text{ m}}{5 \times 60 \text{ s}} = 20 \text{ m/s}$


(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

Word Alert

Instant: a point in time

Figure 2.2

Average speeds of different objects



snail 0.0005 m/s

train 12.5 m/s

cheetah 30 m/s

airplane 280 m/s

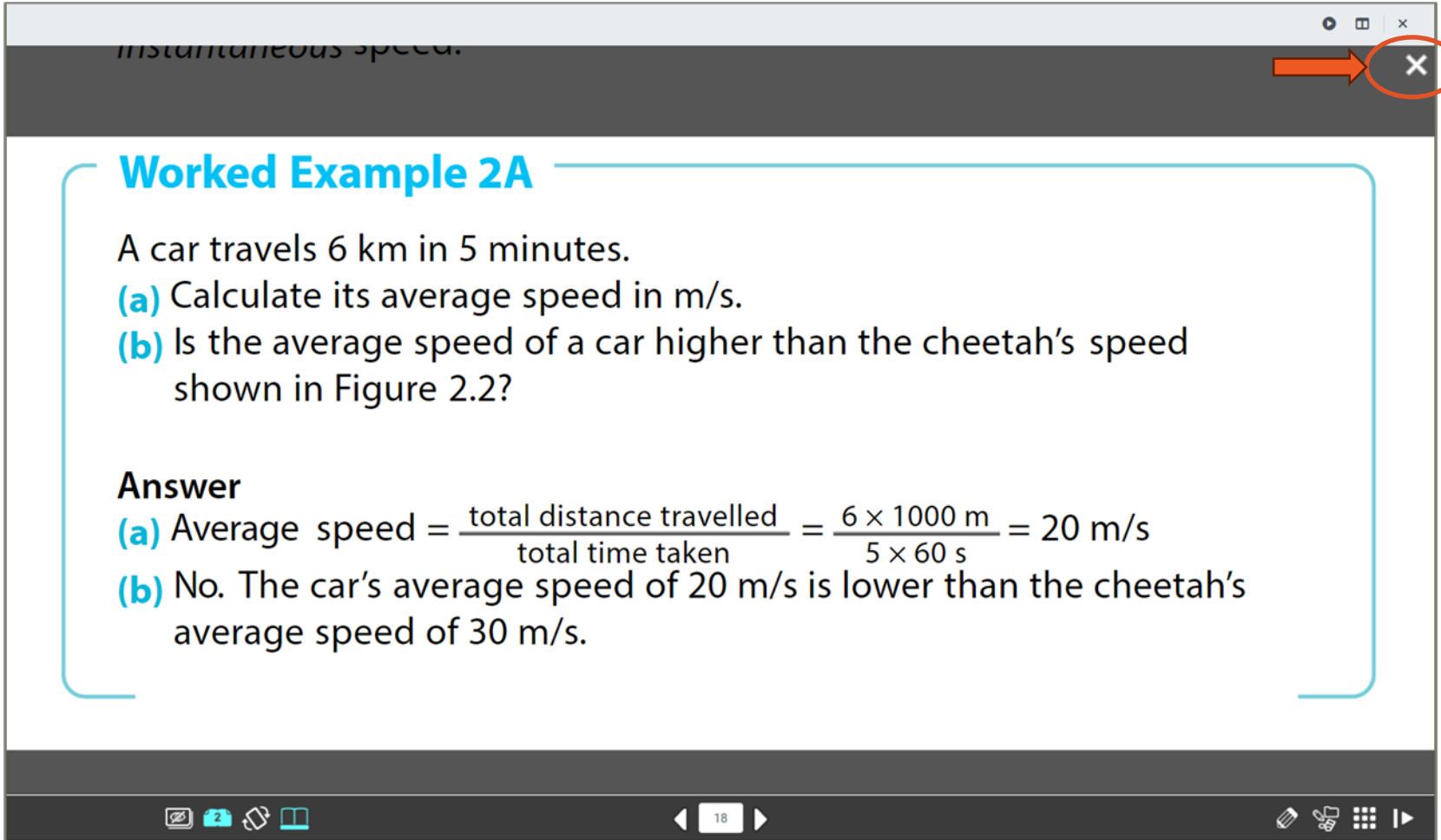
rocket 2500 m/s

Left-click and drag your mouse over the area you would like to zoom in to.

A rectangular dotted line will appear to indicate the selected zoom area.

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instantaneous speed.

Worked Example 2A

A car travels 6 km in 5 minutes.

- (a) Calculate its average speed in m/s.
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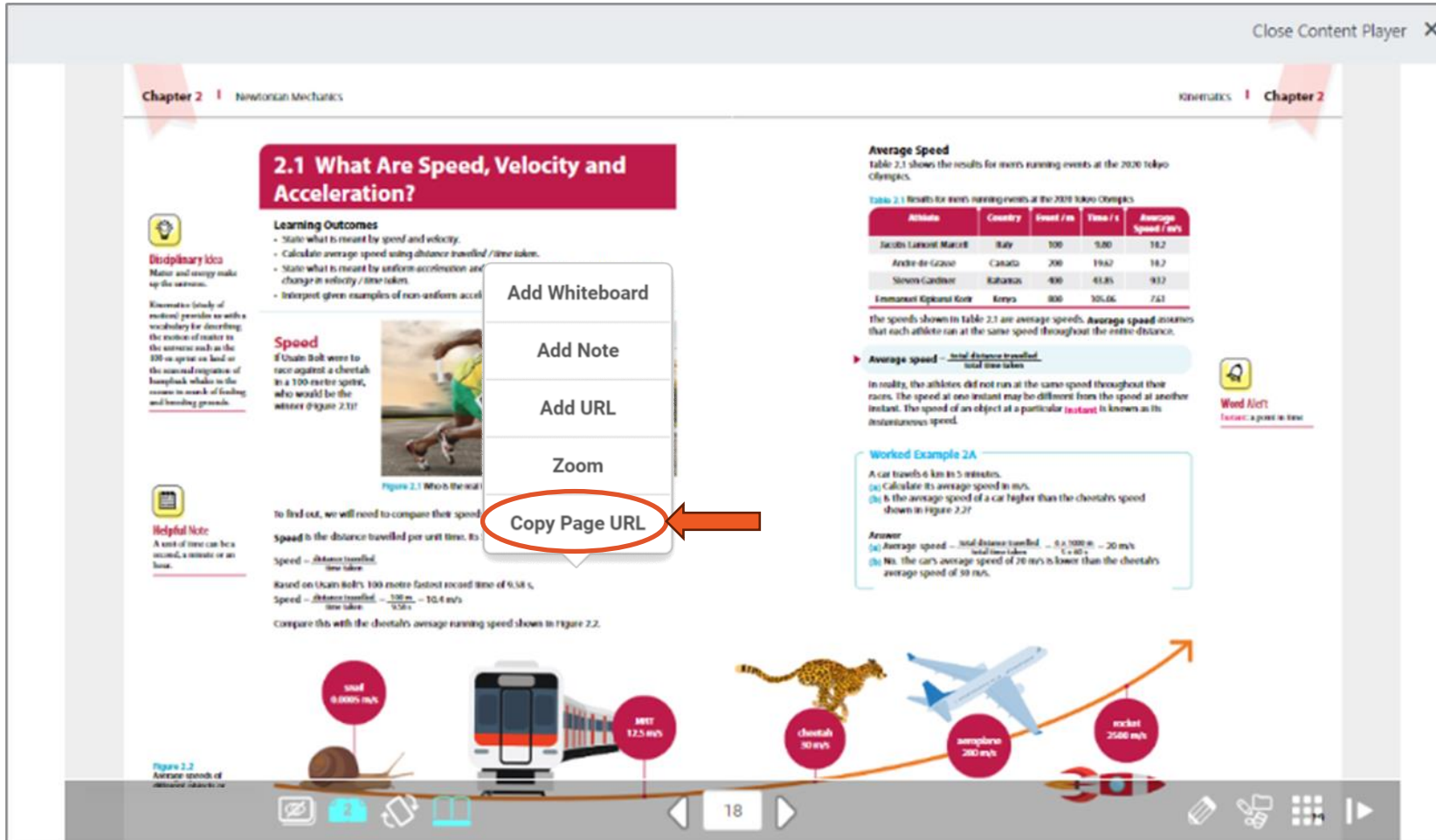
The screenshot shows a presentation window with a dark grey header and footer. The main content area is white. A blue rounded rectangle highlights the 'Worked Example 2A' section. In the top right corner of the window, a red circle highlights a white 'X' icon, with an orange arrow pointing to it from the left. The footer contains a navigation bar with icons for back, forward, and search, and a page number '18'.

When the mouse button is released, the selected area will be zoomed in.

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Chapter 2 | Newtonian Mechanics

2.1 What Are Speed, Velocity and Acceleration?

Learning Outcomes

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Speed

If Usain Bolt were to run 100 m in 9.58 s, his average speed would be:

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Figure 2.1 Who is the fastest of speed?

to find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

Speed = $\frac{\text{distance travelled}}{\text{time taken}}$

Based on Usain Bolt's 100 metre fastest record time of 9.58 s,

Speed = $\frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$

Figure 2.2 Average speeds of different objects

Object	Average Speed (m/s)
snail	0.0005
train	12.5
cheetah	30
airplane	200
rocket	2500

Average Speed

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Jacobs Laurent Marcell	Italy	100	9.80	10.2
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Emmanuel Opikari Koki	Kenya	800	205.66	7.63

the speeds shown in Table 2.1 are average speeds. **Average speed** assumes that each athlete ran at the same speed throughout the entire distance.

Average speed = $\frac{\text{total distance travelled}}{\text{total time taken}}$

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Answer

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(b) No, the car's average speed of 20 m/s is lower than the cheetah's average speed of 30 m/s.

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Physics eBook: Chapter 2.1 - What are Speed, Velocity and Acceleration?

Disciplinary Idea
Matter and energy make up the universe.

Kinematics (study of motion) provides us with a vocabulary for describing the motion of matter in the universe such as the 100-m sprint on land or the seasonal migration of humpback whales in the ocean in search of feeding and breeding grounds.

- State what is meant by speed and velocity.
- Calculate average speed using distance travelled / time taken.
- State what is meant by uniform acceleration and calculate the value of acceleration using change in velocity / time taken.
- Interpret given examples of non-uniform acceleration.

Speed
If Usain Bolt were to race against a cheetah in a 100-metre sprint, who would be the winner (Figure 2.1)?




Figure 2.1 Who is the king of speed?

To find out, we will need to compare their speeds. Speed refers to how fast something moves.

Speed is the distance travelled per unit time. Its SI unit is metre per second (m/s).

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

Based on Usain Bolt's 100-metre fastest record time of 9.58 s.

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{100 \text{ m}}{9.58 \text{ s}} = 10.4 \text{ m/s}$$

Compare this with the cheetah's average running speed shown in Figure 2.2.

Helpful Note
A unit of time can be a second, a minute or an hour.

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