

Climate Emergency & Plastics Pollution

If Not You Then Who?



United Nations Sustainable Development Goal 14
Life Below Water

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SoS – Save our Seas

Summary: The purpose of this module is to provide students with a comprehensive introduction to the issue of plastic pollution in our oceans.

Using the United Nations Sustainable Development Goal 14 “Life Under Water” as the focal point of the project, students develop an understanding of why plastics are a problem, what solutions could be applied and the use of technology, especially AI, in addressing this area of the climate emergency.

The project is presented as a series of 10 lessons or a continuous scheme. The focus is on students addressing key questions and suggesting ways forward. A mix of individual, paired and group activities are presented. This provides a vehicle for students to grow the belief that they are agents in the scenario and that they can enact change individually and with a united approach.

The project is designed to be modular in nature, allowing teachers to edit the content through omitting sessions in order that it can fit the curriculum demands and time constraints of schools.

Whilst the content has an information technology and computer science focus, it is not designed as a purely STEM based investigation. The return to analysis and discussion throughout promotes oracy, giving voice to the views of young people who are the generation facing the wave of problems generated in the climate emergency.

The content and message is presented very much in a cross curricula mode thereby removing some of the stigma attached to subject areas and their perceptions.

Key information

Ten lessons which can be isolated and delivered as a stand-alone sessions or delivered as a complete module. The use of online portals, such as the Climate Central coastal risk screening tool and Google Teachable Machine, do not require an in-depth computer science background beyond exposure to working online and digital literacy skills.

The project is designed primarily for Key Stage 4 and Key Stage 5 students – ages 14-19. However, the content is presented as an editable set of resources allowing for changes which would lower the age range. Similarly, activities move from foundation to more advanced providing a means to remove later tasks but still retaining a base of climate emergency messages.

Activity Details

The lessons enable students to:

- Explore why the oceans are important to life on Earth
- Investigate the amount of plastic pollution
- Interpret what the figures and data mean
- Reflect on the enormity of the problem facing the planet
- Analyse the issues to isolate key areas for action
- Raise awareness of where the plastic is and how it gets to the 5 gyres
- Link the permanent nature of plastic to marine life and ultimately human health and economy
- Know the effects of greenhouse gases in particular methane and carbon dioxide
- Develop an awareness program to encourage advocacy
- Model the impact of plastic to climate and sea levels
- Analyse the humanitarian crisis that rising sea levels will produce
- Design, edit and build a functioning AI system capable of identifying plastics and marine species

Subject links

The lessons links to themes from the following subject areas:

KS4 Citizenship – citizen action, advocacy and campaigning

KS4 Literacy – develop oracy skills promoting communication in written and spoken form

KS4 Mathematics – exploring and working with massive numbers

KS4 Geography - changing climate, ocean currents, sea levels and coastal flooding

KS4 Science - causes of climate change, potential effects of, and mitigation of, increased levels of methane and carbon dioxide






















































KS4 Computing – using online tools and AI to model and create solution to real world problems

Resources for the module

All resources are accessible from a cloud repository, Google Drive. The links to the resources provide the rights to download and edit as local circumstances dictate.

Wherever possible, the resources are provided in Microsoft and Google formats, thereby reducing the need to install paid for software.

List of resources - <https://tinyurl.com/ykfxhcsa>

 Cards	 Ocean Bottles.png 
 Lesson by lesson presentations	 Ocean Trash- 5.25 Trillion Pieces 
 Working with Teachable Machine	 Ocean Trash- 5.25 Trillion Pieces.docx 
 Garbage Patches Explained 	 percent calculator.py 
 Garbage Patches Explained.docx 	 Plastics Pollution - 7 Facts 
 Micro plastic infographic.webp 	 Rising Sea Levels 
 More than 170 trillion plastic particles 	 Save our Seas Workbook 
 More than 170 trillion plastic particles .docx 	 Save our Seas Workbook.docx 
 Ocean Bottles 	 sdg-poster.jpg 
 Ocean Bottles example.docx 	 Seven Facts.webp 
 Ocean bottles ideas 	 Teacher Planning Document SDG 14 Whole Project 
 Ocean bottles ideas No bullets 	 Teacher Planning Document SDG 14 Whole Project.docx 
 Ocean bottles ideas No bullets.docx 	 UNSDG 14 Life Below Water Continuous Project 
 Ocean bottles ideas.docx 	 UNSDG 14 Life Below Water Continuous Project.pptx 

Lessons – the first set of slides in each lesson provide a starter and recap the overall big question, scenario and objectives. This provides continuity and serves to focus students.

Lesson 1 - [Link](#)

Slide 1 – 10 Minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Starter Activity
With a partner, discuss the image.
What words would you use to describe the image? Write these on the image

Starter – display the slide and provide access to a digital version of the ‘Ocean bottles’ document/have hard copies available on student desks.

Ask students to discuss the image featuring a map of the World with plastic water bottles in the oceans.

Prompt students to consider what message the image might be trying to convey. Ask them to think of words they would use to describe the image and write these on the image. If students need further support, you may choose to use the document ‘Ocean Bottles ideas.docx’. This file contains a number of words that may be used in a description of the image.

Students may need support in this. If they do, display the ‘Ocean Bottles example’ document or show students slide 2. The slide is hidden but can be unlocked – right click on the slide and choose ‘unhide’.

This is a shared activity on tables/in pairs. Encourage students to discuss this between themselves.

If students require further scaffolding to engage in the task, consider showing students the ‘Ocean Bottles ideas’ document. This is a list of 89 words that could be used to label the document.

An initial time of 10 minutes has been given to this task. Adjust as need be depending on the group and time constraints. As this is a foundation task, designed to get students thinking about ocean pollution, extend the timing to encourage further discussion if possible.

Slide 2



The slide is hidden but may be used to provide students with scaffolding to work through the activity. The pre-populated document can be issued to encourage students in adding their own content.

Slide 3 – 2 minutes



Slide 3 contains the full list of United Nations Sustainable Development Goals.

The slide is hidden but can be unhidden to introduce the concept of the UN SDGs. Alternatively, copies of the poster containing the 17 goals can be provided to students.

To provide extra context, using this slide or poster will allow you to introduce students to the way in which issues such as SDG 12 'Responsible Consumption and Production' and SDG 13 'Climate Action' whilst separate Goals are very much linked.

Slide 4 – 5 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels

Display slide 4. Introduce the 'Big Picture' by showing the 3 main bullet points.

Explain that the class are going to explore ocean pollution, especially plastics. In this journey, students will explore climate and the impact which plastics have on biodiversity, carbon impact and oxygen levels.

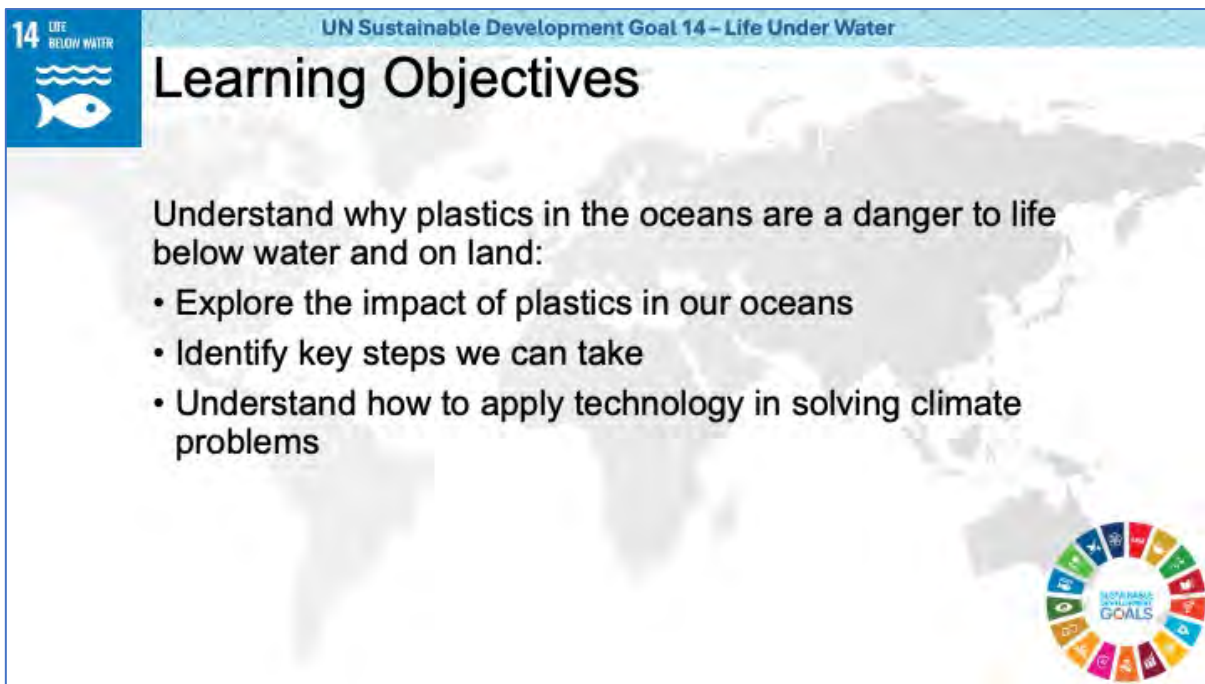
The United Nations have a set of Sustainability Development Goals (often shortened to UN SDG).

Tell students that the work they will be undertaking is focused on SDG 14 'Life Below Water' but that this is also related to other SDGs.

For example, pollution in our oceans is largely a result of poor consumption and production attitudes (**SDG 12**) which has an impact on climate (**SDG 13**).

If you have time, you could go further and ask students to consider how other SDGs are linked into SDG 14 eg **SDG 9** 'Industry, Innovation and Infrastructure' where innovation in plastics production and disposal would have a positive impact.

Slide 5 – 3 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- Understand how to apply technology in solving climate problems

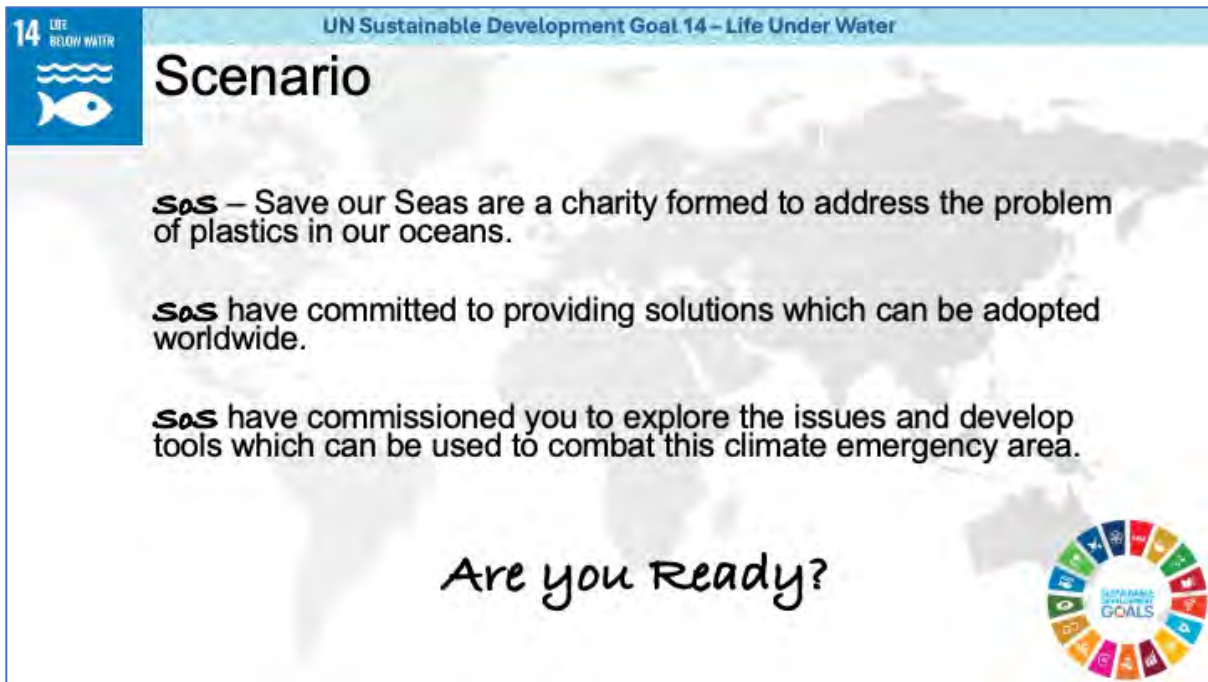
Show slide 5 and tell students that as they investigate the Big Picture topics they will

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- Understand how to apply technology in solving climate problems

These are the overall objectives for the unit.

You may choose to spend time in encouraging a whole class debate on the climate emergency in general – global warming and carbon dioxide are key features but not the only issues.

Slide 6 – 3 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


Scenario

SoS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SoS have committed to providing solutions which can be adopted worldwide.

SoS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



The slide sets up the scenario for the UN SDG 14.

Students will be working for an NGO called SoS – Save our Seas. The purpose of the organisation is to address the problem of plastics in our oceans.

The solutions should be capable of being adopted worldwide. Stress this point to the students. This reinforces the idea that it is an international issue that has a local solution. As students work through this unit they will be introduced to the global perspective on plastics in the oceans and be encouraged to consider how the topics are linked.

Tell students that they will be providing answers and will create a technology-based solution. What this will be is revealed later (it will be an AI tool students design and create).

The project is designed as a largely scenario based unit of work encouraging students to reflect on the climate emergency and plastics pollution.

Slide 7 – 15 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

ACTIVITY

You began your journey by creating a list of words which describes the slide image

Using the link to the word cloud generator, upload your words

From the group word cloud, select a minimum of 3 words and create at least one sentence that summarizes the issue of plastic pollution in our oceans

Sustainable Development Goals

Refer students back to the starter task and ask them to decide on 3 words which they believe best encapsulate the problem.

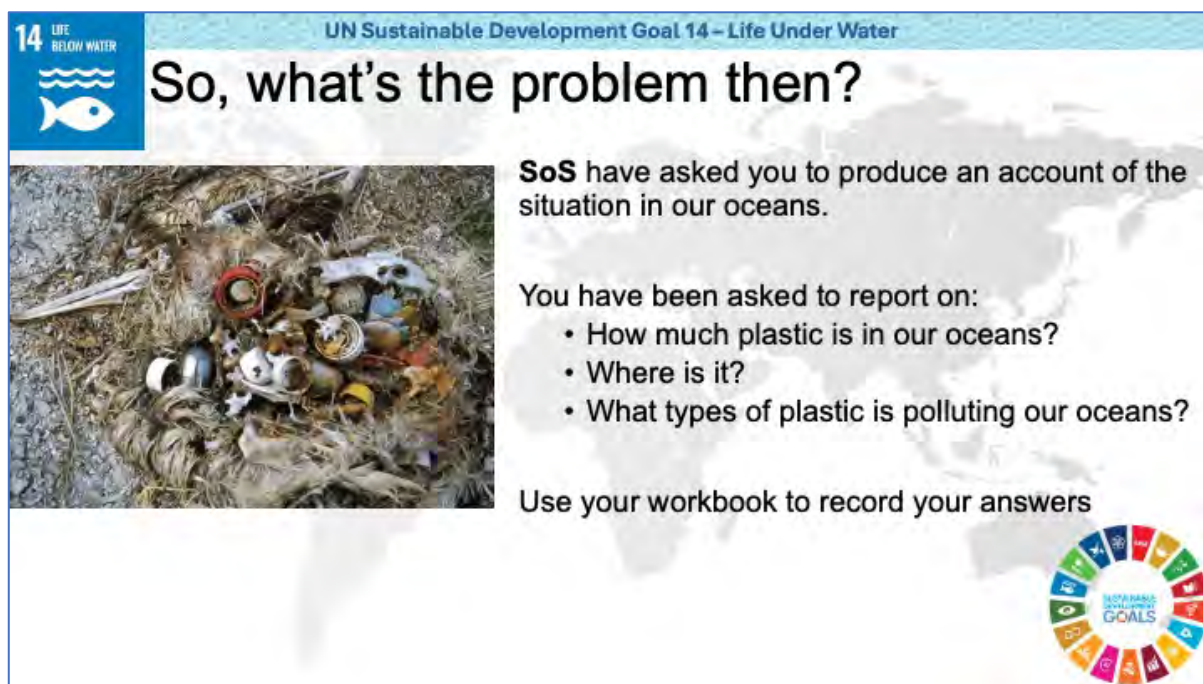
Students should be directed to an online the word cloud creator. There are several online versions. For example, mentimeter (<https://www.mentimeter.com/>) provides a free to use version which generates an easy-to-use link for submission of the words. The activity will collate the group's words into one document which they can all access.

After the 3 words have been added to the cloud, students should take a screenshot of this and it to the cover of their workbook.

The brief for the overall project is provided on page 2 of the [workbook](#). Highlight that the students are working towards their Marine Eco Warrior Certificate (<https://tinyurl.com/mun7etma>)

Once the 3 words have been added and a copy of the cloud added to the workbook, students should choose at least 3 words – they do not need to be their original 3 – and create a sentence or more using the words which summarises their current thinking about the issues surrounding plastics in the oceans.

Slide 8 – 20 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

So, what's the problem then?

SoS have asked you to produce an account of the situation in our oceans.

You have been asked to report on:

- How much plastic is in our oceans?
- Where is it?
- What types of plastic is polluting our oceans?

Use your workbook to record your answers

Show the slide and continue the scenario with the students.

They have been asked to report on plastics based on the questions:

- How much plastic is in our oceans?
- Where is it?
- What types of plastic is polluting our oceans?

The aim of this part of the project is to raise awareness of the scale of the problem.

Two links are provided, from 2015 and 2023. The links highlight the growth of the problem in 9 years: from 5 trillion to 171 trillion pieces.

Students should be given time to read the articles:

<https://education.nationalgeographic.org/resource/ocean-trash-525-trillion-pieces-and-counting-big-questions-remain/>

<https://edition.cnn.com/2023/03/08/world/ocean-plastic-pollution-climate-intl/index.html#:~:text=Plastic%20floats%20in%20the%20Great%20Pacific%20Garbage%20Patch.&text=The%20world's%20oceans%20are%20polluted,according%20to%20a%20new%20study.>

The articles have been saved as Word documents “[Ocean Trash- 5.25 Trillion Pieces](#)”, “[More than 170 trillion plastic particles](#)”. You may choose to use these as an alternative to students accessing the internet.

To scaffold the learning, you could approach the task by asking students to focus on one of the articles and have students feedback to the class on their findings. This may help to embed the learning and enable students to complete the task in their workbooks.

Slide 9 – 2 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- **Explore the impact of plastics in our oceans**
- Identify key steps we can take
- Understand how to apply technology in solving climate problems



The slide highlights Objective 1 “**Explore the impact of plastics in our oceans**”

Review the topics covered.

Lesson 2 - [Link](#)

Slide 1 to 5 – 2 minutes



Show slides 1-5 to remind students what was covered in the previous lesson.

Slide 2





Slide 3

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Slide 4


14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
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Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


Scenario

SoS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SoS have committed to providing solutions which can be adopted worldwide.

SoS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Slide 6 – 4 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

So, what's the problem then?



SoS have asked you to produce an account of the situation in our oceans.

You have been asked to report on:

- How much plastic is in our oceans?
- Where is it?
- What types of plastic is polluting our oceans?

Use your workbook to record your answers



Show the slide and ask students to share some of the information they found out last lesson.

Slide 7 - 4 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

How much?

2015 ~ 5.25 trillion pieces

2023 ~ 170 trillion pieces

3138% ~ increase in less than 10 years

Pacific ocean is up to 7 miles deep.

Imagine that – a pile of garbage 7 miles tall!

Pacific ocean with Mount Everest superimposed

A trillion has 12 zeros = 1,000,000,000,000

Display the slide to emphasise the scale of the numbers and the percentage increase. This will also provide an opportunity for those who could not access the information to use it.

The size of the numbers extend beyond what individuals can feasibly imagine. Reinforce that the problem is not just surface but exists in 3 dimensions. With the Pacific averaging 4,000 metres deep and up to 11,000 metres this provides a column of pollution that could be between 2.5 and 7 miles tall.

To give perspective, Mount Everest is a touch under 9,000 metres. The slide graphic shows the depths of the Pacific with an image of mount Everest superimposed for emphasis.

Slide 8 – 10 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

What does '170 trillion' mean?

10 MILLION
TONS OF PLASTIC ARE DUMPED IN OUR OCEANS ANNUALLY. THAT'S EQUAL TO MORE THAN A GARBAGE TRUCK LOAD EVERY MINUTE!

1 MILLION
MARINE ANIMALS ARE KILLED BY PLASTIC POLLUTION EVERY YEAR

The figures on the total weight of plastics in the oceans is hard to estimate but we do have a good idea of how much is dumped each year and the effect that this has.

What effect might the loss of marine life have on other marine animals?

What about people that rely on marine animals for a living and food?

Show the slide. The right-hand image puts the amount of plastic into perspective using the analogy of a garbage truck a minute.

The right-hand image moves the session towards the effect on marine life. The estimate is that 1 million marine animals are killed each year. Again, the numbers are difficult to visualise.

Two questions are placed on this slide:

- What effect might the loss of marine life have on other marine animals?
- What about people that rely on marine animals for a living and food?

Divide the class into groups and assign one of the questions to each half. Ask the groups to consider the questions and formulate responses.

Ideas to take the questions forward (you may highlight one or two of these to scaffold the session):

- Species that rely on a limited food source may starve if the food source is not available
- Apex predators such as whales and dolphins can become poisoned by the chemicals their food sources absorb through ingesting plastics
- Consider seabirds who might mistake small plastic particles as food
- Shellfish feed by filtering. As they feed, they absorb pieces of plastic which contain toxic chemicals. Humans that eat shellfish and other fish species slowly become poisoned.
- As species decline or become extinct, those relying on fishing for a living find it increasingly difficult to earn a wage to support their families
- Invasive species may use the plastics to travel from one area to another. This can then lead to loss of native species further increasing the problem

Split the time into 5 minutes to go through the slide, 4 minutes for students to formulate ideas and 6 minutes, 3 minutes per side, to deliver their ideas.

You may wish to extend this a more permanent record such as a podcast using free online recorders such as <https://learn.virtualspeech.com/tools/voice-recorder>

Slide 9 – 10 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

What does '170 trillion' mean?

THE FACTS

- 10 MILLION** TONS OF PLASTIC ARE DUMPED IN OUR OCEANS ANNUALLY. THAT'S EQUAL TO MORE THAN A BARBERSHAWP TRUCK LOAD EVERY MINUTE!
- 50%** OF ALL PLASTIC PRODUCED (285 MILLION TONS PER YEAR) IS FOR SINGLE-USE PURPOSES: USED FOR JUST MINUTES, AND THEN THROWN AWAY.
- 100%** OF PLASTICS TESTED HAVE CONTAINED MICROPLASTICS.
- 1 MILLION** MARINE ANIMALS ARE KILLED BY PLASTIC POLLUTION EVERY YEAR.
- 40 POUNDS** OF PLASTIC IS THROWN AWAY EVERY YEAR.
- 3** OF ALL PLASTIC BOTTLES RECYCLED.

"THERE WILL BE MORE PLASTIC IN OUR OCEANS THAN FISH BY 2050."
The Ellen MacArthur Foundation

Consider the infographic above.

Identify one fact and suggest how we could use this to lessen the impact of plastics pollution.

Show slide 9. Tell students that the infographic contains 7 facts related to the problem of ocean plastics. The infographic is available as separate document which can be distributed to the students if necessary.

Students should identify one fact from the infographic and consider how this could be used to persuade others that plastics in the oceans is a problem we need to address. If you would prefer to have more control over this activity, assign a fact to students.

Students should record the fact in their workbooks and write how the fact could be used to persuade people to change their habits.

Slide 10 – 5 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Pause for thought ...



We know that the amount of plastics pollution is growing

We know that there are trillions of pieces and that this is measured in tons

We know that plastics pollution kills millions of sea creatures




Bring the group back together. Show them the slide and reflect on the progress they have made in developing their understanding of the problem and achieving the objective “Explore the impact of plastics in our oceans”.

Tell them that this is an important step in moving towards the objective of “identifying key steps we can take”

Slide 11 to 12 – 20 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Highlighting the issues

Activity

In your table groups, discuss and agree one fact which you believe is the most powerful in illustrating the issues.



Choose a spokesperson from your group to share the table ideas with the class.

Use the **ME – WE – US** framework for agreeing and sharing

ME – what do I hold as a belief

WE – what do we agree as valuable

US – what can we achieve from our agreed values

Slide 12

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Highlighting the issues

Activity

Don't forget to vote!

Plastics Pollution - 7 Facts

Use this survey to vote for the fact you believe is the most important. Listen to all the group presentations before you vote

Which Fact?

- 10 Million tons of plastic are dumped in the oceans annually
- Humans eat over 40 Pounds of plastic in their lifetime
- Less than 9% of all plastics gets recycled
- 50% of all plastics produced is for single-use purposes
- 1 Million marine animals are killed by plastic pollution every year
- There will be more plastic in our oceans than fish by 2050
- 100% of mussels tested have contained microplastics

Submit Clear form

ME WE US

SUSTAINABLE DEVELOPMENT GOALS

Show slide 11 and tell students that they are going to work in table groups (you may make these as large or small as best fits).

Students will choose one of the facts from 7 facts activity and agree which fact they believe is most important. Explain they will use a **ME – WE – US** approach where they start from their own belief and move towards a group consensus.

Encourage students to suggest their facts and put their case for it. This is the **ME** aspect.

The table groups should then agree which is the most powerful/important fact and why. This is the **WE** aspect.

Each table group should elect a spokesperson (you may decide that this would benefit from more than one student) to put forward the table idea. This is the **US** aspect.

As student work through each of the ME – WE – US activity, they should record the process in their workbooks.

Ultimately, the class should be encouraged to agree one fact which they believe is the most important/valuable.

This is an opportunity for the students to engage in and develop debating skills.

Time breakdown:

2 minute introduction

2 minute Me

3 minute We

10 minute US – to give time for all tables to put their ideas together

3 minutes for Google Form

There is a Google Form used to collect votes on which fact is voted as the most important. The form can be copied from here

<https://docs.google.com/forms/d/e/1FAIpQLSe1dHIChjcO3xcgcrDkAwHTU9ImNKEOF2FmCX3fPkEXAlgvkg/viewform?usp=sharing>

When tables have presented their facts, show slide 14 and ask students to vote on the most important fact (does not have to be their own).

Share the form. Clicking on the SEND button will provide the ways in which the form can be shared.

The responses can be shown in real-time and downloaded as a Google Sheet.

Slide 13 – 5 minutes



The slide features a light blue header with the text "UN Sustainable Development Goal 14 - Life Under Water". On the left, there is a blue box with the number "14" and the text "LIFE BELOW WATER" above a white fish icon. The main title "Learning Objectives" is in a large, bold, black font. Below the title, the text "Understand why plastics in the oceans are a danger to life below water and on land:" is followed by a bulleted list. The background of the slide is a faint world map. In the bottom right corner, there is a circular logo for the "Sustainable Development Goals" with 17 colored segments.

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 - Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- **Explore the impact of plastics in our oceans**
- Identify key steps we can take
- Understand how to apply technology in solving climate problems

Sustainable Development Goals

The slide highlights Objective 1 “**Explore the impact of plastics in our oceans**”

Remind students that they have been working through in this lesson, recording their findings in their workbooks and gathering ideas which will be applied in later lessons. Facts have been investigated and voted on that help to clarify some of the issues of ocean plastics.

Emphasize that students are working with others in the class as this is likely to yield better results and provide a group voice.

Lesson 3 - [Link](#)

Slide 1 – 3 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Starter Task

Name 3 facts associated with the issue of ocean plastics

Sustainable Development Goals

The slide features a world map with several plastic water bottles scattered across the oceans. In the top left corner, there is a blue box with the number '14', the text 'LIFE BELOW WATER', and a white fish icon. In the bottom right corner, there is a circular logo for the 'Sustainable Development Goals'.

As students enter the room display the slide. The task refers back to the previous session where students considered 7 facts of plastic pollution.

Slide 2 – 1 minute

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

- 10 Million tons of plastic are dumped in the oceans annually
- Humans eat over 40 Pounds of plastic in their lifetime
- Less than 9% of all plastics gets recycled
- 99% of all plastics produced is for single-use purposes
- 1 Million marine animals are killed by plastic pollution every year
- There will be more plastic in our oceans than fish by 2050
- 100% of mussels tested have contained microplastics

Sustainable Development Goals

The slide features a world map with several plastic water bottles scattered across the oceans. In the top left corner, there is a blue box with the number '14', the text 'LIFE BELOW WATER', and a white fish icon. In the bottom right corner, there is a circular logo for the 'Sustainable Development Goals'.

Display the slide to remind students of the 7 facts they voted on previously.

Slide 3



Slide is hidden but may be shown to remind students of larger sustainability issues

Slide 4 to 6 - 1 minute

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth’s surface is covered in water
- The oceans control Earth’s climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels

Quickly show slides 4-6 to remind students of the scenario and objectives.

Slide 5



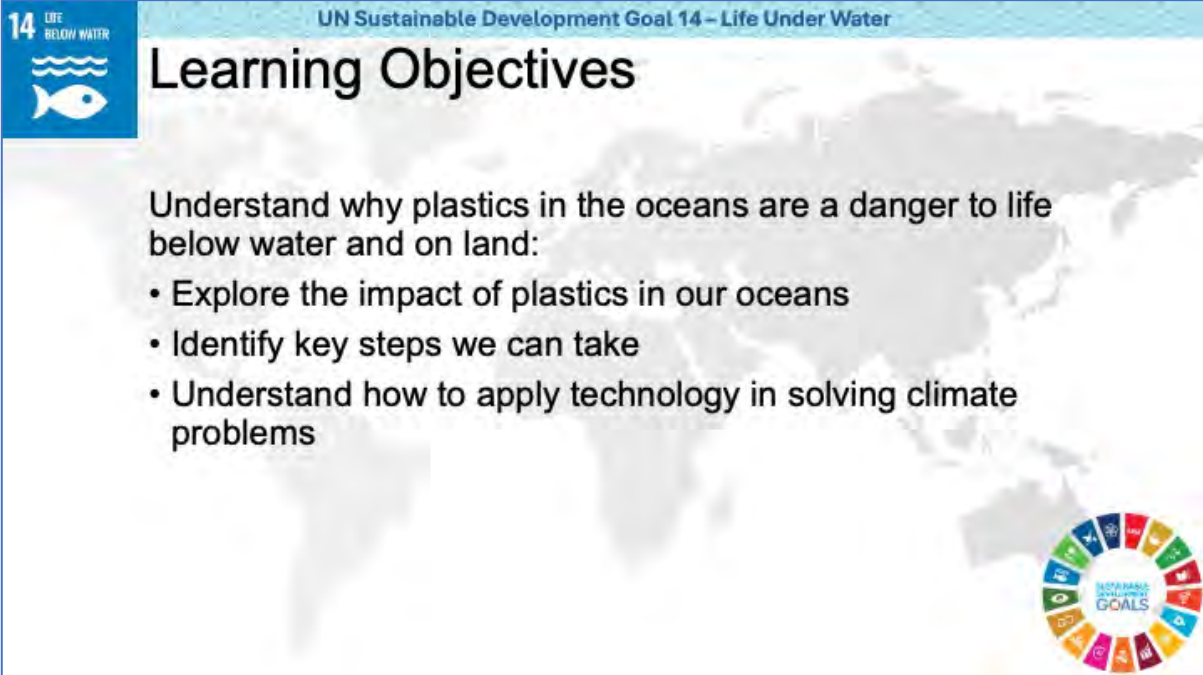
14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- Understand how to apply technology in solving climate problems



Slide 6

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water




Scenario

sas – Save our Seas are a charity formed to address the problem of plastics in our oceans.

sas have committed to providing solutions which can be adopted worldwide.

sas have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Slide 7 – 3 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Where does all the plastic go?

You may have heard of ocean garbage patches, most likely the Pacific garbage patch or island

It does exist but is not what we would call an island

Watch the short video (click on image) look for:

- Where is it?
- How does the garbage get there?
- How big is it?
- How much has been removed?

14 SUSTAINABLE DEVELOPMENT GOALS

Show the slide and tell students that they are now going to investigate where the plastic pollution is.

The most famous location is the Pacific garbage patch/island but there are 5 major 'islands'.

Play the video https://www.youtube.com/shorts/JO_g61RB4wQ The image on the slide is directly linked to the video.

The video focuses on the Pacific garbage patch and lasts a short time (50 seconds). Tell students that a number of pieces of information are given in the video and that they should use their workbooks to answer questions related to this.

The slide acts as an introduction to a deeper investigation.

Slide 8 to 9 – 14 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Where does all the plastic go?

<https://www.theoceanicchallenge.org/ecological-footprint/2016/06/06/plastic-the-great-pacific-garbage-patch>

Slide 9

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Where does all the plastic go?

There are 5 major garbage patches but how do they become concentrated instead of being spread out evenly?

Using this [link](#), consider:

- What is a 'gyre'?
- How does a gyre affect where the garbage is?
- Is the garbage just on the surface of the ocean?

Show slides 8 and tell students that this shows the locations of the 5 worst garbage patches.

Move to slide 9 and focus on the word 'gyre'. Tell students that they are going to investigate what a 'gyre' is and why they are crucial to understanding plastic pollution.

The link will enable students to answer the 3 questions:

- What is a 'gyre'?
- How does a gyre affect where the garbage is?
- Is the garbage just on the surface of the ocean?

Whilst there are 3 main questions on the slide, encourage students to go further and answer the questions:

- What is in the garbage patches?
- Is the garbage easy to remove?
- What could we do to reduce the amount of garbage being collected in the ocean patches?

The 3rd question is an opportunity of students to apply creativity through suggesting ways to remove the massive amounts of garbage.

As an alternative to using the internet, the article is reproduced as a Word document "Garbage Patches Explained".

Scaffolding – you may want to use the Word document to enable students to access the content. For example, split the document into the major paragraphs and distribute these as separate elements.

Slide 10 to 11 – 6 minutes



Slide 11

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water



Impact – Macro to Micro to Nano

Plastic is durable, no I mean *really, really* durable

Most plastic, when thrown away, will degrade but this usually means that one piece divides into several smaller pieces until it becomes micro plastic

We know that many ocean plastics are classed as micro – 5mm – but they get smaller eventually becoming nano plastics

Let's investigate the impact of micro and nano plastics



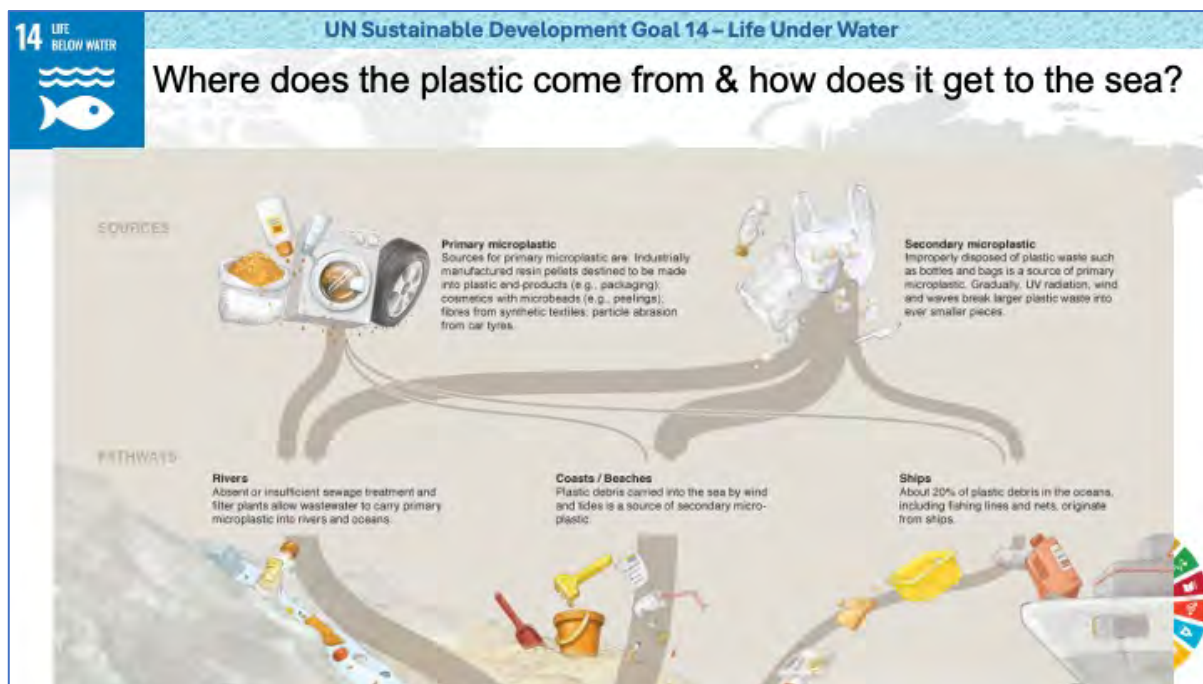
Slide 10 contains an automatic link to a short video
<https://www.youtube.com/shorts/gADYlcmdN2c> – 24 seconds.

The video highlights the durability of plastics. They do not go away but simply break down into smaller and smaller particles.

Ask students to view the video and listen for key words and highlight the major problem being focused on – microplastics.

Show slide 11. This summarises the problem we are looking at – micro and nano plastics. Tell students that we are now going to explore this problem.

Slide 12 – 10 minutes



The purpose of this next section is to explore impact. Students should be made aware that they will be working in groups and that this section has 4 linked activities.

Show the slide. Tell students that this is part of a larger infographic “Micro plastic infographic.webp”.

The infographic can be provided to the students but, if this option is taken, only supply the part in the slide.

Highlight the 2 sources (primary and secondary microplastics) and 3 pathways (rivers, coasts, ships) for ocean plastics.

Students should work in table groups to select a source and then build a public awareness statement around this. This statement will later be used in the creation of a physical document which could be used in an advocacy campaign.

Whilst students will be agreeing the source and statement, they should be including this in their workbooks. This will help to ensure that if members of the group are subsequently absent, the other group members will not be hampered by missing detail. Likewise, students absent from this session will be able to catch-up working with others.

Slide 13 – 10 minutes

The infographic is titled "What are the consequences?" and is part of a larger campaign for UN Sustainable Development Goal 14 - Life Under Water. It features a central illustration of an underwater scene with a manta ray, a whale, and various fish swimming through a cloud of colorful microplastic particles. The text "MICROPLASTIC" is prominently displayed in the center, with a subtitle stating: "Trillions of microplastic particles circulate through the world's oceans, from the Antarctic to the Arctic, both close to the surface and in the deep sea." Below this, three sections detail the impacts:

- POISONING**
Microplastic contains a range of chemical additives, such as plasticizers and flame retardants. These additives, as well as pollutants attaching to microplastic may cause tumors, infertility, genetic defects, abnormal development of larvae, and weakened immune system.
- Internal injuries and reduced fitness**
Sharp edges of plastic particles may cause injuries to the intestinal tract of small animals like mussels or crustaceans, which result in inflammation and chronic illness. Microplastic accumulation in the stomach can also reduce food intake and compromise the animal's energy.
- Fake food**
Microplastic is taken in together with food. This problem affects a wide range of marine animals from plankton to crustaceans, mussels, worms, fish, sea turtles, whales, rays, basking sharks, and sea birds.

At the bottom of the infographic, it asks: "What search terms will you use to source images?" and includes a circular logo for the Sustainable Development Goals.

Show the slide, tell students that this is the middle part of the larger infographic. This slide focuses on 3 major impacts to marine life (poisoning, internal injuries, fake food).

Ask students to read the 3 short paragraphs. They have this in their workbooks.

This is part 2 of the advocacy campaign.

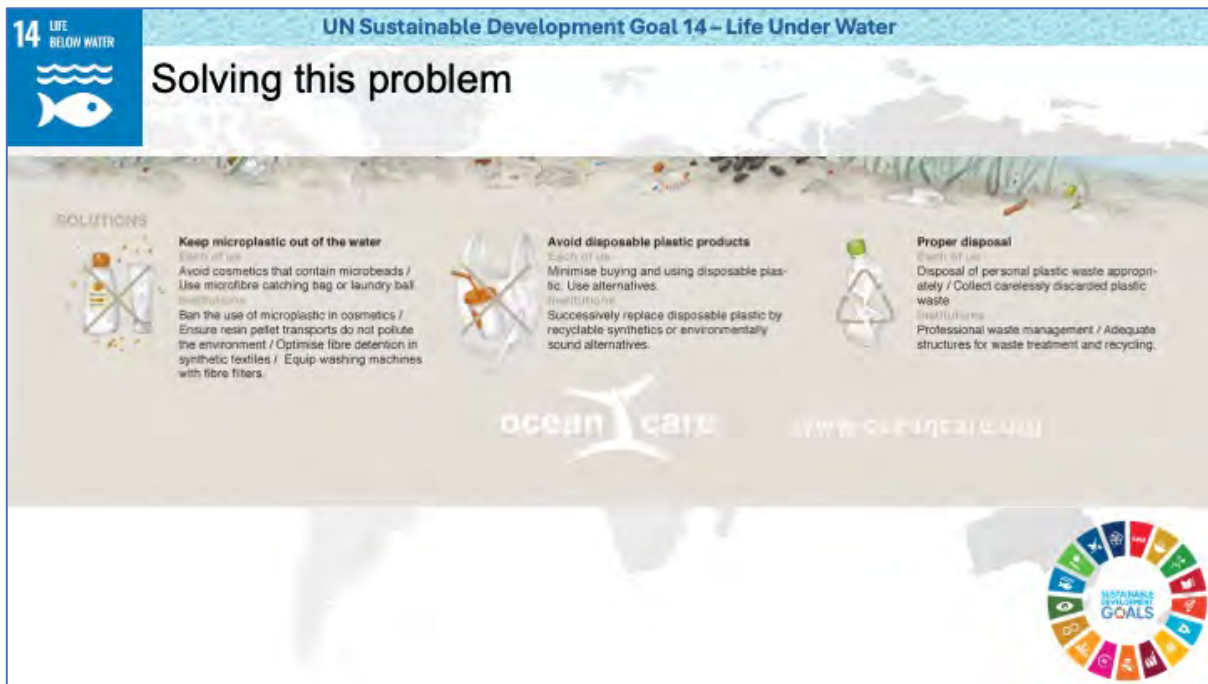
Students should agree which of the 3 impacts they will focus on. Students should search for a suitable image to represent the problem. The image does not need to be an actual photograph.

A good source of images is pixabay.com. If your organisation allows it, you may choose to let students use AI to create a suitable image using a site such as openart.ai

Encourage students to consider the search/creation terms they will use to source the image. Some suggestions such as 'impact', 'marine impact', 'climate impact', 'ocean pollution' are included in the student workbooks.

Once an agreed image has been found/created, students should paste this into their workbooks along with the source URL.

Slide 14 – 10 minutes



Show the slide and tell students that this is part 3 of the activity set.

Highlight the infographic, in particular, tell students that 3 broad solutions are being presented. Ask students to read the solutions and note that the solutions have been split into what individuals and institutions can do.

Emphasise that whilst institutions should do their part in solving the issues, we, as individuals, cannot be removed from the solution.

Explain that whilst the solutions give a broad approach, eg 'minimise buying ...' how this might be achieved is not included. This is the students' opportunity to be creative in suggesting how the solutions might be made real.

Students should agree a group solution and include this in their workbooks. The approaches can be varied. For example, students may decide on a set of steps, a statement of action, investment and penalties.

Slide 15 – 2 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- **Explore the impact of plastics in our oceans**
- Identify key steps we can take
- Understand how to apply technology in solving climate problems



Show slide 15 and tell students that they have completed Objective 1.

Evidence: facts and figures have been explored and gathered. Next, they will move to the 'Identify key steps we can take' objective.

Lesson 4 - [Link](#)

Slide 1 – 3 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Starter Task

Identify 2 ways in which the issue of plastics pollution could be prompted

As students enter the room display the slide. The task links back to the previous session where students considered the origin, consequences and broad solutions to the plastics pollution problem.

Slide 2

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

1 NO POVERTY	2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	4 QUALITY EDUCATION	5 GENDER EQUALITY	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	17 PARTNERSHIPS FOR THE GOALS	

Slide is hidden but may be shown to remind students of larger sustainability issues.



Slide 3 to 5 – 1 minute

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Show slides 3 - 5 to remind students of the scenario and objectives.

Slide 4

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- **Identify key steps we can take**
- Understand how to apply technology in solving climate problems



Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


Scenario

Sas – Save our Seas are a charity formed to address the problem of plastics in our oceans.

Sas have committed to providing solutions which can be adopted worldwide.

Sas have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?

The image is a slide for a presentation about UN Sustainable Development Goal 14. It features a light blue header with the goal number and name. The main content is set against a background of a world map. The text describes the charity 'Sas' and their mission to address ocean plastics. It also mentions a commission to explore issues and develop tools. The slide ends with the handwritten-style question 'Are you Ready?' and a circular logo of the 17 Sustainable Development Goals in the bottom right corner.

Slide 6 – 45 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

SoS Need you!

SoS have asked you to create a set of information cards highlighting the problem of plastics in our oceans

Examples have been provided to help you decide on approach

Display the slide.

This activity brings together the previous 3 activities and informs students what their advocacy task is. This is an applied task in which students are given the opportunity to bring their newfound knowledge and understanding to develop a resource.

Students are presented with a scenario in which they are asked to create a set of information cards for distribution at festivals. The purpose is to raise awareness of the problem of plastic water bottles and other garbage that makes its way to the oceans.

There are several options which can be used to create the artefact. A link to a canva.com template is provided <https://tinyurl.com/yc3pac6u> This acts as an example based on a related climate scenario. The template can be accessed and copied to the user's account. From here the students can share the file to enable collaboration.

Other online or installed apps may be used to create the document. A more accessible version can be found in the 'card blank.docx' file. This is a double sided, foldable, blank which creates an A5 result. There are 2 complete exemplars to provide ideas on how the finished product may look "card example Footprint.docx", "card example Mighty Oak.docx".

Working as a group, students should revisit their Part 1, Part 2 and Part 3 elements. The image from Part 2 should figure in the cards with suitably adjusted text forming the message from Part 1 and Part 3. Optionally, students may opt to create a series of cards in the exemplar Canva document.

Slide 7 – 7 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

SoS Need you!

Show and Tell

Visit other groups and view the cards other groups have created



The slide displays a collection of student-created educational cards. On the left, there is a 4x4 grid of 16 small cards. Each card features a tree icon and text, likely related to environmental science or climate change. Below the grid are two larger cards: one titled 'Carbon in Your Hand' showing a tree on a hand, and another titled '100 Year Old Oak' showing a tree with '1 Tonnas of Carbon' written below it. In the bottom right corner, there is a circular logo for 'Sustainable Development GOALS' with goal 14 highlighted.

Show the slide and allow students to view the work of other groups. You may want to define an order in which students visit other tables eg clockwise/anticlockwise.

Slide 8 – 4 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- **Identify key steps we can take**
- Understand how to apply technology in solving climate problems



The slide features a world map in the background. In the bottom right corner, there is a circular logo for 'Sustainable Development GOALS' with goal 14 highlighted.

Show slide 8 and tell students that they have taken positive steps to raising awareness of the issues and have created a practical artefact which could be used.

Lesson 5 - [Link](#)

Slide 1 – 3 minutes

As students enter the room display the slide. The questions refer to earlier work on how plastics get into the oceans.

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Starter Task

What is a 'gyre'?

How much of the planet's surface is covered in water

Slide 2

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

1 NO POVERTY	2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	4 QUALITY EDUCATION	5 GENDER EQUALITY	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	17 PARTNERSHIPS FOR THE GOALS	

Slide is hidden but may be shown to remind students of larger sustainability issues.



Slide 3-5 – 3 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth’s surface is covered in water
- The oceans control Earth’s climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Quickly show the slides to remind students of the scenario and objectives.

Tell students that they are now moving onto the 3rd objective “Understand how to apply technology in solving climate problems”

This links to the previous objectives, especially “Identify key steps we can take” because they are going to use and produce tools which can help in the climate emergency.

Slide 4

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**



Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


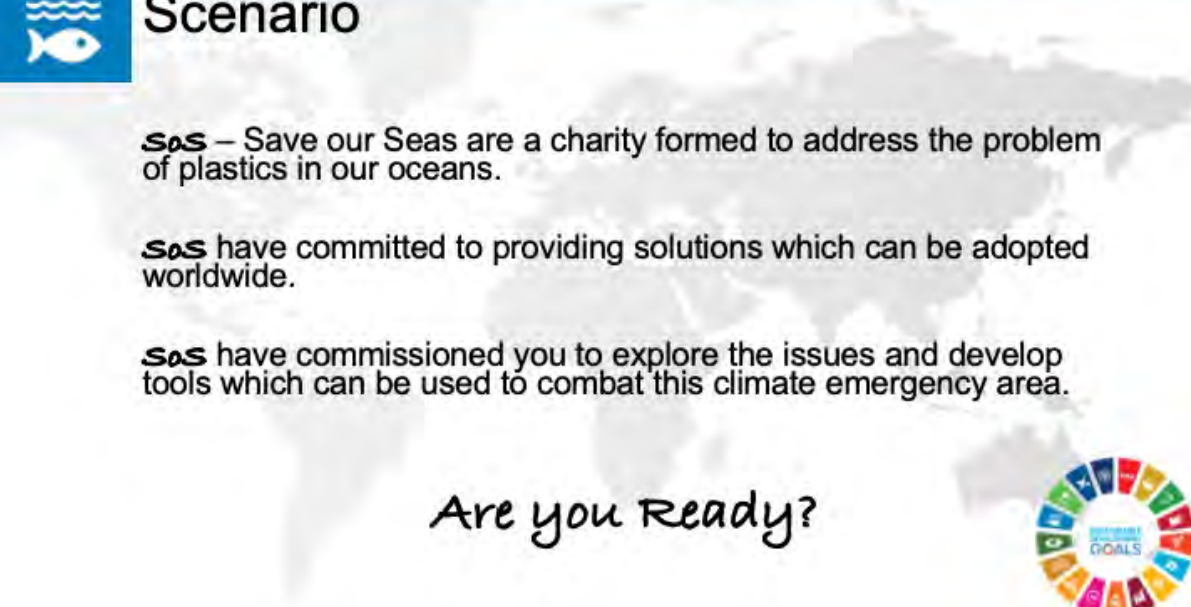

Scenario

SOS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SOS have committed to providing solutions which can be adopted worldwide.

SOS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Slide 6 to 7 – 20 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Climate implications

Which major greenhouse gas is released by ocean plastics?



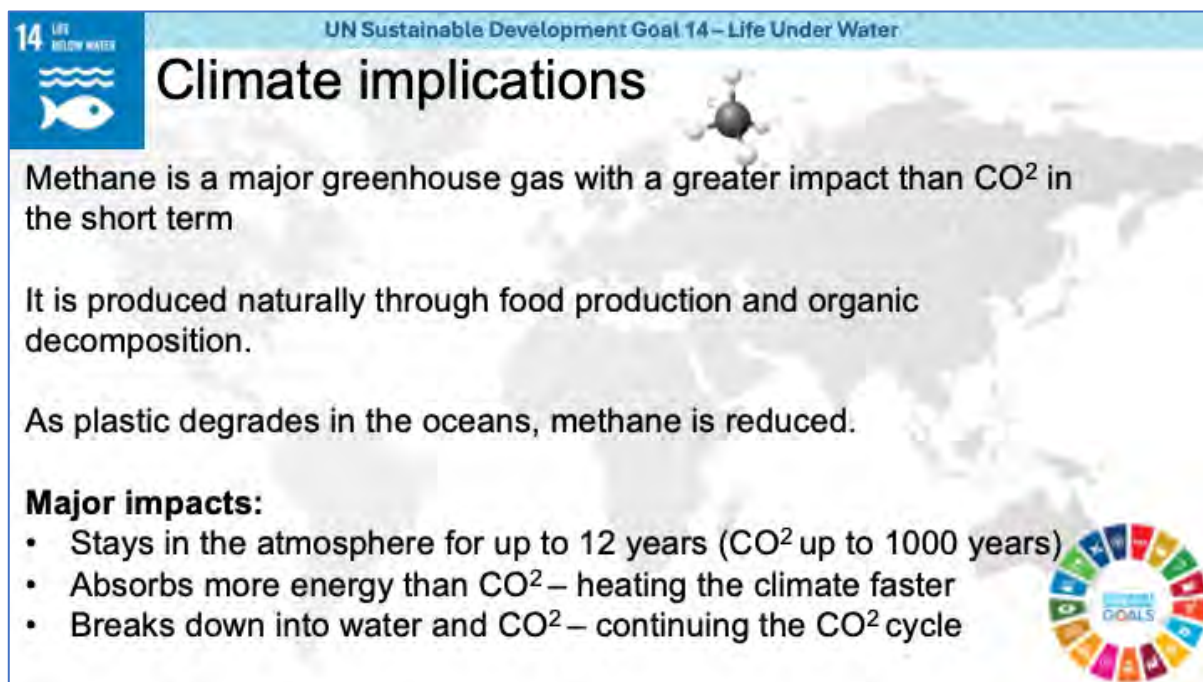
Use your workbooks to show what you know about this gas



Watch until 1:30



Slide 7



14 LIFE BELOW WATER
UN Sustainable Development Goal 14 – Life Under Water

Climate implications

Methane is a major greenhouse gas with a greater impact than CO² in the short term

It is produced naturally through food production and organic decomposition.

As plastic degrades in the oceans, methane is released.

Major impacts:

- Stays in the atmosphere for up to 12 years (CO² up to 1000 years)
- Absorbs more energy than CO² – heating the climate faster
- Breaks down into water and CO² – continuing the CO² cycle

Show slide 6. Tell students that they are now going to investigate the link between plastic in the oceans and global warming.

As they break down, plastics release several greenhouse gasses. In particular, methane is released. This is a highly potent greenhouse. In the short term it causes more damage than carbon dioxide, heats the atmosphere faster and breaks into hydrogen and carbon dioxide. In effect, at the end of its life, methane adds CO² to the atmosphere therefore extending harm to the environment.

Play the video (<https://tinyurl.com/nuhjpbkn>) on the slide until 1:30.

Students should be directed to their workbooks in the **Microplastics Versus the Climate** section. There are several questions which focus on the effects of methane. To start, students are asked to say what the formula CH₄ stands for.

The focus then switches, making the point that whilst carbon dioxide is the most frequently highlighted greenhouse gas, other gases are also a problem. Using the link <https://tinyurl.com/39r3v3bb> students should respond to the questions.

Slide 7 is hidden. Optionally, this may be used to reinforce the activity. Simply right click the slide and choose unhide.

Slide 8 to 9 – 10 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Sea levels

Mumbai at far greater risk from rising sea than earlier projected

CITY WILL BE UNLIVABLE

The Washington Post Study jolts sea-rise predictions

Ice-Sheet Melt Seen Harming Cities by 2100

CLIMATE EMERGENCY

If we don't act now this is our future

from 2021 **The Guardian**

Sustainable Development Goals

Slide 9

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

What's the impact?

- 1.5° = 26+cms sea level rise by end of century
- 2.0° = 36+cms sea level rise by end of century
- 3.0° = 50+cms sea level rise by end of century

Bangladesh

WEST BENGAL

TRIPURA

MIZO

Below tideline in 2100

Sustainable Development Goals

Show slide 8. This features several newspaper headlines focusing on the problem of rising sea levels. Allow students 3 minutes to read the headlines and ask them how methane may be linked to the headlines.

Show slide 9. This slide provides information on possible sea level rises at 1.5, 2.0 and 3.0 degrees rise in global temperatures.

The image shows the regions of West Bengal and Bangladesh with areas at risk of flooding highlighted in red. You may choose to use a different image to focus on your own geographical area.

Tell students that they are going to model sea level rises using an online app.

Slide 10 – 20 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

What's the impact?

To see what this might look for you, go here
<https://tinyurl.com/bdz9szva>

- Choose the **Temperature** map
- Choose a location eg London
- Move the slider through 1.5, 2 and 3 degrees
- What might the impact be on the rest of your country if temperatures continue to rise?

This slide introduces the sea level modeller at <https://tinyurl.com/bdz9szva>

The app is an interactive online tool which allows individuals to select an area and model sea level rises based on Year, Water level, Temperature, Warming choices and Ice sheets.

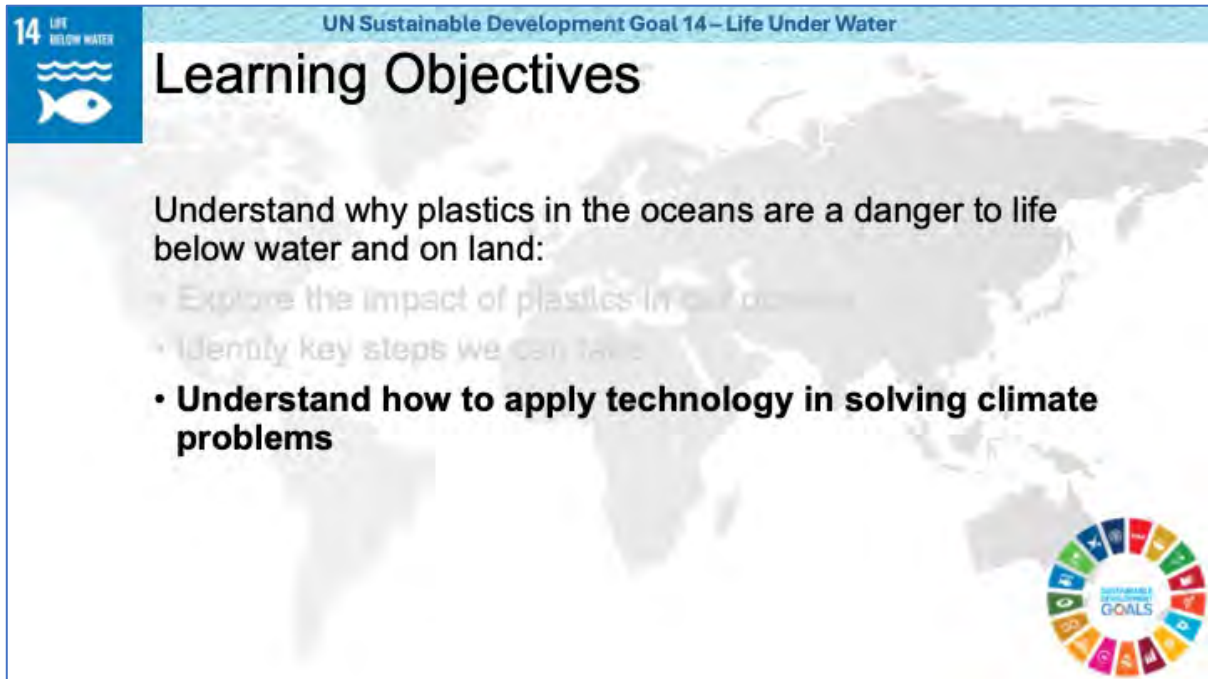
Activate the app and choose Temperature (click on the Choose Map button). Move the slider to 2.0 or 3.0 degrees. On the righthand side of the page select the 'Search places' tool and enter a city near your location.

Ask students to load the app and follow the instructions on the slide.

In the student workbook there is a question "What might the impact be on the rest of your country if temperatures continue to rise?"

Explain to students that if areas become prone to intermittent flooding or are permanently flooded then populations are likely to move. This can have a massive impact on population densities – more people in less space – mass migration leading to issues with borders and refugee status. This is, potentially, a controversial topic so should be handled with some degree of planning and behaviour management.

Slide 11 – 5 minutes



14 LIFE UNDER WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

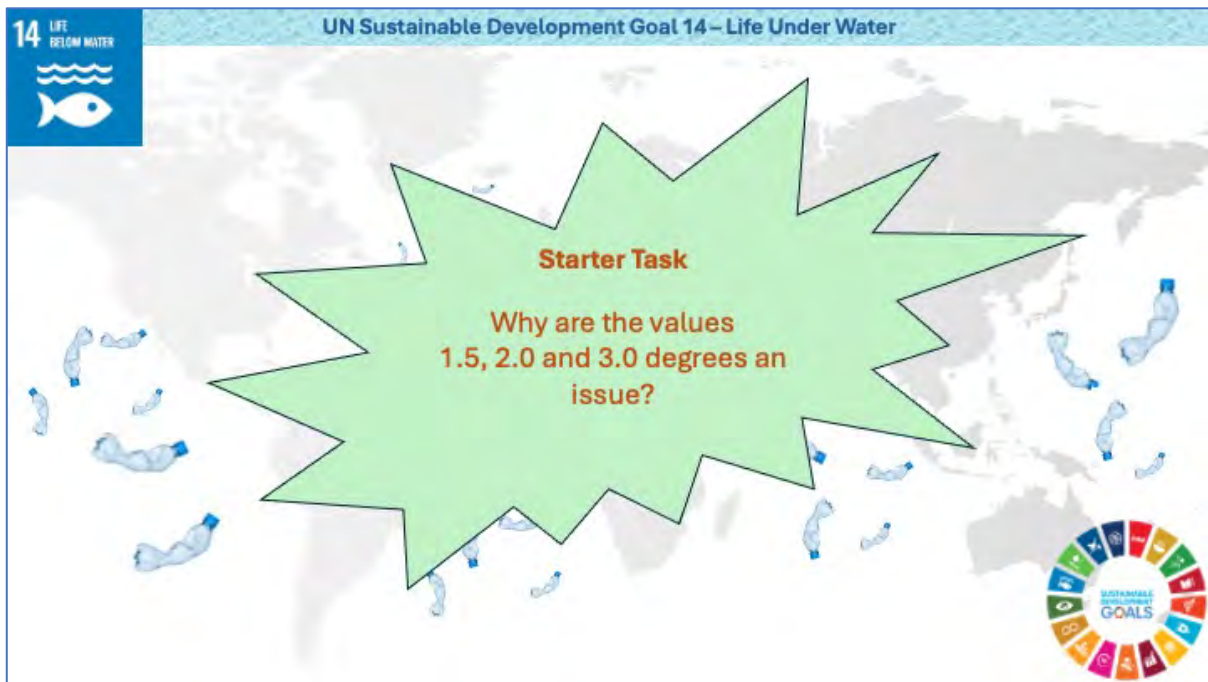
Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**

Show slide 11 and tell students that they have explored the issue of rising sea levels and that this is heavily linked to global warming which is heavily linked to plastics pollution.

Lesson 6 - [Link](#)

Slide 1 – 2 minutes



Display the slide for students as they enter the room.

The question links to the previous lesson. A range of answers may be provided by students eg “The higher the value, the greater the level of rising sea levels”, “The higher the value the greater the risk of flooding”, “The higher the value the greater the risk of mass migration”.

Slide 2



Slide is hidden but may be shown to remind students of larger sustainability issues.



Slide 3 to 5 – 1 minute

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Slide 4


14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**



Slide 5



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Scenario

sas – Save our Seas are a charity formed to address the problem of plastics in our oceans.

sas have committed to providing solutions which can be adopted worldwide.

sas have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Quickly show the slides to remind students of the scenario and objectives.

Remind students that they are now working on the 3rd objective “Understand how to apply technology in solving climate problems” and last lesson they used the online risk modeller at [Climate Central](#)

Slide 6 – 20 minutes

14 LIFE BELOW WATER

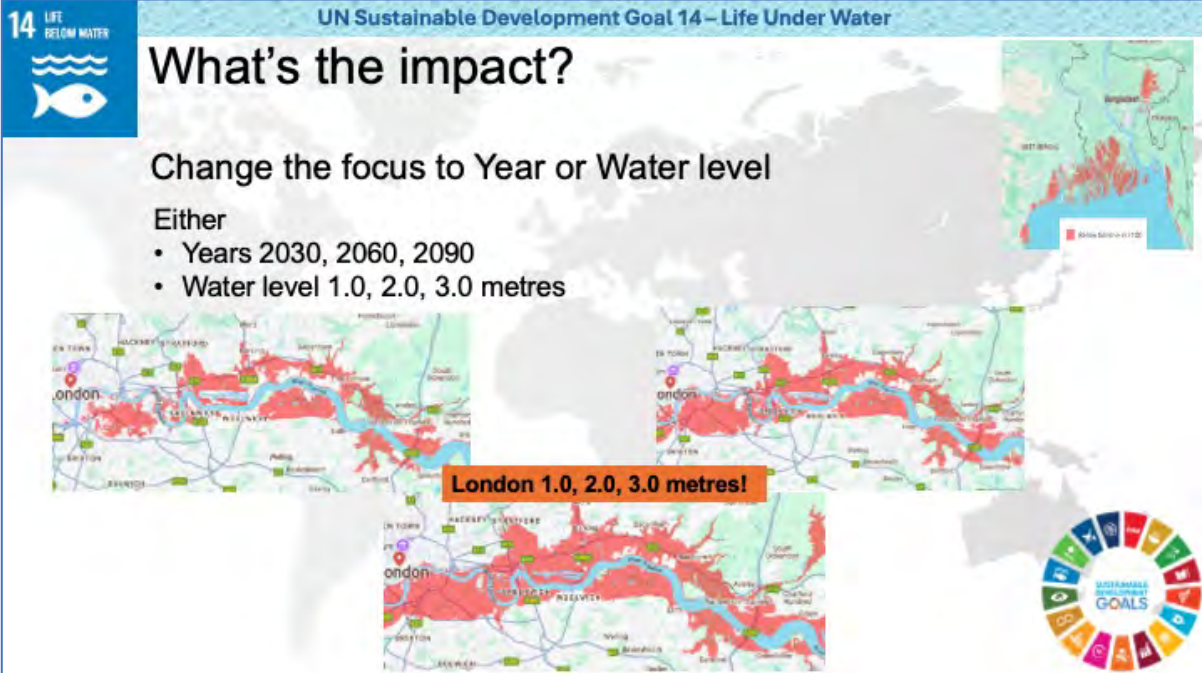
UN Sustainable Development Goal 14 – Life Under Water

What's the impact?

Change the focus to Year or Water level

Either

- Years 2030, 2060, 2090
- Water level 1.0, 2.0, 3.0 metres



London 1.0, 2.0, 3.0 metres!


Check how comfortable students are with using the app. Show them slide 6 and read through the instructions. The images show London flooding at 1.0, 2.0 and 3.0 metres. It can be seen that the river level will rise and cover land that is populated by millions of people.

Students should choose one or both of the scenarios for their chosen location. Students should capture the image of the effect at each of the increments: years and/or water level. The screenshots should be pasted into the workbooks.

Slide 7 – 35 minutes

UN Sustainable Development Goal 14 – Life Under Water

Bring it together – what are the messages?





To help in reducing impact, SoS have asked you to create a short report based around the work you have undertaken with the Climate Central app.

Think about all that you have achieved so far –

- The amount of plastic in our oceans
- How plastic gets into our oceans
- Where the garbage islands are
- How the plastic breaks down
- The consequences to marine life
- The problem of methane and carbon dioxide
- The threat to the world because of rising sea levels

Use the template to the left to work with a partner
In creating a Sea Level Report



Congratulate students on their progress so far. They have moved from being observers of the climate emergency to activists able to show what is causing harm, the harm that is being caused and what may happen in their lifetimes.

Show the slide. Students are being asked to compile a short report for SoS.

A report template has been produced for students to use <https://tinyurl.com/4rh8t3nw>

Working with another student, one of them should access the file and make a copy to their and share this with their partner. They can now work on this collaboratively.

The report asks students to edit the file to include their chosen location and include evidence on temperature rise and water level and/or year covered in the previous exercise.

Students should then include a statement on population movement. This link <https://tinyurl.com/u46v7t7r> provides information which can be used.

The last part of the report asks students to produce a statement on how plastics are affecting the climate emergency. This is an open task in which students can incorporate elements from the project and other detail they believe is relevant.

Slide 8 - Hidden



The slide shows the Eco Warrior Certificate you may wish to award to students for the work they have been undertaking.

The slide is hidden but can be unhidden by right clicking and selecting unhide.

Whilst the certificate is shown here, it can be awarded at any stage. For example, you may choose to omit aspects of the project.

Link to editable certificate <https://tinyurl.com/mun7etma>

Slide 9 – 2 minutes



Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**

Show slide 9 and tell students that they have completed the exploration of rising sea levels and have reported on this.

Lesson 7 - [Link](#)

Slide 1 – 3 minutes



Display the slide for students as they enter the room.

Slide 2



Slide is hidden but may be shown to remind students of larger sustainability issues.



Slide 3 to 5 – 2 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Slide 4


14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**



Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


Scenario

SoS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SoS have committed to providing solutions which can be adopted worldwide.

SoS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Quickly show the slides to remind students of the scenario and objectives.

Tell students that they are now working on the final part of the 3rd objective and that this is very much a practical journey where they will edit and build an AI tool which could be used in the climate emergency.

Slide 6 to 7 – 5 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Introduction

From observer to participant

You have established that we have a climate emergency

More importantly, you have shown that you can be an advocate for change

SoS have partnered with a tech startup to develop AI solutions for the climate emergency

SoS have asked you to create the AI

Let's get to work!



Slide 7

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Introduction



The Brief

One of the issues we have is being able to identify plastics and other garbage in the oceans

SoS have deployed a range of ocean cameras which send photographs via satellite

Rather than use humans to view the images, **SoS** want you to create an AI which can identify what has been captured

Your prototype may be used to identify marine species following the initial trial



Slide 6 introduces the next stage of the project. Alternatively, you may wish to use this as a standalone project.

Students are informed that they will create an AI which will be used to tackle climate emergency issues, particularly focused on the oceans.

There are example AI solutions and sample data sets which students will use. The AI will be developed online using Google Teachable Machine
<https://teachablemachine.withgoogle.com/>

A folder of resources is provided to support the work with Teachable Machine [here](#)

Slide 7 provides the brief – students will develop their AI to identify images of the oceans.

As the project develops, students will build their solution starting with an AI which identifies the likelihood of an image being plastic or non-plastic. This will develop further to identify whether the plastic is on or below the surface. This references back to the earlier issue of plastics in the water column. Remind students of this issue.

Students will have the opportunity to edit their system so that it can identify plastics and other garbage.

The final development will incorporate the ability to identify marine species such as turtles

Slide 8 to 9 – 45 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Activity 1

The Solution?

Using the example Teachable Machine AI 'Blank AI':

- Open it
- Train it

Use your workbook to show how you have developed your AI

Support resource
["Getting Started with AI Video 1.mp4"](#)
["Getting Started with AI Video 2.mp4"](#)

Slide 9

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Activity 1

Testing our AI

Now your system is trained:

- Click on the file option
- Drag an image of unpolluted or polluted water image to the window

How accurate was your AI – what percentage is showing and does that match the image.

Answer the question in your workbook:

- "Why do you need to train your AI?"
- "How accurate is your AI?"

Slide 8 marks the start of the applied activity.

You may prefer to make this a paired activity. As the files being used are based in the Google Workspace, one student should be the lead and they will need to share the AI file and related files with the other student.

Students may start with the blank AI (Blank AI.tm) or basic model (PlasticsV1.tm). The second file is preloaded with images of clear seas and seas with plastic pollution. The file may be loaded into your Google Drive or be made accessible from a school drive. Students

will need to open Google Teachable Machine (<https://teachablemachine.withgoogle.com/>) to load the file.

The video file 'Getting Started with AI Video 1' provides a video tutorial on how to access the AI. This should be viewed before the session. Likewise, students may use the video as they develop their ideas.


Slide 9 moves students to testing their AI. The folder "Plastic Pollution" holds 2 sub folders. The folder 'not tested' contains 1,700 images of plastics in the oceans and ocean seas clear of plastic. Students should use these to test their AI.

The dataset may be downloaded and stored on your drive system or transferred to your school Google Drive system and the links provided to students.

Following the opening and training of the AI, students should answer the questions "How AI can help in the climate emergency", "Why do we need to train our AI?" and "How accurate is your AI?"

Encourage students to screengrab their evidence of the AI working.

Slide 10 – 5 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**

Show slide 10 and tell students that they began their journey into working with Ai. Next steps will be developing the solution further so that it can identify with greater detail.

Lesson 8 - [Link](#)

Slide 1 – 3 minutes



Display the slide for students as they enter the room.

The question serves as a way of highlighting this next stage of the plastic reminds students that they have worked on an AI but also introduces the problem of other objects, including marine life and locations.

Ask students how they would respond to the question.

Slide 2



Slide is hidden but may be shown to remind students of larger sustainability issues.



Slide 3 to 6 – 2 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels



Slide 4


14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**



Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Scenario

SoS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SoS have committed to providing solutions which can be adopted worldwide.

SoS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Slide 6

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Introduction



The Brief

One of the issues we have is being able to identify plastics and other garbage in the oceans

SoS have deployed a range of ocean cameras which send photographs via satellite

Rather than use humans to view the images, **SoS** want you to create an AI which can identify what has been captured

Your prototype may be used to identify marine species following the initial trial



Quickly show the slides to remind students of the scenario and objectives.

Slide 6 is reminder of the AI brief being worked to.

Slide 7 – 10 minutes



Slide 7 uses a video <https://www.youtube.com/watch?v=3S2w-ewCf5s> to showcase how AI is being used. Show the video to students.

Tell students that what they are doing with Teachable Machine is increasing awareness of how AI can be used in the climate emergency and that the video extends this.

As they are watching the video, students should be noting the benefits of AI for inclusion in their workbooks. This is the last part of Step 1 in the AI section of their workbooks.

Slide 8 to 11 – 40 minutes



Slide 9 Hidden

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Activity 1

Improving our AI

Plastic

210 Image Samples

Webcam Upload

Not Plastic


220 Image Samples

Webcam Upload

Surface Plastic

161 Image Samples

Webcam Upload



9

Slide 10

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Activity 1

On, In or Under?

Previously we investigated the water column

- Add a class for underwater garbage
- Train the AI
- Test the AI

Plastic

161 Image Samples

Webcam Upload

Not Plastic

220 Image Samples

Webcam Upload

Surface Plastic

161 Image Samples

Webcam Upload

Underwater Mixed Garbage

161 Image Samples

Webcam Upload

Preview Export Model

Input ON OFF

Choose images from your files or drag & drop here

Import images from Google Drive


Output

Plastic

Not Plastic

Surface Plastic

Underwater Mixed Garbage



10

Slide 11 Hidden

The slide is titled "On, In or Under?" and is part of "Activity 1" for "UN Sustainable Development Goal 14 – Life Under Water". It features a world map background. On the left, there is a blue box with the number "14" and the text "LIFE BELOW WATER" above a fish icon. The main content area displays four categories of plastic waste, each with a title, a count of image samples, and a row of sample images. The categories are: "Plastic" (210 Image Samples), "Not Plastic" (200 Image Samples), "Surface Plastic" (151 Image Samples), and "Underwater Mixed Garbage" (247 Image Samples). Each category has a "Webcam" and "Upload" button. In the bottom right corner, there is a circular logo for the "Sustainable Development Goals" with the number "11" below it.

The slides provide an opportunity for students to develop their confidence and skill with Teachable Machine and AI.

Slide 8 focuses on students adding a class called 'Surface Plastic' so that the AI can identify if the plastic being identified is likely to be on the surface of the sea. Remind students that we previously looked at the issue of surface and water column pollution so will need to be able to develop information on not just whether there is plastic in the seas but also where it is if we are to track and remove it.

Show students slide 8 and check that they are confident – they will have previously developed their initial idea, now they are adding to it.

If required, a video tutorial is available to support this activity "[Teachable Machine Adding a New Class](#)"

Slide 9, hidden, provides a direct link to the support video. You may choose to play the video to introduce the activity.

The dataset for this activity is '[Surface Plastic](#)' available here for download or direct use

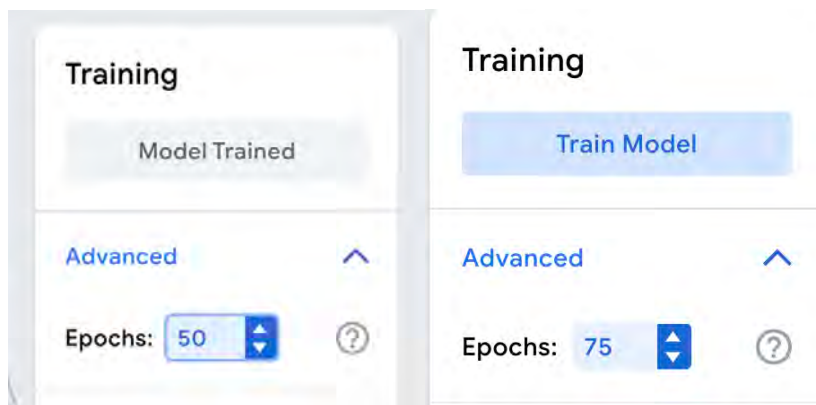
Slide 10 continues the theme and asks students to add a 5th class – 'Underwater mixed Garbage'.

As previously, there is a video to support this "[Teachable Machine Underwater Garbage Video 4.mp4](#)" along with a dataset "[Underwater](#)"

Slide 11, hidden, provides a direct link to the support video.

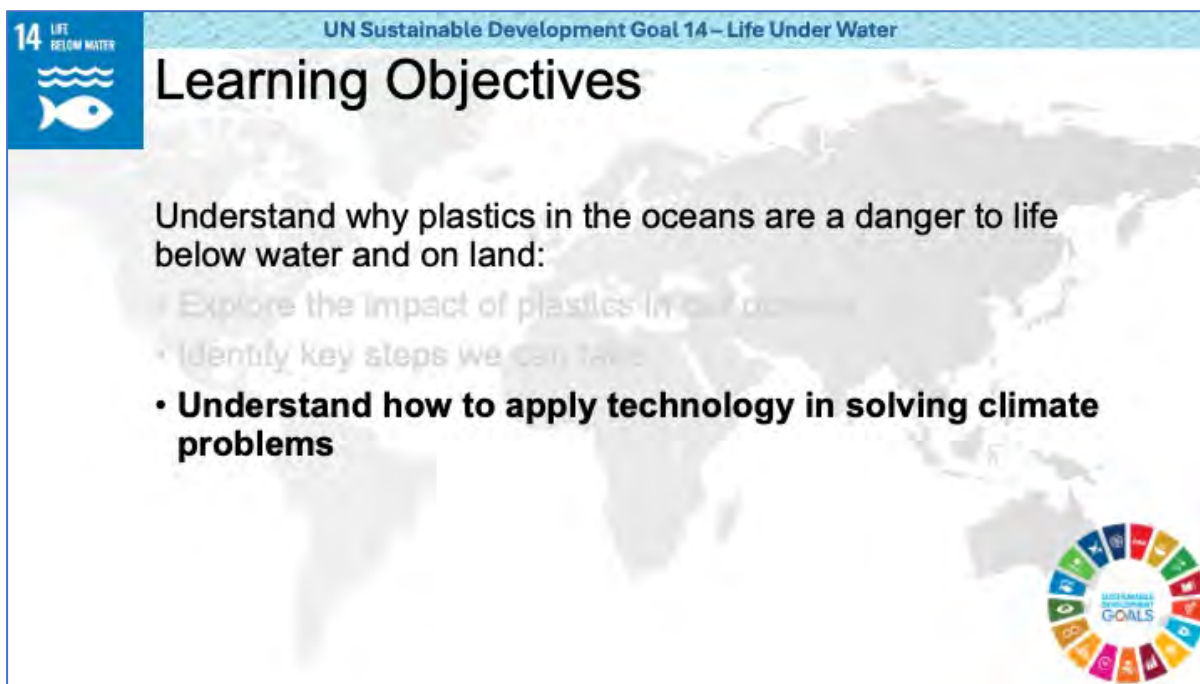
You may want to combine the Surface Plastics and Underwater Garbage activities into one activity.

As students add more classes to their AI there will be variation in how well the system predicts what the images are showing. This is an effect of increasing the number of classes. If students encounter ambiguity in images being correctly identified they can increase the number of epochs used to train the AI. This achieved through increasing the number of training epochs in the Training window:



Tutorial video “Teachable Machines Turtle Class Video 5” from minute 3:00 demonstrates this.

Slide 12 – 5 minutes

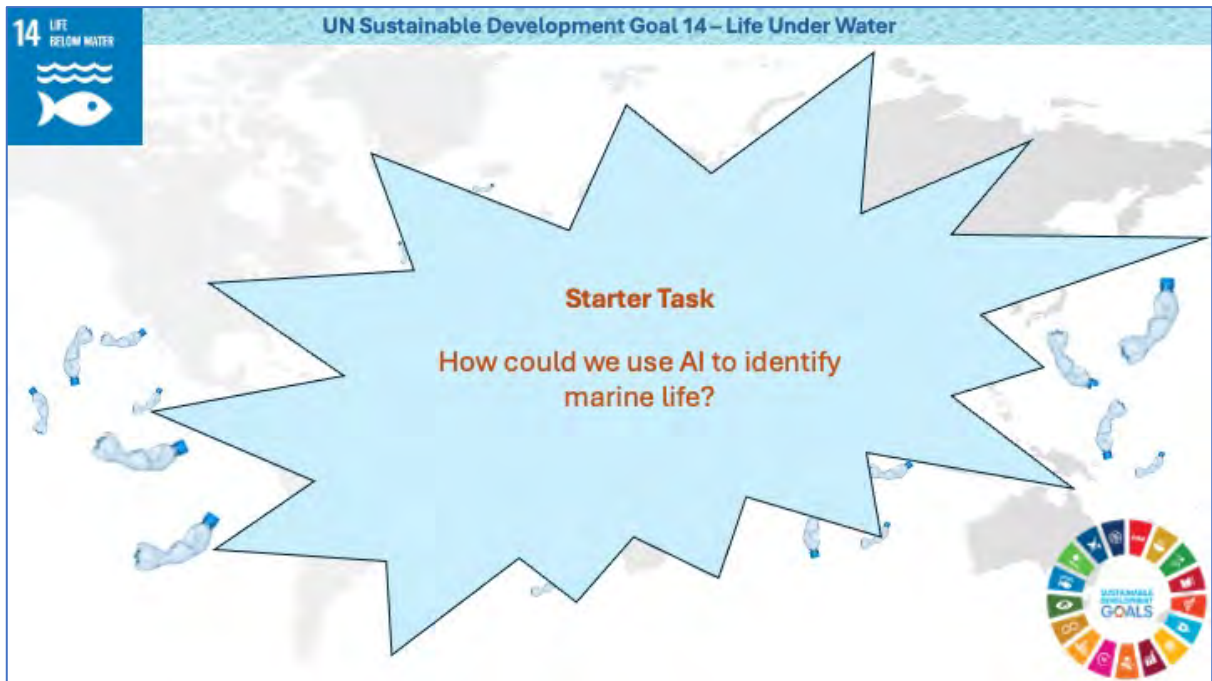
The slide is titled '14 LIFE BELOW WATER' and 'UN Sustainable Development Goal 14 – Life Under Water'. The main heading is 'Learning Objectives'. The text on the slide reads: 'Understand why plastics in the oceans are a danger to life below water and on land:'. Below this, there are two bullet points: '• Explore the impact of plastics in our oceans' and '• Identify key steps we can take'. A third bullet point is highlighted in bold: '• Understand how to apply technology in solving climate problems'. The slide also features a circular logo of the 17 Sustainable Development Goals in the bottom right corner.

Show slide 12 and congratulate them on their work on this technological approach to providing solutions for the climate emergency.

Remind students that they now have 4 classes in their AI which provides a more detailed idea of what is happening in our oceans.

Lesson 9 - [Link](#)

Slide 1 – 3 minutes



Display the slide for students as they enter the room.

The question serves as a way of the need to monitor the effects of plastic pollution on marine life – this refers back to earlier work students will have carried out.

Ask students how they would respond to the question.

Slide 2



Slide is hidden but may be shown to remind students of larger sustainability issues.

Slide 3 to 6 – 2 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels

Slide 6 Quickly show the slides to remind students of the scenario and objectives.

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Introduction



The Brief

One of the issues we have is being able to identify plastics and other garbage in the oceans

SoS have deployed a range of ocean cameras which send photographs via satellite

Rather than use humans to view the images, **SoS** want you to create an AI which can identify what has been captured

Your prototype may be used to identify marine species following the initial trial



6


Slide 6 is reminder of the AI brief being worked to. Highlight the 4th point on the slide.

Slide 7 to 8 – 25 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Biodiversity Alert!




SoS have been alerted that there are variations in the turtle population near the ocean garbage patches

Your help is required

SoS have asked you to add a Turtle class to your AI

Using your AI skills, add the class and train the model using the Turtles dataset



6

Slide 8

Slide 8 presents a scenario to the students. SoS are asking them to develop their AI so that it can identify turtles that may be in or near the garbage patches.

Slide 9 is hidden and contains the video tutorial for this part of the project. You may wish to keep this hidden to see how well students work independently.

The workbook contains a brief and set of instructions for students to develop the AI so that it can identify turtles. This is in the **'Step 3 – Biodiversity alert!'** section.

Slide 9 – 25 minutes

The slide features a header with '14 LIFE BELOW WATER' and a fish icon, 'UN Sustainable Development Goal 14 – Life Under Water', and 'Activity 6'. The main title is 'Go Further'. The text provides instructions: 'Using the Ocean Life dataset', 'You will see that there are lots of different species with a subfolder called 'Fish'', 'Create subfolders to hold different marine life eg sharks, jellyfish, divers ...', 'Add these to your AI in new classes', and 'Retrain and test'. A circular 'Sustainable Development Goals' logo is in the bottom right. The bottom half of the slide is split: the left side shows a turtle swimming over a large pile of plastic waste (bottles, bags) on the ocean floor, while the right side shows a map of the world with the same SDG logo.

Direct students to divide the 'Mixed' folder into subfolders so that there is data which can be trained on a much wider set of marine life eg jellyfish, sharks, dolphins, etc.

Slide 9 directs students to the Ocean Life dataset

Dataset <https://tinyurl.com/38yv79vz>

Slide 10 – 5 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- **Understand how to apply technology in solving climate problems**

17 SUSTAINABLE DEVELOPMENT GOALS

Show the objectives and tell students that they now have a functioning AI which could be used to view images from ocean exploration and provide valuable data that can be used to monitor the state of our oceans.

Ask students what the next stage might be. For example, pairing drone technology with AI would enable the AI to use images from a wide geographical area to build an idea of how the oceans are doing.

Tell students that in the next lesson they will be bringing their ideas together.

Lesson 10 - [Link](#)

Slide 1 – 10 minutes



Display the slide for students as they enter the room.

The slide serves to get students to zone in on what they are taking away. They have investigated several complex ideas and worked with technology to address the climate emergency.

Refer students to their workbooks for ideas.

Encourage students to share.

Slide 2



Slide is hidden but may be shown to remind students of larger sustainability issues.

Slide 3 to 5 – 3 minutes

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Big Picture

- 71% of the Earth's surface is covered in water
- The oceans control Earth's climate
- Plastics in the oceans affect:
 - Biodiversity
 - Carbon impact
 - Oxygen levels

Slide 4


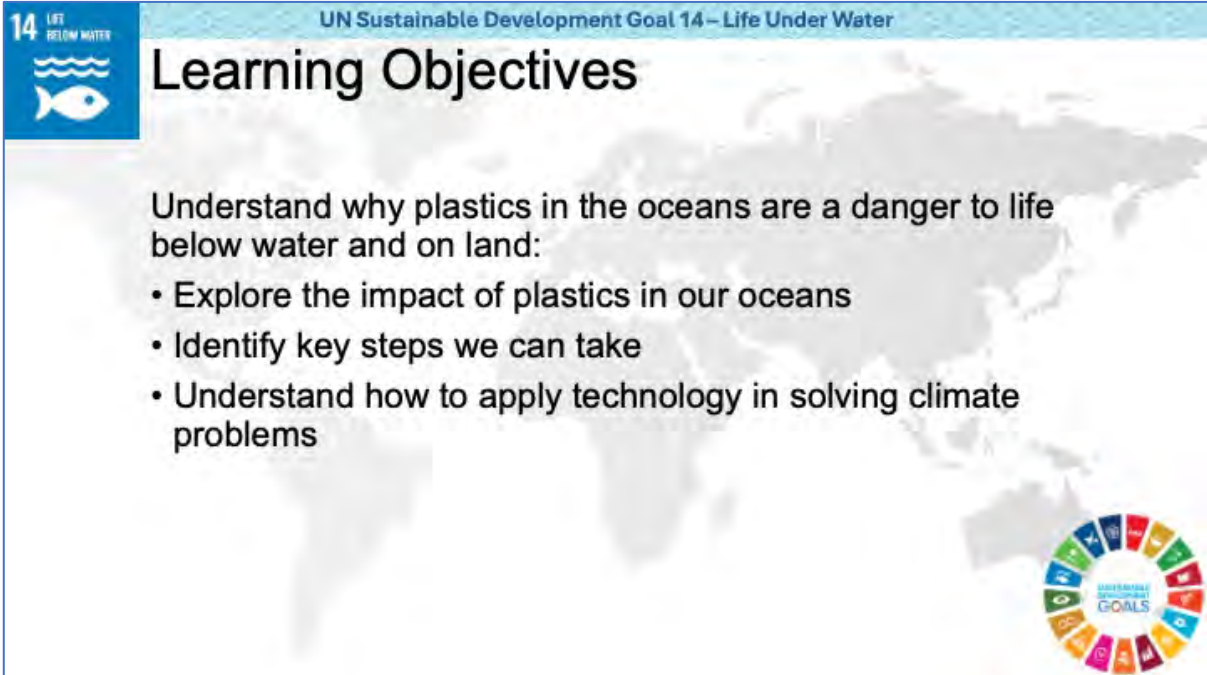
14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- Understand how to apply technology in solving climate problems



Slide 5

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Scenario

SOS – Save our Seas are a charity formed to address the problem of plastics in our oceans.

SOS have committed to providing solutions which can be adopted worldwide.

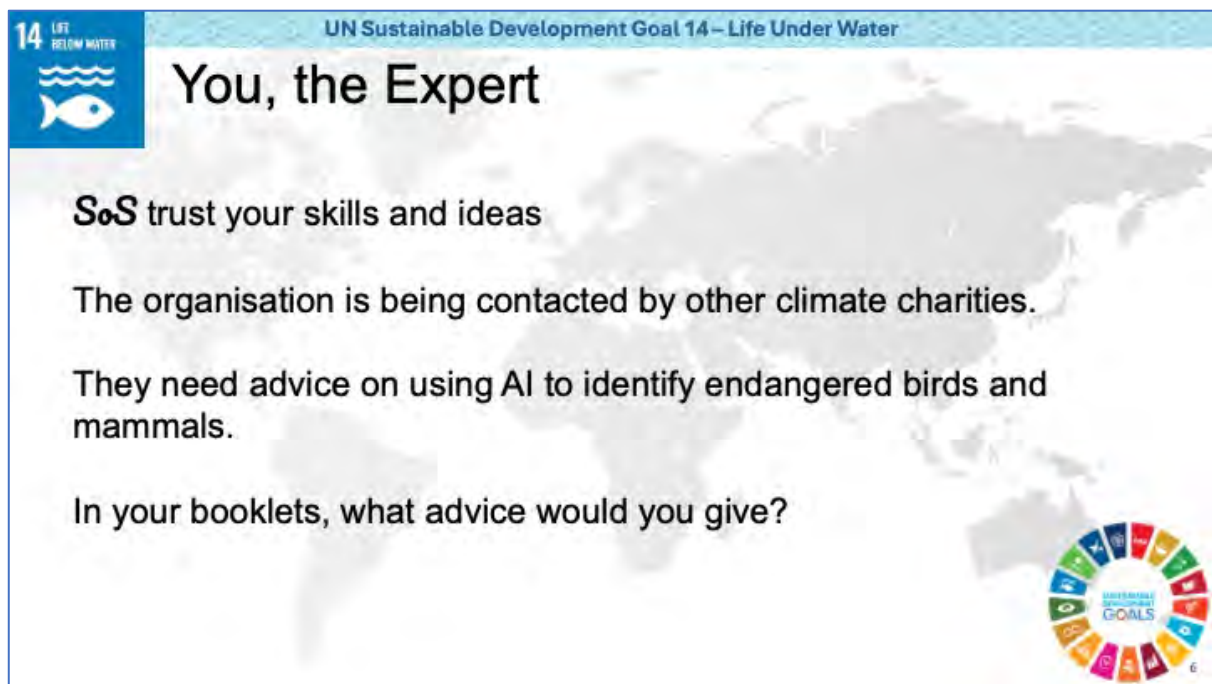
SOS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

Are you Ready?



Quickly show the slides to remind students of the scenario and objectives.

Slide 6 – 30 minutes



14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water


You, the Expert

SoS trust your skills and ideas

The organisation is being contacted by other climate charities.

They need advice on using AI to identify endangered birds and mammals.

In your booklets, what advice would you give?



Slide 6 encourages students to consider how they would advise organisations in the use of AI based on their experiences.

This is a reflective task where students are encouraged to review what they have achieved and how others may benefit from their experiences.

Students may need to be taken through a review of what they have accomplished. This can be achieved through a mix of recap on the previous slides and rereading of the workbook activities.

Slide 7 – 10 minutes

14 LIFE BELOW WATER


UN Sustainable Development Goal 14 – Life Under Water

The End of the Journey

Well done! You have created a complex AI which could be used to tackle the plastics in our oceans problem – maybe your career path?

In your workbook, answers for the following::

- In one sentence, how can AI be deployed to tackle climate emergency?
- What advice would you give on the type and size of datasets that should be used?
- Now that **SoS** have a worldwide system monitoring the oceans, how can sharing data improve the reliability of AI systems?
- Are AI systems better than humans at tackling complex tasks?
- Why?



Slide 7 asks students to complete a number of end questions in their workbooks. This is designed to embed what has happened in this section of the project

Slide 8 Hidden

14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water



ECO TECHNOLOGY AWARD

THIS CERTIFIES THAT

NAME HERE

has developed Artificial Intelligence systems to combat ocean pollution

[Signature]

NAME HERE

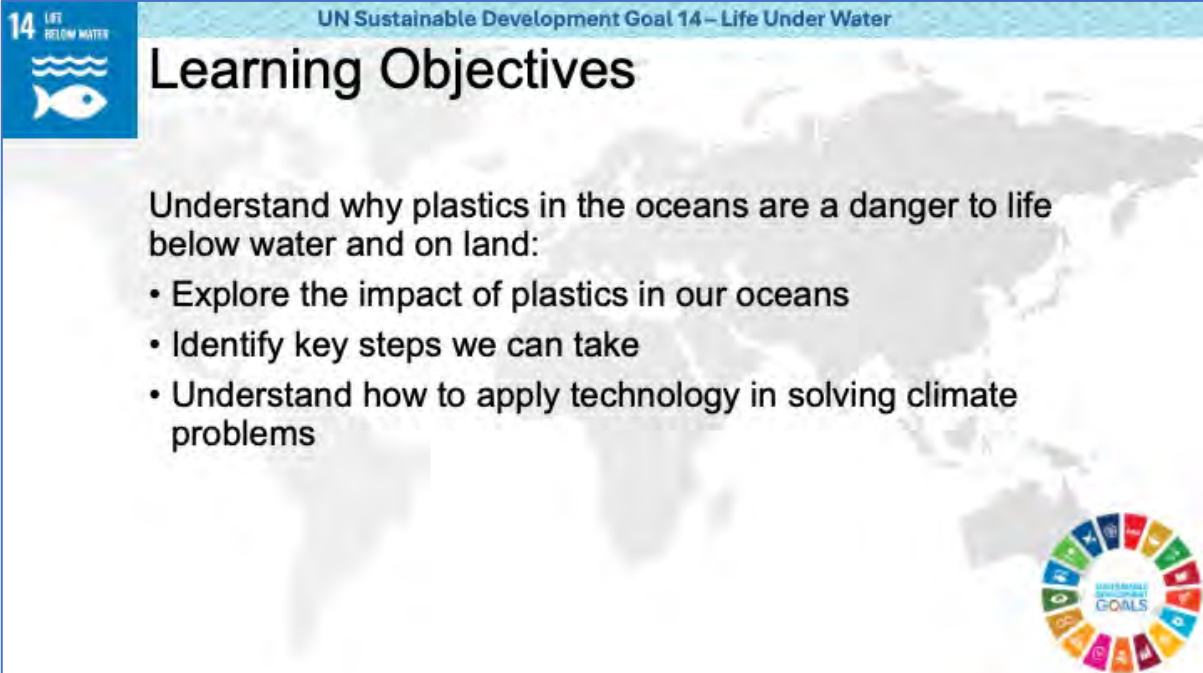
[Signature]

NAME HERE



Slide 8 is hidden. If appropriate, award students an Eco Technology Award for their work on developing an AI and raising awareness of how technology can be used in the addressing the climate emergency

Slide 9 – 7 minutes




14 LIFE BELOW WATER

UN Sustainable Development Goal 14 – Life Under Water

Learning Objectives

Understand why plastics in the oceans are a danger to life below water and on land:

- Explore the impact of plastics in our oceans
- Identify key steps we can take
- Understand how to apply technology in solving climate problems



The slide features a light blue header with the text 'UN Sustainable Development Goal 14 – Life Under Water'. On the left, there is a blue square containing the number '14', the text 'LIFE BELOW WATER', and a white icon of a fish and waves. The main content area has a light grey world map background. The title 'Learning Objectives' is in a large, bold, black font. Below the title, there is a paragraph and a bulleted list. In the bottom right corner, there is a circular graphic of the 17 Sustainable Development Goals.

Slide 9 is a copy of the original, broad objectives for the whole project. Use this to remind students of what they have achieved

Save our Seas File List

Name	Format	Location
Blank AI	tm	Climate Change Challenge/Working with Teachable Machine/Example AI
Card Blank	Google Docs	Climate Change Challenge/Cards
Card Blank	Word	Climate Change Challenge/Cards
card example Footprint	Word	Climate Change Challenge/Cards
Card example mighty Oak	Word	Climate Change Challenge/Cards
Garbage Patches Explained	Google Doc	Climate Change Challenge UNSDG 14
Garbage Patches Explained	Word	Climate Change Challenge UNSDG 14
Getting Started with AI Video 1	mp4	Climate Change Challenge/Working with Teachable Machine/Videos
Getting Started with AI Video 2	mp4	Climate Change Challenge/Working with Teachable Machine/Videos
Lesson 1 – 10	Google Slides	Lesson by lesson presentations/Google format
Lesson 1 – 10	PowerPoint	Lesson by lesson presentations/Microsoft
Micro plastic infographic	webp	Climate Change Challenge UNSDG 14
More than 170 trillion plastic particles	Google Docs	Climate Change Challenge UNSDG 14
More than 170 trillion plastic particles	Word	Climate Change Challenge UNSDG 14

Ocean Bottles	png	Climate Change Challenge UNSDG 14
Ocean Bottles	Word	Climate Change Challenge UNSDG 14
Ocean Bottles ideas	Google Docs	Climate Change Challenge UNSDG 14
Ocean Bottles ideas	Word	Climate Change Challenge UNSDG 14
Ocean Bottles ideas No bullets	Google Docs	Climate Change Challenge UNSDG 14
Ocean Bottles ideas No bullets	Word	Climate Change Challenge UNSDG 14
Ocean Life Dataset	Image	Climate Change Challenge/Working with Teachable Machine/Datasets
Ocean Trash- 5.25 Trillion Pieces	Google Docs	Climate Change Challenge UNSDG 14
Ocean Trash- 5.25 Trillion Pieces	Word	Climate Change Challenge UNSDG 14
Oceans Bottles	Google Doc	Climate Change Challenge UNSDG 14
Percent calculator	Py (Python)	Climate Change Challenge UNSDG 14
Plastic Pollution	Image	Climate Change Challenge/Working with Teachable Machine/Datasets
Plastics Pollution - 7 Facts	Google Form	Climate Change Challenge UNSDG 14
PlasticV1	tm	Climate Change Challenge/Working with Teachable Machine/Example AI
PlasticV2	tm	Climate Change Challenge/Working with Teachable Machine/Example AI
PlasticV3	tm	Climate Change Challenge/Working with

		Teachable Machine/Example AI
PlasticV4	tm	Climate Change Challenge/Working with Teachable Machine/Example AI
Rising Sea Levels	Google Doc	Climate Change Challenge UNSDG 14
Save our Seas Workbook	Google Doc	Climate Change Challenge UNSDG 14
Save our Seas Workbook	Word	Climate Change Challenge UNSDG 14
sdg poster	jpg	Climate Change Challenge UNSDG 14
Seven Facts	webp	Climate Change Challenge UNSDG 14
Surface Plastic	Image	Climate Change Challenge/Working with Teachable Machine/Datasets
Teacher guide	Word	Climate Change Challenge/Working with Teachable Machine/Datasets
Teacher guide	PDF	Climate Change Challenge/Working with Teachable Machine/Datasets
Teachable Machine Adding a New Class Video 3	mp4	Climate Change Challenge/Working with Teachable Machine/Videos
Teachable Machine Underwater Garbage Video 4	mp4	Climate Change Challenge/Working with Teachable Machine/Videos
Teachable Machines Turtle Class Video 5	mp4	Climate Change Challenge/Working with Teachable Machine/Videos

Teacher Planning Document SDG 14 Lesson by Lesson	Google Doc	Lesson by lesson presentations/Google format
Teacher Planning Document SDG 14 Lesson by Lesson	Word	Lesson by lesson presentations/Microsoft
Teacher Planning Document SDG 14 Whole Project	Google Doc	Climate Change Challenge UNSDG 14
Teacher Planning Document SDG 14 Whole Project	Word	Climate Change Challenge UNSDG 14
Turtles	Image	Climate Change Challenge/Working with Teachable Machine/Datasets
Underwater	Image	Climate Change Challenge/Working with Teachable Machine/Datasets
UNSDG 14 Life Below Water Continuous Project	Google Slides	Climate Change Challenge UNSDG 14
UNSDG 14 Life Below Water Continuous Project	PowerPoint	Climate Change Challenge UNSDG 14

Lesson by Lesson Plan

United Nations Sustainable Development Goal 14 – Life Below Water

Teacher Project delivery Plan

This document presents the UNSDG 14, Life Below Water, based project as a set of lessons which may be delivered over time eg once a week, twice a term. A slightly different plan document, and continuous presentation, has been produced to support 2 full days of focus.

Timings may be altered to fit your circumstances, age of students and prior experience.

The project is designed to be editable. Lessons may be removed to reduce time.

Support files: videos, posters, links, datasets, example AI and guidance is provided to support the project.

Wherever possible, the focus is on students working. This is covered as a range of individual, paired and group activities. Where a particular form of working is suggested, this should be modified to suit your circumstances, access to online facilities and equipment.

Central to the project is the students' workbook. This will form a record of progress as students develop their skills and understanding. The workbook is presented in editable format to allow you to modify as necessary.

Google Drive is used as a means of storing and distributing files, but this may be substituted for your preferred, alternative, learning environment.

Lesson	Slides	Timing	Activity	Resources
1	1 - 2	10 minutes	<p>Starter – display the slide and provide access to a digital version of the ‘Ocean bottles’ document/have hard copies available on student desks.</p> <p>Ask students to discuss the image featuring a map of the World with plastic water bottles in the oceans.</p> <p>Prompt students to consider what message the image might be trying to convey. Ask them to think of words they would use to describe the image and write these on the image. If students need further support, you may choose to use the document ‘Ocean Bottles ideas.docx’. This file contains a number of words that may be used in a description of the image.</p> <p>Students may need support in this. If they do, display the ‘Ocean Bottles example’ document or show students slide 2. The slide is hidden but can be unlocked – right click on the slide and choose ‘unhide’.</p> <p>This is a shared activity on tables/in pairs. Encourage students to discuss this between themselves.</p> <p>If students require further scaffolding to engage in the task, consider showing students the ‘Ocean Bottles ideas’ document.</p>	<p>Ocean Bottles.docx</p> <p>Ocean Bottles example.docx</p> <p>Ocean Bottles ideas.docx</p>

			<p>This is a list of 89 words that could be used to label the document.</p> <p>An initial time of 10 minutes has been given to this task. Adjust as need be depending on the group and time constraints. As this is a foundation task, designed to get students thinking about ocean pollution, extend the timing to encourage further discussion if possible.</p>	
1	3	2 minutes	<p>Slide 3 contains the full list of United Nations Sustainable Development Goals.</p> <p>The slide is hidden but can be unhidden to introduce the concept of the UN SDGs. Alternatively, copies of the poster containing the 17 goals can be provided to students.</p> <p>To provide extra context, using this slide or poster will allow you to introduce students to the way in which issues such as SDG 12 'Responsible Consumption and Production' and SDG 13 'Climate Action' whilst separate Goals are very much linked.</p>	sdg-poster.jpg
1	4	5 minutes	<p>Display slide 4. Introduce the 'Big Picture' by showing the 3 main bullet points.</p> <p>Explain that the class are going to explore ocean pollution, especially plastics. In this journey, students will explore climate and the impact which plastics have on biodiversity, carbon impact and oxygen levels.</p> <p>The United Nations have a set of Sustainability Development Goals (often shortened to UN SDG). Tell students that the work</p>	Optional sag-poster.jpg

			<p>they will be undertaking is focused on SDG 14 'Life Below Water' but that this is also related to other SDGs.</p> <p>For example, pollution in our oceans is largely a result of poor consumption and production attitudes (SDG 12) which has an impact on climate (SDG 13).</p> <p>If you have time, you could go further and ask students to consider how other SDGs are linked into SDG 14 eg SDG 9 'Industry, Innovation and Infrastructure' where innovation in plastics production and disposal would have a positive impact.</p>	
1	5	3 minutes	<p>Show slide 5 and tell students that as they investigate the Big Picture topics they will</p> <ul style="list-style-type: none"> • Explore the impact of plastics in our oceans • Identify key steps we can take • Understand how to apply technology in solving climate problems <p>These are the overall objectives for the unit.</p> <p>You may choose to spend time in encouraging a whole class debate on the climate emergency in general – global warming and carbon dioxide are key features but not the only issues</p>	
1	6	3 minutes	<p>The slide sets up the scenario for the UN SDG 14.</p> <p>Students will be working for an NGO called SoS – Save our Seas. The purpose of the organisation is to address the problem of plastics in our oceans.</p> <p>The solutions should be capable of being adopted worldwide. Stress this point to the students. This reinforces the idea that it</p>	

			<p>is an international issue that has a local solution. As students work through this unit they will be introduced to the global perspective on plastics in the oceans and be encouraged to consider how the topics are linked.</p> <p>Tell students that they will be providing answers and will create a technology-based solution. What this will be is revealed later (it will be an AI tool students design and create).</p> <p>The project is designed as a largely scenario based unit of work encouraging students to reflect on the climate emergency and plastics pollution.</p>	
1	7	15 minutes	<p>Refer students back to the starter task and ask them to decide on 3 words which they believe best encapsulate the problem.</p> <p>Students should be directed to an online the word cloud creator. There are several online versions. For example, mentimeter (https://www.mentimeter.com/) provides a free to use version which generates an easy-to-use link for submission of the words. The activity will collate the group's words into one document which they can all access.</p> <p>After the 3 words have been added to the cloud, students should take a screenshot of this and it to the cover of their workbook.</p> <p>The brief for the overall project is provided on page 2 of the workbook. Highlight that the students are working towards their Marine Eco Warrior Certificate (https://tinyurl.com/mun7etma)</p>	<p>Starter activity with words describing the oceans</p> <p>Online word cloud.</p> <p>Save our Seas Workbook</p>

			Once the 3 words have been added and a copy of the cloud added to the workbook, students should choose at least 3 words – they do not need to be their original 3 – and create a sentence or more using the words which summarises their current thinking about the issues surrounding plastics in the oceans.	
1	8	20 minutes	<p>Show the slide and continue the scenario with the students. They have been asked to report on plastics based on the questions:</p> <ul style="list-style-type: none"> • How much plastic is in our oceans? • Where is it? • What types of plastic is polluting our oceans? <p>The aim of this part of the project is to raise awareness of the scale of the problem.</p> <p>Two links are provided, from 2015 and 2023. The links highlight the growth of the problem in 9 years: from 5 trillion to 171 trillion pieces.</p> <p>Students should be given time to read the articles: https://education.nationalgeographic.org/resource/ocean-trash-525-trillion-pieces-and-counting-big-questions-remain/ https://edition.cnn.com/2023/03/08/world/ocean-plastic-pollution-climate-intl/index.html#:~:text=Plastic%20floats%20in%20the%20Great%20Pacific%20Garbage%20Patch.&text=The%20world's%20oc</p>	<p>Ocean Trash- 5.25 Trillion Pieces</p> <p>More than 170 trillion plastic particles</p> <p>Access to the internet</p> <p>Ocean Trash- 5.25 Trillion Pieces.docx</p> <p>More than 170 trillion plastic particles.docx</p>

[eans%20are%20polluted,according%20to%20a%20new%20study.](#)

The articles have been saved as Word documents “Ocean Trash- 5.25 Trillion Pieces”, “More than 170 trillion plastic particles”. You may choose to use these as an alternative to students accessing the internet.

To scaffold the learning, you could approach the task by asking students to focus on one of the articles and have students feedback to the class on their findings. This may help to embed the learning and enable students to complete the task in their workbooks.

Similarly, for students finding access to the articles more difficult, extract segments from the Word versions and allocate these to students.

This task can work as an individual/paired or group task.

The overall aim is that students can find out that the rise in plastics pollution is huge.

The articles point to the locations of the largest patches of pollution. These are referred to as ‘gyres’ in the “Ocean Trash – 5.25 trillion pieces” article. This is a technical name for massive ocean currents where the largest accumulation of plastics exists. The term will be revisited later. Encourage students to consider that the pollution is not just surface bound but extends into the deep-water columns.

			<p>From the readings and the images, students will be able to identify the types of plastic. If students do not highlight it, tell them that we still produce single use plastics.</p> <p>Students are asked to calculate the % rise in plastic pollution between 2015 and 2023. The formula is provided in the workbook. For classes comfortable with computer science and programming, a simple program has been provided “percent calculator.py”. Students may use this to calculate the percentage increase rather calculators.</p>	
1	9	2 minutes	<p>The slide highlights Objective 1 “Explore the impact of plastics in our oceans”</p> <p>Remind students that they have been working through in this lesson, recording their findings in their workbooks and gathering ideas which will be applied in later lessons.</p>	
2	1-5	2 minutes	Quickly show the slides to remind students what was covered in the previous lesson.	
2	6	4 minutes	Show the slide and ask students to share some of the information they found out last lesson.	
2	7	4 minutes	<p>Show students the slide to emphasise the scale of the numbers and the percentage increase. This will also provide an opportunity for those who could not access the information to use it.</p> <p>The size of the numbers extend beyond what individuals can feasibly imagine. Reinforce that the problem is not just surface but exists in 3 dimensions. With the Pacific averaging 4,000 metres deep and up to 11,000 metres this provides a column of pollution that could be between 2.5 and 7 miles tall.</p>	

			To give perspective, Mount Everest is a touch under 9,000 metres. The slide graphic shows the depths of the Pacific with an image of mount Everet superimposed for emphasis.	
2	8	10 minutes	<p>Show the slide. The right-hand image puts the amount of plastic into perspective using the analogy of a garbage truck a minute.</p> <p>The right-hand image moves the session towards the effect on marine life. The estimate is that 1 million marine animals are killed each year. Again, the numbers are difficult to visualise.</p> <p>Two questions are placed on this slide:</p> <ul style="list-style-type: none"> • What effect might the loss of marine life have on other marine animals? • What about people that rely on marine animals for a living and food? <p>Divide the class into groups and assign one of the questions to each half. Ask the groups to consider the questions and formulate responses.</p> <p>Ideas to take the questions forward (you may highlight one or two of these to scaffold the session):</p> <ul style="list-style-type: none"> • Species that rely on a limited food source may starve if the food source is not available • Apex predators such as whales and dolphins can become poisoned by the chemicals their food sources absorb through ingesting plastics 	

			<ul style="list-style-type: none"> • Consider seabirds who might mistake small plastic particles as food • Shellfish feed by filtering. As they feed, they absorb pieces of plastic which contain toxic chemicals. Humans that eat shellfish and other fish species slowly become poisoned. • As species decline or become extinct, those relying on fishing for a living find it increasingly difficult to earn a wage to support their families • Invasive species may use the plastics to travel from one area to another. This can then lead to loss of native species further increasing the problem <p>Split the time into 5 minutes to go through the slide, 4 minutes for students to formulate ideas and 6 minutes, 3 minutes per side, to deliver their ideas.</p> <p>You may wish to extend this a more permanent record such as a podcast using free online recorders such as https://learn.virtualspeech.com/tools/voice-recorder</p>	
2	9	10 minutes	<p>Show slide 9. Tell students that the infographic contains 7 facts related to the problem of ocean plastics. The infographic is available as separate document which can be distributed to the students if necessary.</p> <p>Students should identify one fact from the infographic and consider how this could be used to persuade others that plastics in the oceans is a problem we need to address. If you would prefer to have more control over this activity, assign a fact to students.</p>	<p>Workbook</p> <p>Seven Facts.webp</p>

			Students should record the fact in their workbooks and write how the fact could be used to persuade people to change their habits.	
2	10	5 minutes	<p>Bring the group back together. Show them the slide and reflect on the progress they have made in developing their understanding of the problem and achieving the objective “Explore the impact of plastics in our oceans”.</p> <p>Tell them that this is an important step in moving towards the objective of “identifying key steps we can take”</p> <p>Tell students that they are now going to move to the next stage where they will deepen their understanding and start to act.</p>	
2	11-12	20 minutes	<p>Show slide 11 and tell students that they are going to work in table groups (you may make these as large or small as best fits).</p> <p>Students will choose one of the facts from 7 facts activity and agree which fact they believe is most important. Explain they will use a ME – WE – US approach where they start from their own belief and move towards a group consensus.</p> <p>Encourage students to suggest their facts and put their case for it. This is the ME aspect.</p> <p>The table groups should then agree which is the most powerful/important fact and why. This is the WE aspect.</p> <p>Each table group should elect a spokesperson (you may decide that this would benefit from more than one student) to put forward the table idea. This is the US aspect.</p>	<p>Google form https://docs.google.com/forms/d/e/1FAIpQLSe1dHICjicO3xcqcrDkAwHTU9ImNKEOF2FmCX3fPkEXAlqvkg/viewform?usp=sharing</p> <p>Optionally Seven Facts.webp</p> <p>Workbooks</p>

		<p>As student work through each of the ME – WE – US activity, they should record the process in their workbooks.</p> <p>Ultimately, the class should be encouraged to agree one fact which they believe is the most important/valuable.</p> <p>This is an opportunity for the students to engage in and develop debating skills.</p> <p>Time breakdown: 2 minute introduction 2 minute Me 3 minute We 10 minute US – to give time for all tables to put their ideas together 3 minutes for Google Form</p> <p>There is a Google Form used to collect votes on which fact is voted as the most important. The form can be copied from here https://docs.google.com/forms/d/e/1FAIpQLSe1dHICjicO3xcgcrDkAwHTU9ImNKEOF2FmCX3fPkEXAlqvkg/viewform?usp=sharing</p> <p>When tables have presented their facts, show slide 14 and ask students to vote on the most important fact (does not have to be their own).</p> <p>Share the form. Clicking on the SEND button will provide the ways in which the form can be shared.</p>	
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			The responses can be shown in real-time and downloaded as a Google Sheet.	
2	13	5 minutes	<p>The slide highlights Objective 1 “Explore the impact of plastics in our oceans”</p> <p>Remind students that they have been working through in this lesson, recording their findings in their workbooks and gathering ideas which will be applied in later lessons. Facts have been investigated and voted on that help to clarify some of the issues of ocean plastics.</p> <p>Emphasize that students are working with others in the class as this is likely to yield better results and provide a group voice.</p>	
3	1	3 minutes	As students enter the room display the slide. The task refers back to the previous session where students considered 7 facts of plastic pollution.	
3	2	1 minute	Display the slide to remind students of the 7 facts they voted on previously.	
3	4-6	1 minute	Quickly show the slides to remind students of the scenario and objectives.	
3	7	3 minutes	<p>Show the slide and tell students that they are now going to investigate where the plastic pollution is.</p> <p>The most famous location is the Pacific garbage patch/island but there are 5 major ‘islands’.</p> <p>Play the video https://www.youtube.com/shorts/JO_q61RB4wQ The 1image on the slide is directly linked to the video.</p> <p>The video focuses on the Pacific garbage patch and lasts a short time (50 seconds). Tell students that a number of pieces</p>	<p>Video https://www.youtube.com/shorts/JO_q61RB4wQ</p>

			<p>of information are given in the video and that they should use their workbooks to answer questions related to this.</p> <p>The slide acts as an introduction to a deeper investigation.</p>	
3	8-9	14 minutes	<p>Show the slide and tell students that this shows the locations of the 5 worst garbage patches.</p> <p>Move to slide 9 and focus on the word 'gyre'. Tell students that they are going to investigate what a 'gyre' is and why they are crucial to understanding plastic pollution.</p> <p>The link will enable students to answer the 3 questions:</p> <ul style="list-style-type: none"> • What is a 'gyre'? • How does a gyre affect where the garbage is? • Is the garbage just on the surface of the ocean? <p>Whilst there are 3 main questions on the slide, encourage students to go further and answer the questions:</p> <ul style="list-style-type: none"> • What is in the garbage patches? • Is the garbage easy to remove? • What could we do to reduce the amount of garbage being collected in the ocean patches? <p>The 3rd question is an opportunity of students to apply creativity through suggesting ways to remove the massive amounts of garbage.</p> <p>As an alternative to using the internet, the article is reproduced as a Word document "Garbage Patches Explained".</p>	<p>https://tinyurl.com/2r8favdr</p> <p>Garbage Patches Explained.docx</p>

			Scaffolding – you may want to use the Word document to enable students to access the content. For example, split the document into the major paragraphs and distribute these as separate elements.	
3	10-11	6 minutes	<p>Slide 10 contains an automatic link to a short video https://www.youtube.com/shorts/gADYlcmdN2c – 24 seconds.</p> <p>The video highlights the durability of plastics. They do not go away but simply break down into smaller and smaller particles.</p> <p>Ask students to view the video and listen for key words and highlight the major problem being focused on – microplastics.</p> <p>Show slide 11. This summarises the problem we are looking at – micro and nano plastics. Tell students that we are now going to explore this problem.</p>	<p>Video</p> <p>https://www.youtube.com/shorts/gADYlcmdN2c</p>
3	12	10 minutes	<p>The purpose of this next section is to explore impact. Students should be made aware that they will be working in groups and that this section has 4 linked activities.</p> <p>Show the slide. Tell students that this is part of a larger infographic “Micro plastic infographic.webp”.</p> <p>The infographic can be provided to the students but, if this option is taken, only supply the part in the slide.</p> <p>Highlight the 2 sources (primary and secondary microplastics) and 3 pathways (rivers, coasts, ships) for ocean plastics.</p> <p>Students should work in table groups to select a source and then build a public awareness statement around this. This</p>	<p>Micro plastic infographic.webp</p> <p>Workbook</p>

			<p>statement will later be used in the creation of a physical document which could be used in an advocacy campaign.</p> <p>Whilst students will be agreeing the source and statement, they should be including this in their workbooks. This will help to ensure that if members of the group are subsequently absent, the other group members will not be hampered by missing detail. Likewise, students absent from this session will be able to catch-up working with others.</p>	
3	13	10 minutes	<p>Show the slide, tell students that this is the middle part of the larger infographic. This slide focuses on 3 major impacts to marine life (poisoning, internal injuries, fake food).</p> <p>Ask students to read the 3 short paragraphs. They have this in their workbooks.</p> <p>This is part 2 of the advocacy campaign.</p> <p>Students should agree which of the 3 impacts they will focus on. Students should search for a suitable image to represent the problem. The image does not need to be an actual photograph.</p> <p>A good source of images is pixabay.com. If your organisation allows it, you may choose to let students use AI to create a suitable image using a site such as openart.ai</p> <p>Encourage students to consider the search/creation terms they will use to source the image. Some suggestions such as 'impact', 'marine impact', 'climate impact', 'ocean pollution' are included in the student workbooks.</p>	<p>Micro plastic infographic.webp</p> <p>Workbook</p>

			Once an agreed image has been found/created, students should paste this into their workbooks along with the source URL.	
3	14	10 minutes	<p>Show the slide and tell students that this is part 3 of the activity set.</p> <p>Highlight the infographic, in particular, tell students that 3 broad solutions are being presented. Ask students to read the solutions and note that the solutions have been split into what individuals and institutions can do.</p> <p>Emphasise that whilst institutions should do their part in solving the issues, we, as individuals, cannot be removed from the solution.</p> <p>Explain that whilst the solutions give a broad approach, eg 'minimise buying ...' how this might be achieved is not included. This is the students' opportunity to be creative in suggesting how the solutions might be made real.</p> <p>Students should agree a group solution and include this in their workbooks. The approaches can be varied. For example, students may decide on a set of steps, a statement of action, investment and penalties.</p>	<p>Micro plastic infographic.webp</p> <p>Workbook</p>
3	15	2 minutes	<p>Show slide 15 and tell students that they have completed Objective 1.</p> <p>Evidence: facts and figures have been explored and gathered. Next, they will move to the 'Identify key steps we can take' objective.</p>	

4	1	3 minutes	As students enter the room display the slide. The task links back to the previous session where students considered the origin, consequences and broad solutions to the plastics pollution problem.	
4	3-5	1 minute	Quickly show the slides to remind students of the scenario and objectives.	
4	6	45 minutes	<p>Show the slide.</p> <p>This activity brings together the previous 3 activities and informs students what their advocacy task is. This is an applied task in which students are given the opportunity to bring their new found knowledge and understanding to develop a resource.</p> <p>Students are presented with a scenario in which they are asked to create a set of information cards for distribution at festivals. The purpose is to raise awareness of the problem of plastic water bottles and other garbage that makes its way to the oceans.</p> <p>There are several options which can be used to create the artefact. A link to a canva.com template is provided https://tinyurl.com/yc3pac6u This acts as an example based on a related climate scenario. The template can be accessed and copied to the user's account. From here the students can share the file to enable collaboration.</p> <p>Other online or installed apps may be used to create the document. A more accessible version can be found in the 'card blank.docx' file. This is a double sided, foldable, blank which creates an A5 result. There are 2 complete exemplars to provide ideas on how the finished product may look "card example Footprint.docx", "card example Mighty Oak.docx".</p>	<p>Canva template https://tinyurl.com/yc3pac6u</p> <p>card blank.docx</p> <p>card example Footprint.docx</p> <p>card example Mighty Oak.docx</p>

			Working as a group, students should revisit their Part 1, Part 2 and Part 3 elements. The image from Part 2 should figure in the cards with suitably adjusted text forming the message from Part 1 and Part 3. Optionally, students may opt to create a series of cards in the exemplar Canva document.	
4	7	7 minutes	Show the slide and allow students to view the work of other groups. You may want to define an order in which students visit other tables eg clockwise/anticlockwise	
4	8	4 minutes	Show slide 8 and tell students that they have taken positive steps to raising awareness of the issues and have created a practical artefact which could be used.	
5	1	3 minutes	As students enter the room display the slide. The questions refer to earlier work on how plastics get into the oceans.	
5	3-5	2 minutes	Quickly show the slides to remind students of the scenario and objectives. Tell students that they are now moving onto the 3rd objective “Understand how to apply technology in solving climate problems” This links to the previous objectives, especially “Identify key steps we can take” because they are going to use and produce tools which can help in the climate emergency.	
	6-7	20 minutes	Show slide 6. Tell students that they are now going to investigate the link between plastic in the oceans and global warming.	https://tinyurl.com/nuhjobkn

			<p>As they break down, plastics release several greenhouse gasses. In particular, methane is released. This is a highly potent greenhouse. In the short term it causes more damage than carbon dioxide, heats the atmosphere faster and breaks into hydrogen and carbon dioxide. In effect, at the end of its life, methane adds CO² to the atmosphere therefore extending harm to the environment.</p> <p>Play the video (https://tinyurl.com/nuhjpbkn) on the slide until 1:30.</p> <p>Students should be directed to their workbooks in the Microplastics Versus the Climate section. There are several questions which focus on the effects of methane. To start, students are asked to say what the formula CH₄ stands for.</p> <p>The focus then switches, making the point that whilst carbon dioxide is the most frequently highlighted greenhouse gas, other gases are also a problem. Using the link https://tinyurl.com/39r3v3bb students should respond to the questions.</p> <p>Slide 7 is hidden. Optionally, this may be used to reinforce the activity. Simply right click the slide and choose unhide.</p>	
	8-9	10 minutes	Show slide 8. This features several newspaper headlines focusing on the problem of rising sea levels. Allow students 3 minutes to read the headlines and ask them how methane may be linked to the headlines.	

			<p>Show slide 9. This slide provides information on possible sea level rises at 1.5, 2.0 and 3.0 degrees rise in global temperatures.</p> <p>The image shows the regions of West Bengal and Bangladesh with areas at risk of flooding highlighted in red. You may choose to use a different image to focus on your own geographical area.</p> <p>Tell students that they are going to model sea level rises using an online app.</p>	
5	10	20 minutes	<p>This slide introduces the sea level modeller at https://tinyurl.com/bdz9szva</p> <p>The app is an interactive online tool which allows individuals to select an area and model sea level rises based on Year, Water level, Temperature, Warming choices and Ice sheets.</p> <p>Activate the app and choose Temperature (click on the Choose Map button). Move the slider to 2.0 or 3.0 degrees. On the righthand side of the page select the 'Search places' tool and enter a city near your location.</p> <p>Ask students to load the app and follow the instructions on the slide.</p> <p>In the student workbook there is a question "What might the impact be on the rest of your country if temperatures continue to rise?"</p> <p>Explain to students that if areas become prone to intermittent flooding or are permanently flooded then populations are likely</p>	<p>https://tinyurl.com/bdz9szva</p>

			to move. This can have a massive impact on population densities – more people in less space – mass migration leading to issues with borders and refugee status. This is, potentially, a controversial topic so should be handled with some degree of planning and behaviour management.	
5	11	5 minutes	Show slide 11 and tell students that they have explored the issue of rising sea levels and that this is heavily linked to global warming which is heavily linked to plastics pollution.	
6	1	2 minutes	Display the slide for students as they enter the room. The question links to the previous lesson. A range of answers may be provided by students eg “The higher the value, the greater the level of rising sea levels”, “The higher the value the greater the risk of flooding”, “The higher the value the greater the risk of mass migration”.	
6	3-5	1 minute	Quickly show the slides to remind students of the scenario and objectives. Remind students that they are now working on the 3rd objective “Understand how to apply technology in solving climate problems” and last lesson they used the online risk modeller at Climate Central	
6	6	20 minutes	Check how comfortable students are with using the app. Show them slide 6 and read through the instructions. The images show London flooding at 1.0, 2.0 and 3.0 metres. It can be seen that the river level will rise and cover land that is populated by millions of people.	https://tinyurl.com/bdz9szva

			Students should choose one or both of the scenarios for their chosen location. Students should capture the image of the effect at each of the increments: years and/or water level. The screengrabs should be pasted into the workbooks.	
6	7	35 minutes	<p>Congratulate students on their progress so far. They have moved from being observers of the climate emergency to activists able to show what is causing harm, the harm that is being caused and what may happen in their lifetimes.</p> <p>Show the slide. Students are being asked to compile a short report for SoS.</p> <p>A report template has been produced for students to use https://tinyurl.com/4rh8t3nw</p> <p>Working with another student, one of them should access the file and make a copy to their_ and share this with their partner. They can now work on this collaboratively.</p> <p>The report asks students to edit the file to include their chosen location and include evidence on temperature rise and water level and/or year covered in the previous exercise.</p> <p>Students should then include a statement on population movement. This link https://tinyurl.com/u46v7t7r provides information which can be used.</p> <p>The last part of the report asks students to produce a statement on how plastics are affecting the climate emergency. This is an open task in which students can incorporate elements from the project and other detail they believe is relevant.</p>	<p>https://tinyurl.com/4rh8t3nw</p> <p>Impact on population https://tinyurl.com/u46v7t7r</p>

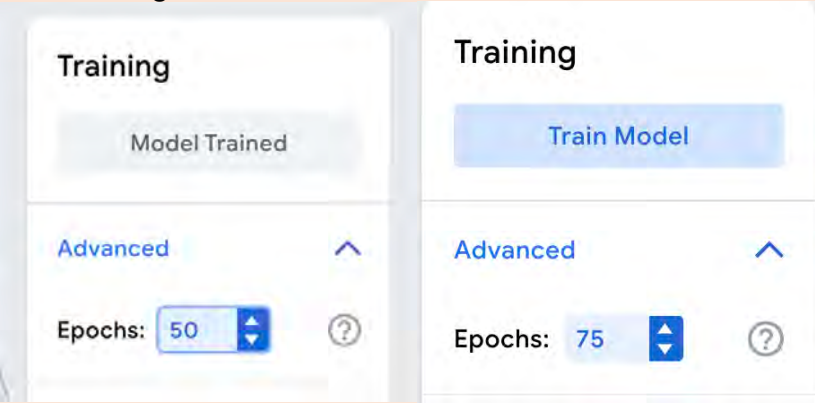
6	8		<p>The slide shows the Eco Warrior Certificate you may wish to award to students for the work they have been undertaking.</p> <p>The slide is hidden but can be unhidden by right clicking and selecting unhide.</p> <p>Whilst the certificate is shown here, it can be awarded at any stage. For example, you may choose to omit aspects of the project.</p> <p>Link to editable certificate https://tinyurl.com/mun7etma</p>	<p>Certificate template https://tinyurl.com/mun7etma</p>
6	9	2 minutes	Show slide 9 and tell students that they have completed the exploration of rising sea levels and have reported on this.	
7	1	3 minutes	<p>Display the slide for students as they enter the room.</p> <p>The question serves as a way of highlighting this next stage of the plastic pollution project.</p> <p>Ask students how they would respond to the question.</p>	
7	3-5	2 minutes	<p>Quickly show the slides to remind students of the scenario and objectives.</p> <p>Tell students that they are now working on the final part of the 3rd objective and that this is very much a practical journey where they will edit and build an AI tool which could be used in the climate emergency.</p>	
7	6-7	5 minutes	Slide 6 introduces the next stage of the project. Alternatively, you may wish to use this as a standalone project.	Teachable Machine folder resources

			<p>Students are informed that they will create an AI which will be used to tackle climate emergency issues, particularly focused on the oceans.</p> <p>There are example AI solutions and sample data sets which students will use. The AI will be developed online using Google Teachable Machine https://teachablemachine.withgoogle.com/</p> <p>A folder of resources is provided to support the work with Teachable Machine here</p> <p>Slide 7 provides the brief – students will develop their AI to identify images of the oceans.</p> <p>As the project develops, students will build their solution starting with an AI which identifies the likelihood of an image being plastic or non-plastic. This will develop further to identify whether the plastic is on or below the surface. This references back to the earlier issue of plastics in the water column. Remind students of this issue.</p> <p>Students will have the opportunity to edit their system so that it can identify plastics and other garbage.</p> <p>The final development will incorporate the ability to identify marine species such as turtles</p>	
7	8-9	45 minutes	<p>Slide 8 marks the start of the applied activity.</p> <p>You may prefer to make this a paired activity. As the files being used are based in the Google Workspace, one student should be the lead and they will need to share the AI file and related files with the other student.</p>	<p>Blank AI.tm</p> <p>PlasticsV1.tm</p> <p>Getting Started with AI Video 1.mp4</p>

			<p>Students may start with the blank AI (Blank AI.tm) or basic model (PlasticsV1.tm). The second file is preloaded with images of clear seas and seas with plastic pollution. The file may be loaded into your Google Drive or be made accessible from a school drive. Students will need to open Google Teachable Machine (https://teachablemachine.withgoogle.com/) to load the file.</p> <p>The video file 'Getting Started with AI Video 1' provides a video tutorial on how to access the AI. This should be viewed before the session. Likewise, students may use the video as they develop their ideas.</p> <p>Slide 9 moves students to testing their AI. The folder "Plastic Pollution" holds 2 sub folders. The folder 'not tested' contains 1,700 images of plastics in the oceans and ocean seas clear of plastic. Students should use these to test their AI.</p> <p>The dataset may be downloaded and stored on your drive system or transferred to your school Google Drive system and the links provided to students.</p> <p>Following the opening and training of the AI, students should answer the questions "How AI can help in the climate emergency", "Why do we need to train our AI?" and "How accurate is your AI?"</p> <p>Encourage students to screengrab their evidence of the AI working.</p>	<p>Getting Started with AI Video 2.mp4</p> <p>Plastics pollution dataset</p>
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7	10	5 minutes	Show slide 10 and tell students that they began their journey into working with Ai. Next steps will be developing the solution further so that it can identify with greater detail.	
8	1	3 minutes	<p>Display the slide for students as they enter the room.</p> <p>The question serves as a way of highlighting this next stage of the plastic reminds students that they have worked on an AI but also introduces the problem of other objects, including marine life and locations.</p> <p>Ask students how they would respond to the question.</p>	
8	3-6	2 minutes	<p>Quickly show the slides to remind students of the scenario and objectives.</p> <p>Slide 6 is reminder of the AI brief being worked to.</p>	
8	7	10 minutes	<p>Slide 7 uses a video https://www.youtube.com/watch?v=3S2w-ewCf5s to showcase how AI is being used. Show the video to students.</p> <p>Tell students that what they are doing with Teachable Machine is increasing awareness of how AI can be used in the climate emergency and that the video extends this.</p> <p>As they are watching the video, students should be noting the benefits of AI for inclusion in their workbooks. This is the last part of Step 1 in the AI section of their workbooks.</p>	https://tinyurl.com/yu2msrcj
8	8-11	40 minutes	<p>The slides provide an opportunity for students to develop their confidence and skill with Teachable Machine and AI.</p> <p>Slide 8 focuses on students adding a class called 'Surface Plastic' so that the AI can identify of the plastic being identified is likely to on the surface of the sea. Remind students that we</p>	<p>Teachable Machine Adding a New Class.mp4</p> <p>Surface Plastic dataset</p>

		<p>previously looked at the issue of surface and water column pollution so will need to be able develop information on not just whether there is plastic in the seas but also where it is if we are track and remove.</p> <p>Show students slide 8 and check that they are confident – they will have previously developed their initial idea, now they are adding to it.</p> <p>If required, a video tutorial is available to support this activity “Teachable Machine Adding a New Class”</p> <p>Slide 9, hidden, provides a direct link to the support video. You may choose to play the video to introduce the activity.</p> <p>The dataset for this activity is ‘Surface Plastic’ available here for download or direct use</p> <p>Slide 10 continues the theme and asks students to add a 5th class – ‘Underwater mixed Garbage’.</p> <p>As previously, there is a video to support this “Teachable Machine Underwater Garbage Video 4.mp4” along with a dataset “Underwater”</p> <p>Slide 11, hidden, provides a direct link to the support video.</p> <p>You may want to combine the Surface Plastics and Underwater Garbage activities into one activity.</p> <p>As students add more classes to their AI there will be variation in how well the system predicts what the images are showing.</p>	<p>Teachable Machine Underwater Garbage Video 4.mp4</p> <p>Underwater dataset</p>
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			<p>This is an effect of increasing the number of classes. If students encounter ambiguity in images being correctly identified they can increase the number of epochs used to train the AI. This achieved through increasing the number of training epochs in the Training window:</p>  <p>Tutorial video “Teachable Machines Turtle Class Video 5” from minute 3:00 demonstrates this.</p>	
8	12	5 minutes	<p>Show slide 12 and congratulate them on their work on this technological approach to providing solutions for the climate emergency.</p> <p>Remind students that they now have 4 classes in their AI which provides a more detailed idea of what is happening in our oceans.</p>	
9	1	3 minutes	<p>Display the slide for students as they enter the room.</p> <p>The question serves as a way of the need to monitor the effects of plastic pollution on marine life – this refers back to earlier work students will have carried out.</p>	

			Ask students how they would respond to the question.	
9	3-6	2 minutes	<p>Quickly show the slides to remind students of the scenario and objectives.</p> <p>Slide 6 is reminder of the AI brief being worked to. Highlight the 4th point on the slide.</p>	
9	7-8	25 minutes	<p>Slide 7 presents a scenario to the students. SoS are asking them to develop their AI so that it can identify turtles that may be in or near the garbage patches.</p> <p>Slide 8 is hidden and contains the video tutorial for this part of the project. You may wish to keep this hidden to see how well students work independently.</p> <p>The workbook contains a brief and set of instructions for students to develop the AI so that it can identify turtles. This is in the 'Step 3 – Biodiversity alert!' section.</p>	<p>Turtle dataset https://tinyurl.com/2mdjntjb</p> <p>Video Tutorial https://tinyurl.com/5648rfup</p>
9	9	25 minutes	<p>Direct students to divide the 'Mixed' folder into subfolders so that there is data which can be trained on a much wider set of marine life eg jellyfish, sharks, dolphins, etc.</p> <p>Slide 9 directs students to the Ocean Life dataset</p> <p>Dataset https://tinyurl.com/38yv79vz</p>	<p>Ocean Life dataset https://tinyurl.com/38yv79vz</p>

9	10	5 minutes	<p>Show the objectives and tell students that they now have a functioning AI which could be used to view images from ocean exploration and provide valuable data that can be used to monitor the state of our oceans.</p> <p>Ask students what the next stage might be. For example, pairing drone technology with AI would enable the AI to use images from a wide geographical area to build an idea of how the oceans are doing.</p> <p>Tell students that in the next lesson they will be bringing their ideas together.</p>	
10	1	10 minutes	<p>Display the slide for students as they enter the room.</p> <p>The slide serves to get students to zone in on what they are taking away. They have investigated several complex ideas and worked with technology to address the climate emergency.</p> <p>Refer students to their workbooks for ideas.</p> <p>Encourage students to share.</p>	
10	3-5	3 minutes	<p>Quickly show the slides to remind students of the scenario and objectives.</p>	
10	6	30 minutes	<p>Slide 6 encourages students to consider how they would advise organisations in the use of AI based on their experiences.</p> <p>This is a reflective task where students are encouraged to review what they have achieved and how others may benefit from their experiences.</p>	

			Students may need to be taken through a review of what they have accomplished. This can be achieved through a mix of recap on the previous slides and rereading of the workbook activities.	
10	7	10 minutes	Slide 7 asks students to complete a number of end questions in their workbooks. This is designed to embed what has happened in this section of the project	
10	8		Slide 8 is hidden. If appropriate, award students an Eco Technology Award for their work on developing an AI and raising awareness of how technology can be used in the addressing the climate emergency	Editable certificate link https://tinyurl.com/4dujxp4m
10	9	7 minutes	Slide 9 is a copy of the original, broad objectives for the whole project. Use this to remind students of what they have achieved	

Student Workbook

SoS - Save our Seas

Insert Word Cloud
Here!

Name:

Class:

SoS - Save our Seas

Save our Seas are a charity formed to address the problem of plastics in our oceans.

SoS have committed to providing solutions which can be adopted worldwide.

SoS have commissioned you to explore the issues and develop tools which can be used to combat this climate emergency area.

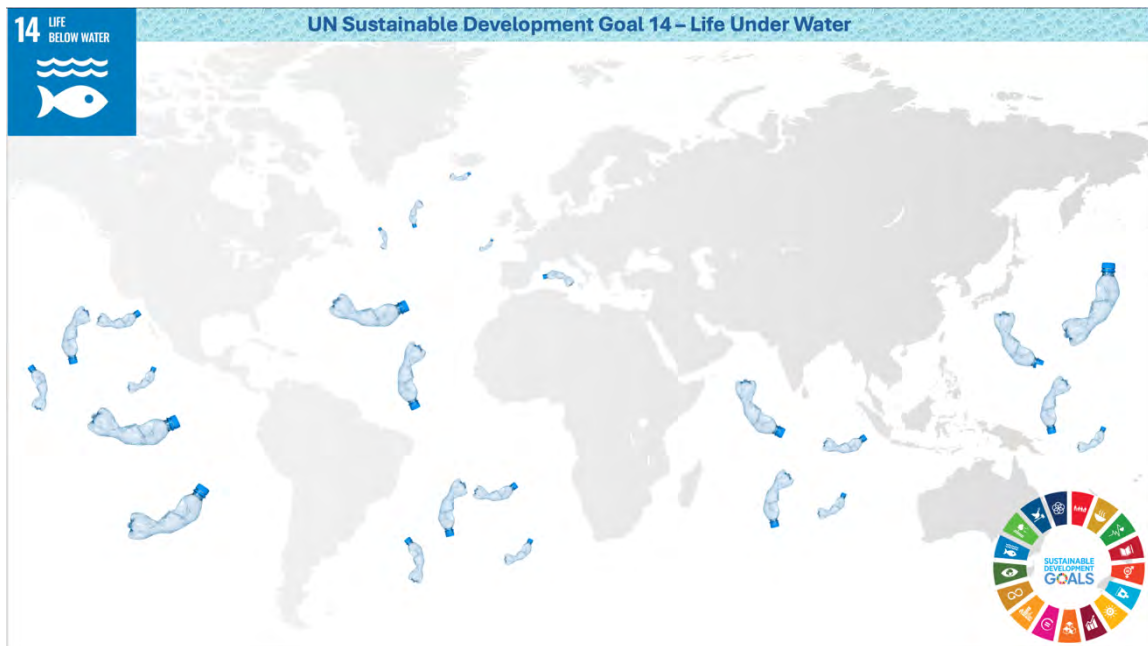
In undertaking the exploration of this area, you will build your knowledge of why plastics in our oceans are a major contributing factor to pollution are, marine biodiversity loss, global warming and



Once you have explored the issues you will investigate ways in which you can help solve the problems and use AI to identify pollution.

Keep your workbook up to date to earn your Marine Eco Warrior Certificate!

Getting started



From the group word cloud, choose 3 words and from these create at least one sentence that you believe summarises the issue of plastics pollution in our oceans

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What's the problem?

Has the amount of plastic pollution grown in the past decade? Here are 2 links to explore this issue:

[Link 1](#) This article was published in 2015

[Link 2](#) This article was published in 2023

You may use and include your own links to data on the amount of plastic waste.

How much plastic was estimated to be in the oceans in 2015?

.....

How much plastic was estimated to be in the oceans in 2023?

.....

The 2 links claim that there is an increase. If we use the figures, we can estimate the percentage increase between 2015 and 2023.

The formula for this is $(\text{end figure} - \text{start figure}) / \text{start figure} * 100$. This will give you the percentage increase.

To make the calculation easier, round the figures to whole numbers.

The % increase in plastic pollution between the years 2015 and 2023 is

.....

Getting to grips with the issues

The infographic provides information on 7 facts. We can see that by dumping 10 million tons of plastic into the oceans each year has several impacts.



Using the infographic, identify one of the other facts and suggest how we could lessen impact.

<https://plasticoceans.org/the-facts/>

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Me - We – Us

Table agreement:

Me – I hold a belief that

.....

.....

We agree that the following fact is valuable

.....

.....

Us, as a group, have a set of shared values which can achieve

.....

.....

Where does all the garbage go?



https://www.youtube.com/shorts/JO_q61RB4wQ

Using the video link, answer the following questions:

Where is the Pacific garbage patch?

.....

How does the garbage get there?

.....

How big is it?

.....

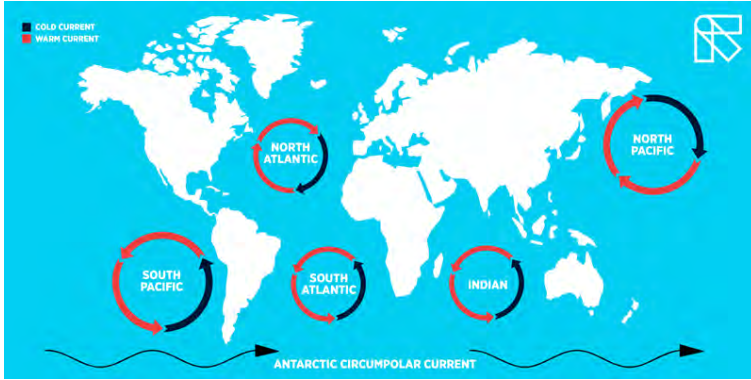
How much has been removed?

.....

What is the estimated weight of the Pacific garbage patch? [Go here](#)

.....

More than one!



<https://blog.marinedebris.noaa.gov/garbage-patches-explained#:~:text=Garbage%20patches%20are%20areas%20of,in%20the%20northern%20Pacific%20Ocean.>

What is a 'gyre'?

How does a gyre affect where the garbage is?

Is the garbage just on the surface of the ocean?

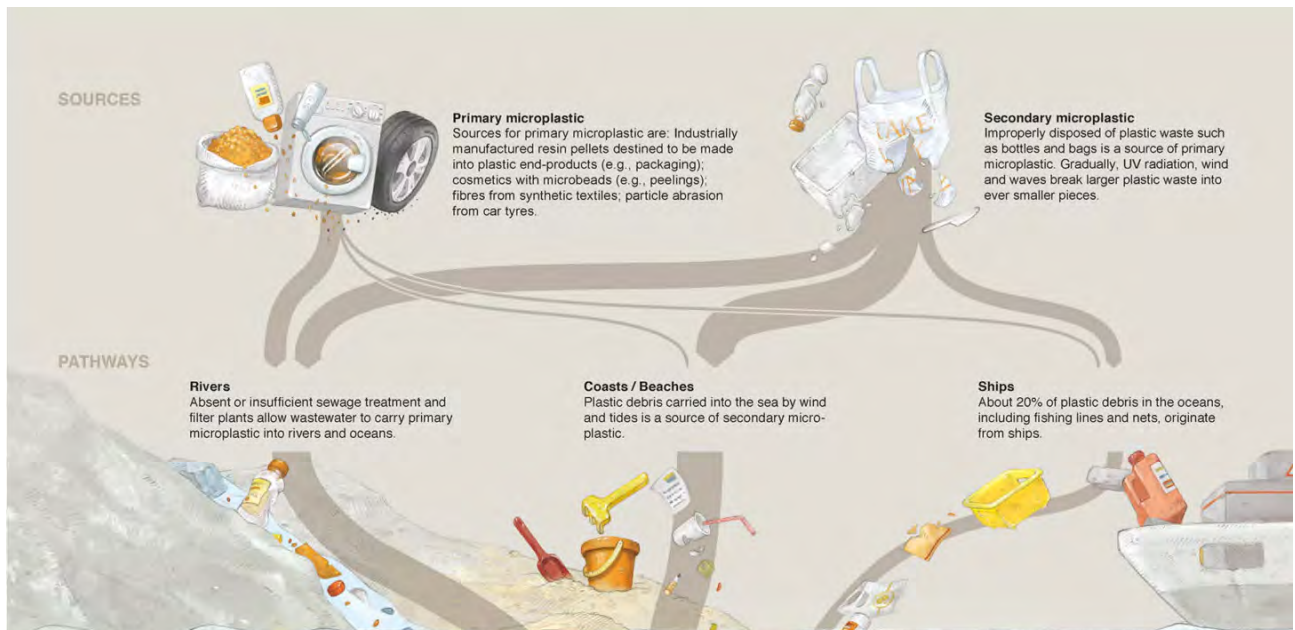
Going further

What is in the garbage patches?

Is the garbage easy to remove?

What could we do to reduce the amount of garbage being collected in the ocean patches?

Impact – Macro to Micro



<https://tinyurl.com/33c8rkbx>

Part 1

Working in your table groups, explore the top third of the infographic. As a group, which of the two sources of microplastic would you tackle?

Agree a statement which highlights the issue (make it clear which source of microplastic it is you are addressing). Your statement should be capable of raising awareness of the issue.

.....

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Part 2

Continuing working in your groups, identify one of the impacts and choose an image that

represents this. A good source of images is pixabay.com. Consider search terms such as 'impact', 'marine impact', 'climate impact', 'ocean pollution'.

Include the URL of the image for later access.

Paste the image here:

Part 4

You have successfully collaborated in your exploration of microplastic, creating 3 artifacts.

Now you will bring the elements together using canva.com.

SoS are impressed with your eco credentials and have asked you to create a set of information cards. They will be handing out the cards at music festivals to encourage responsible disposal of plastic, especially water bottles.

Each card should use your image from Part 2 on the front and a suitable message from your Part 1 and Part 3 work.

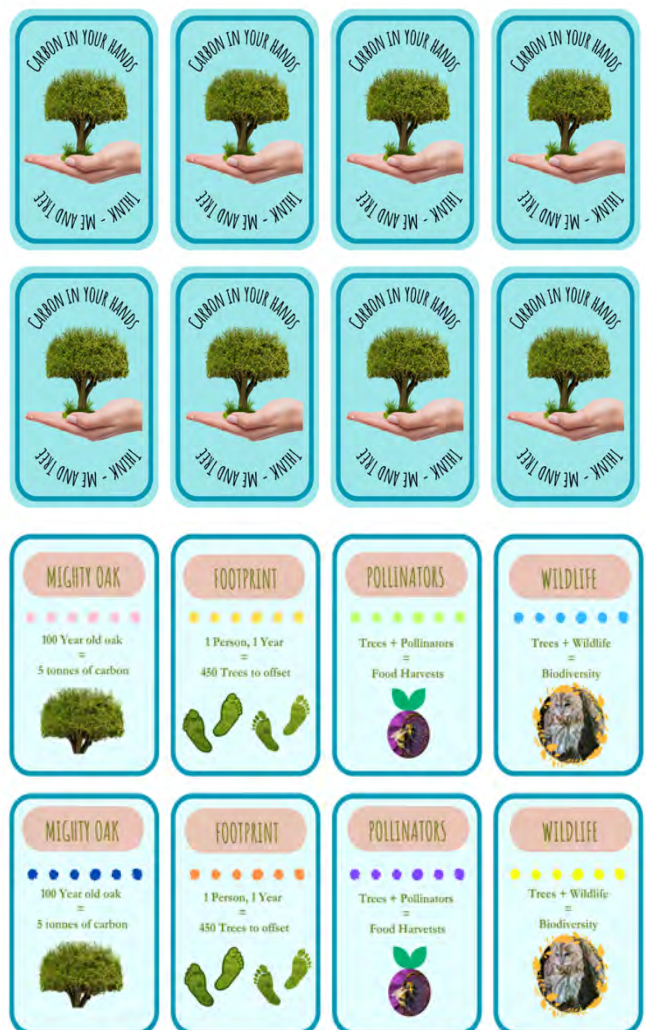
You may choose to use the same message on each card or have variations to form a pack.

To provide you with inspiration, a similar charity to **SoS** have produced a set of double-sided cards for a tree awareness campaign.

The examples to the right were created at canva.com

Using this site will allow you to collaborate on the card creation. Just choose one person to create the blank, share the link and you are part of the team.

Prefer to work in Word? Here is an example of a card. Your teacher will provide you with the link.



Microplastics Versus the Climate

A major greenhouse gas is mentioned in the first part of the video here

<https://www.youtube.com/watch?v=k1Jt6e2OPHY>

Name the gas produced by degrading plastic – the formula has been given to you.

CH₄ =

SoS have spent a lot of time exploring the effect of carbon dioxide and are worried that not as much time is spent on providing information on other gases.

SoS have asked you to explore the gas above. They would like to know what the effects of the gas is and how long it remains in the environment.

Here is a link to get you started (but you can use your own):

<https://tinyurl.com/39r3v3bb>

% Contribution to global warming

How many more times harmful it this gas when compared to carbon dioxide
.....

What percentage reduction would reducing methane emissions lead to limiting global warming to 1.50° C

How many years is the gas active in the environment after it has been released
.....

Well done! That's a lot of figures.

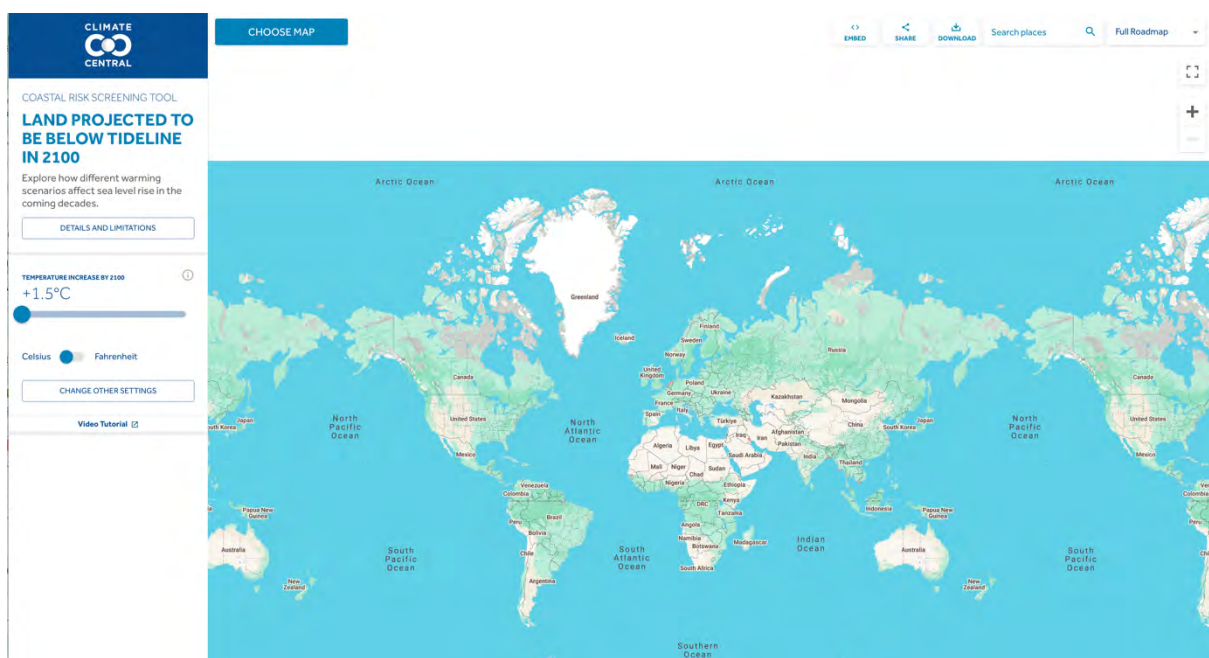
What about Climate, Global Warming and Sea Levels?

SoS are really happy with the work you have done so far. It looks like not only the oceans and marine life are affected but global warming will rise the sea levels. This will affect everyone on the planet.

If areas are under water, the residents will need somewhere else to live. This could lead to mass migration and the problems that brings.

Use the Climate Central app here <https://tinyurl.com/bdz9szva>

- Choose the **Temperature** map
- Choose a location eg London
- Move the slider through 1.5, 2 and 3 degrees
- What might the impact be on the rest of your country if temperatures continue to rise?



Take a screenshot and paste the different images into your workbook to show the changes

SoS can see that you are becoming a climate change specialist – maybe that's a career for you?

Go back to the Climate Central app and change the map type to water level or year.

If you chose water level, show the map at 1.0, 2.0 and 3.0 metres. If you chose year, show the map at 2030, 2060 and 2090.

Map type = Water Level / Year (delete whichever you do not use)

Bring it together

SoS now have a much better idea of how plastics in the oceans has an impact on marine life, greenhouse gas, sea levels and human life. This is all part of what is now becoming known as the '**climate emergency**'. Your contributions can help to reduce impact – the more people know the more we can turn '**climate emergency**' into '**climate celebration**'.

To help in reducing impact, **SoS** have asked you to create a short report based around the work you have undertaken with the Climate Central app.

Working with one other person, one of you should download the document here <https://tinyurl.com/4rh8t3nw> and share it with your partner. You can now contribute to the document at the same time.

There are 3 tasks to complete first:

- Temperature rise
- Water level or Year
- Population movement

Once you have added your ideas and evidence, agree on a statement that explains how the dumping of plastics in the oceans is affecting the climate emergency. Even better, extend the statement to suggest the steps that we (individuals, groups, companies, nations) should take. Consider how technology, such as the forecasting app at Climate Central can convey important messages.

This link <https://tinyurl.com/u46v7t7r> may help you in gathering data and ideas.

From Observer to Participant

The problem:

SoS are working to reduce plastics pollution in our oceans.

Encouraged by your work with the Climate Central app, **SoS** have asked you to create an AI which will scan images to check on pollution.

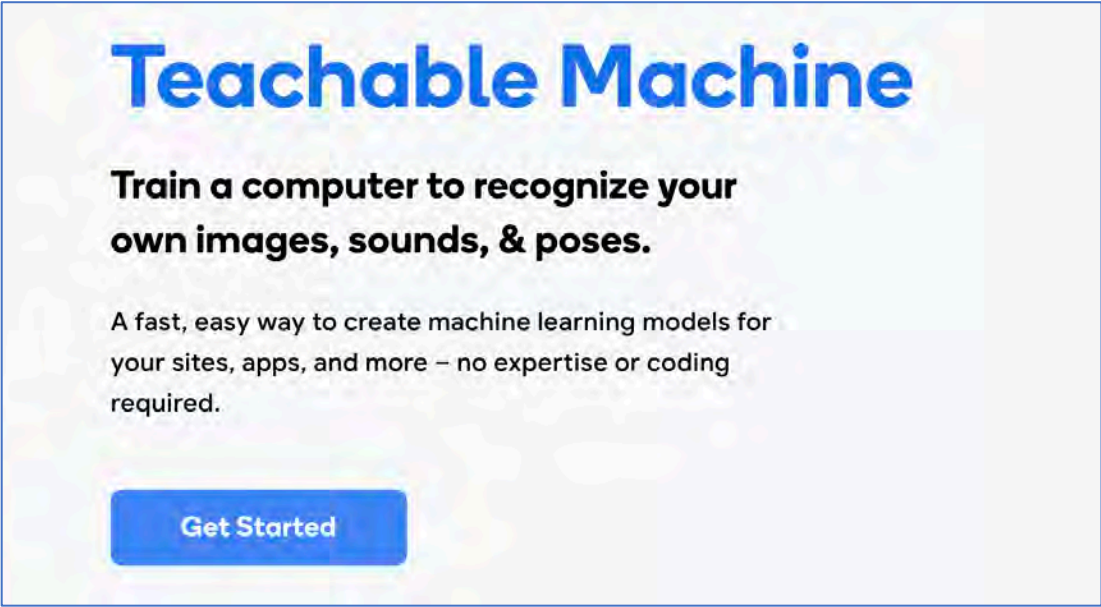
SoS have deployed cameras at the five garbage patches. These automatically send images to the headquarters.

This will allow **SoS** to report on the increase or decrease in pollution and the types of plastics which are being found.

SoS have provided a draft of their AI. It contains 2 sets of images:

Plastics and ***Not Plastic***.

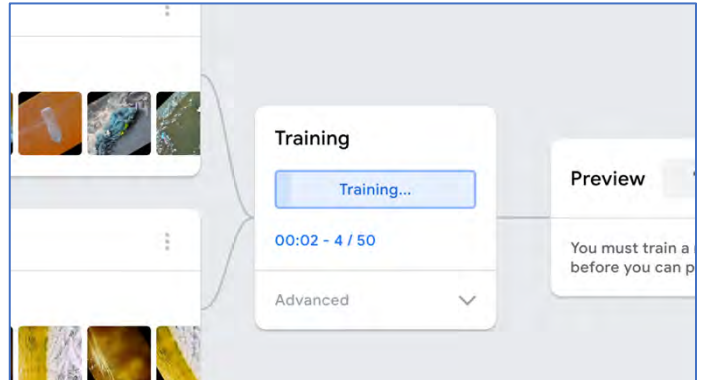
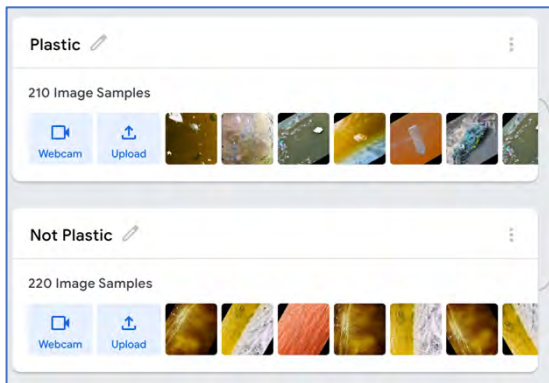
You will be using Google's Teachable Machine to develop your climate emergency solution.



The image shows a screenshot of the Teachable Machine website. At the top, the text "Teachable Machine" is displayed in a large, bold, blue font. Below this, the text "Train a computer to recognize your own images, sounds, & poses." is written in a bold, black font. Underneath, a smaller line of text reads: "A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required." At the bottom of the section, there is a blue button with the text "Get Started" in white.

Step 1- Create the Solution

Open the project file and train it (your teacher will show you where the project file is)



Video support files:

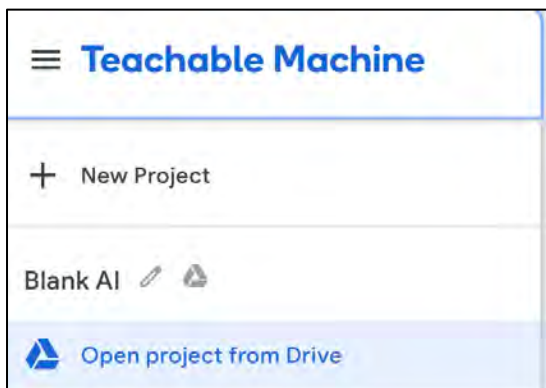
[Getting Started with AI Video 1.mp4](#)

[Getting Started with AI Video 2.mp4](#)

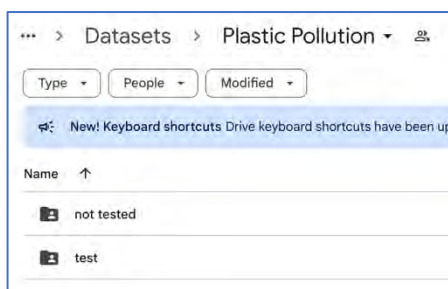
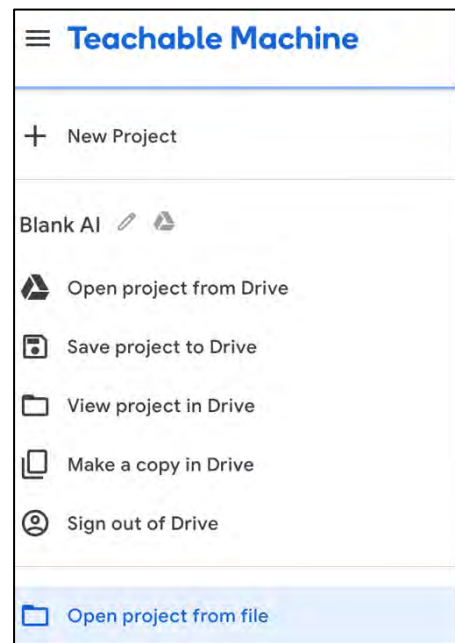
Teachable Machine support files for this part:

[Image dataset](#)

Blank AI.tm (if you are starting from scratch) **OR** PlasticsV1.tm (if you are starting with a basic model)



OR



With your system ready for use, consider how AI could be used to send alerts of pollution in our oceans.

Why do you need to train your AI?

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.....

How accurate is your AI?

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Screengrab your AI predicting whether the image is plastic or not plastic (you may want to use your webcam and show a picture to that)

How AI can help in the climate emergency:

.....

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.....

Step 2 - Improving your AI

As you add the Surface Plastics and Underwater Garbage classes, record your progress through screengrabbing the evidence. Do not forget to show your testing.

Support files:

Video tutorial [Teachable Machine Adding a New Class.mp4](#)

Dataset [Surface Plastic](#)

Video tutorial [Teachable Machine Underwater Garbage Video 4.mp4](#)

Dataset [Underwater](#)

Step 3 – Biodiversity alert!

SoS need your help. Their tech startup partners are really impressed with your work in identifying plastics and garbage in the oceans.

A direct climate emergency effect has been variations in turtle populations, especially near the garbage patches.

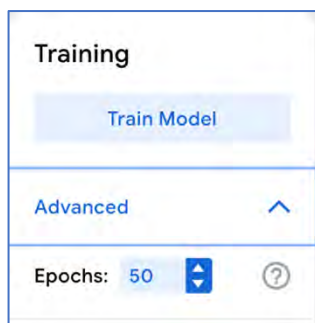
Using a dataset called Turtles <https://tinyurl.com/2mdjntjb> add a turtles class and train this on your AI.

SoS and the tech startup need you to show how accurately the AI can show whether an image is a turtle or not.

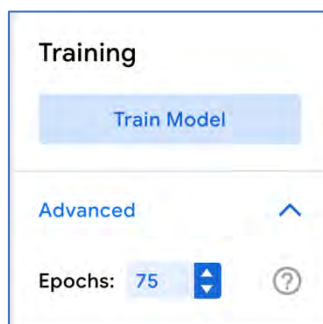
To really test the system, you can use images in a further dataset (Oceanlife <https://tinyurl.com/38yv79vz>). This contains a wide range of images which your AI has not seen before.

You may find that your system is not as accurate as you would expect it to be. One way that you can improve accuracy is by training the system on the images for a longer time.

Look under the “Training” window. Click on the ‘Advanced’ button and you will see several options.



We are interested in the ‘Epochs’. The higher the value the greater the accuracy. Drawback is that it takes slightly longer to train your AI if you increase the Epochs.



Change the 50 to 75, retrain your model and test your system again. What has this done to your accuracy? What about training with a 100 epochs?

Turtle identity screengrabs

Part 4 - You, the Expert

SoS and others are really impressed with the way your system works. They have asked you to give advice on how best to create and develop an AI.

They want advice on using AI to monitor areas where endangered birds and mammals are affected by climate change.

What advice would you give?

The End of the Journey.....?

- In one sentence, how can AI be deployed to tackle climate emergency?

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- What advice would you give on the type and size of datasets that should be used?

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- Now that SoS have a worldwide system monitoring the oceans, how can sharing data improve the reliability of AI systems?

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- Are AI systems better than humans at tackling complex tasks?

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- Why?

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