

# COMMON SEAS EDUCATION

## Learning objectives



Common Seas has worked with partners to create a set of universal Ocean Plastics Learning Objectives, utilising the frameworks developed by UNESCO and those working for Ocean Literacy. These learning objectives are listed below and are subscribed to by Common Seas Ocean Plastics Academy partners. We hope that these overarching learning objectives are useful to other individuals and organisations planning their own education programming to help a plastic waste free future.

Ocean Plastics learning objective	Lessons				
	1	2	3	4	5
<b>Cognitive learning objectives</b>					
• The learner understands the fundamental properties of plastics, including the use of additives.	✓				
• The learner understands the scope and geographical scale of plastic use and plastic pollution historically as well as current predictions.					
• The learner understands the pathways through which plastics enter the ocean and marine life.				✓	✓
• The learner understands the social, environmental and economic cost of plastics across its entire life cycle.		✓		✓	✓
• The learner can identify and evaluate ways to improve the sustainability of plastics at different stages of the product life cycle <sup>1</sup> .				✓	
<b>Socio-emotional learning objectives</b>					
• The learner can reflect on their own use of plastics, and how this use might affect the marine environment.		✓	✓	✓	
• The learner actively seeks alternative designs, behaviours and practices that reduce their contribution to plastic pollution.				✓	
• The learner can communicate the societal and environmental impacts of plastic use, referring to the scientific evidence base.			✓		
• The learner is able to influence the behaviours and practices of others in their community in terms of plastic use and management.					
• The learner can collaborate at a range of scales to campaign for the reduction of plastic pollution.					
<b>Behavioural learning objectives</b>					
• The learner is able to access and improve waste management systems in their local area.					
• The learner can plan and implement campaigns that lead to a reduction in plastic pollution at a range of scales.					
• The learner is able to evaluate media narratives about plastic pollution and present a balanced judgement to their peers.					
• The learner is able to make informed decisions as a consumer to reduce plastic pollution.					
• The learner is able to research different approaches to design, including circularity and biomimicry.					

<sup>1</sup> Including improved design, alternative materials, waste management and individual behaviour.

# COMMON SEAS EDUCATION SCHEME OF WORK

## Mapped against National Curriculum for England Key Stage 3, Science

KS3 Science Element of the curriculum	Lessons				
	1	2	3	4	5
<b>Materials</b> <ul style="list-style-type: none"> <li>• Properties of polymers</li> </ul>	✓	✓	✓		
<b>Energy Changes</b> <ul style="list-style-type: none"> <li>• Heating and thermal equilibrium: how a temperature difference between two objects leads to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation, and how such transfers tend to reduce the temperature difference. Use of insulators.</li> </ul>		✓			
<b>Scientific working skills</b> <ul style="list-style-type: none"> <li>• Make predictions using scientific knowledge and understanding.</li> <li>• To select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.</li> <li>• To use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety.</li> <li>• To make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.</li> <li>• Presenting observations and other data using appropriate methods.</li> <li>• Translating data from one form to another.</li> <li>• Interpreting observations and other data, including identifying patterns and trends, making inferences and drawing conclusions.</li> </ul>		✓			
<b>Interactions and interdependencies</b> <ul style="list-style-type: none"> <li>• How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.</li> </ul>				✓	
<b>Genetics and evolution</b> <ul style="list-style-type: none"> <li>• How changes in the environment may leave individuals within a species, and some entire species less well adapted to compete successfully and reproduce, which in turn may lead to extinction.</li> </ul>				✓	
<b>Knowledge</b> <ul style="list-style-type: none"> <li>• How organisms affect, and are affected by their environment, including the accumulation of toxic materials.</li> </ul>					✓

## Lesson 1: How are plastics made?

### Overview

In this chemistry Key Stage 3 (KS3) lesson, students will learn how monomers and polymers dictate the properties of plastics. This lesson focuses on how plastics are made. Included are teacher resources for students to make their own polymer, using PVA and borax, to observe how changing the structure of a substance changes its properties.

### Learning outcomes

- State that plastics are made from oil
- Describe the steps involved in making oil
- State what a monomer and a polymer is
- Describe how changing a substance's structure can change its properties

### Resources



**Slideshow 1:**  
How are plastics made?



**Activity Overview 1a:**  
How to make slime



**Student Sheet 1a:**  
Plastic production table

**Student Sheet 1b:**  
Plastic card sort

**Student Sheet 1c:**  
How to make slime



**Thinglink:**  
Seven types of plastic

## Lesson 2: Why are plastics useful?

### Overview

In this chemistry Key Stage 3 (KS3) lesson, students investigate the different properties of plastics. In groups students design an investigation testing either thermal insulation or tensile strength. Included are teacher resources with an investigation template.

### Learning outcomes

- Describe how plastics can be both harmful and useful
- Identify independent, dependent, and control variables
- Develop investigation skills including control variables and repeats
- Evaluate results in a graph

### Resources



**Slideshow 2:**  
Why are plastics useful?



**Activity Overview 2a:**  
Plastics independent investigations



**Student Sheet 2a:**  
Plastics independent investigations

## Lesson 3: What happens after you throw it away?

### Overview

In this chemistry Key Stage 3 (KS3) lesson, students investigate rates of decay. The lesson is focused on students designing their own investigation. Included are teacher resources allowing students to test how a conventional plastic bag decays compared to a compostable bag (using a potato as a substitute), in different conditions.

### Learning outcomes

- Recognise that most plastic ends up in either landfill or the sea.
- Order materials based on the time they take to degrade.
- Describe alternatives to using plastics
- Create an investigation on how to increase the speed of decay.

### Resources



**Slideshow 3:**  
What happens to plastic when you throw it away



**Activity Overview 3a:**  
Degradation test



**Student Sheet 3a:**  
How long will it take to degrade?

**Student Sheet 3b:**  
Biodegradable plastic bags  
academic paper

**Student Sheet 3c:**  
Design a biodegrade test

**Student Sheet 3d:**  
Dr Imogen Napper's study



**External Link:**  
Inspiring Stories: Imogen Napper

## Lesson 4: How does plastic affect the environment?

### Overview

In this biology Key Stage 3 (KS3) lesson, students learn how plastics affect the marine environment. This lesson is focused on the physical harm caused by plastics to marine organisms. Included are teacher resources that promote students to become advocates for reducing plastic waste to protect our oceans.

### Learning outcomes

- Order most common types of plastic waste
- Describe how plastic waste impacts the environment
- Predict how plastic waste impacts a variety of marine organisms
- Formulate solutions to plastic waste issues

### Resources



**Slideshow 4:**  
How does plastic affect the environment?



**Student Sheet 4a:**  
Sources of marine plastic

**Student Sheet 4b:**  
Plastics in the ocean

**Student Sheet 4c:**  
Marine life cards



**External Link:**  
Sea turtle with a straw up its nostril

## Lesson 5: Plastics and bioaccumulation

### Overview

In this biology Key Stage 3 (KS3) lesson, students will learn about plastics and bioaccumulation. This lesson is focused on how chemical pollutants cause harm to marine organisms. Included are teacher resources to model bioaccumulation and an orca case study.

### Learning outcomes

- State that pollutants can enter an organism's body from the environment
- Describe how energy and pollutants are passed through a food chain / web
- Evaluate whether plastics contribute to bioaccumulation
- Analyse data to identify trends

### Resources



**Slideshow 5:**  
Plastics and bioaccumulation



**Mark Scheme 5a:**  
Plastics and bioaccumulation assessment



**Student Sheet 5a:**  
Plastics and bioaccumulation assessment



**Subject Update:**  
How to: improve students online research skills

## Mapped against National Curriculum for England Key Stage 3, ; Yc[ fUd\m

KS3 Geography Element of the curriculum	Lessons								
	1	2	3	4	5	6	7	8	9
<b>Aims</b>									
<ul style="list-style-type: none"> <li>Develop contextual knowledge of the location of globally significant places – both terrestrial and marine – including their defining physical and human characteristics and how these provide a geographical context for understanding the actions of processes</li> </ul>	✓								
<ul style="list-style-type: none"> <li>Collect, analyse and communicate with a range of data gathered through experiences of fieldwork that deepen their understanding of geographical processes</li> </ul>								✓	✓
<ul style="list-style-type: none"> <li>Interpret a range of sources of geographical information, including maps, diagrams, globes, aerial photographs and Geographical Information Systems (GIS)</li> </ul>		✓	✓			✓	✓		
<ul style="list-style-type: none"> <li>Communicate geographical information in a variety of ways, including through maps, numerical and quantitative skills and writing at length</li> </ul>			✓			✓	✓		
<b>Locational knowledge</b>									
<ul style="list-style-type: none"> <li>Extend their locational knowledge and deepen their spatial awareness of the world's countries using maps of the world to focus on Africa, Russia, Asia (including China and India), and the Middle East, focusing on their environmental regions, including polar and hot deserts, key physical and human characteristics, countries and major cities</li> </ul>			✓	✓	✓				
<b>Human and physical geography</b>									
<ul style="list-style-type: none"> <li>Physical geography relating to: geological timescales and plate tectonics; rocks, weathering and soils; weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts</li> </ul>	✓								
<ul style="list-style-type: none"> <li>Human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors; and the use of natural resources</li> </ul>	✓	✓	✓	✓	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>Understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems</li> </ul>	✓	✓	✓	✓	✓	✓	✓	✓	✓
<b>Geographical skills and framework</b>									
<ul style="list-style-type: none"> <li>build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field</li> </ul>	✓		✓	✓	✓				
<ul style="list-style-type: none"> <li>use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information</li> </ul>								✓	✓

# SCHEME OF WORK

## Lesson 1: What is the 'Great Pacific Garbage Patch' really like?

### Overview

This first lesson in the unit introduces students to the topic of marine plastics. First, they visit the 'Great Pacific Garbage Patch' and find out what is happening in the middle of the ocean. Then, students will develop their knowledge of ocean currents and how they can concentrate plastic waste. Last, students will investigate how rubbish reaches the middle of the ocean.

### Learning outcomes

- Reflect on marine plastic pollution
- Describe and locate the 'Great Pacific Garbage Patch'
- Map and investigate ocean gyres
- Describe how plastic accumulates in gyres and is a global phenomenon
- Differentiate between managed and unmanaged plastic and explain its pathway to the ocean

### Resources



**Slideshow 1:**  
What is the 'Great Pacific Garbage Patch' really like?



**Student Sheet 1a:**  
The 'Great Pacific Garbage Patch'

**Student Sheet 1b:**  
All about gyres

**Student Sheet 1c:**  
Map the gyres



**Video:**  
What happened to the rubber ducks



**External link:**  
The Majestic Plastic Bag - A Mockumentary

## Lesson 2: What is plastic and why is it a problem in the ocean?

### Overview

With plastics being ubiquitous in modern life, students examine what has made this material so popular. Students then learn what happens to litter when it enters the ocean. Finally, the lesson looks at how plastics affect turtles, and whether we have enough information to take drastic action on plastics, or whether we need to wait for more research to be conducted.

### Learning outcomes

- Consider how the properties of plastic make it so popular
- Rank how different types of litter biodegrade in the ocean
- Suggest how plastics can harm turtles
- Evaluate whether there is enough scientific evidence to take drastic action on plastics
- Consider how the properties of plastic make it so harmful

### Resources



**Slideshow 2:**  
What is plastic and why is it a problem in the ocean?



**Student Sheet 2a:**  
Plastic starters

**Student Sheet 2b:**  
What is plastic and why is it a problem in the ocean?

**Student Sheet 2c:**  
Plastic and turtles

**Student Sheet 2d:**  
Plastic action vote

# SCHEME OF WORK

## Lesson 3: Plastic case study - tourism in Kenya

### Overview

Plastic does not just have an environmental and health impact, it can also affect economies and communities. For tourism locations, a pristine beach will attract more visitors than one covered in plastic waste. In this lesson, students will look at a tourism case study on Lamu Island off the coast of Kenya.

### Learning outcomes

- Assess what makes Lamu a popular tourist destination
- Apply mapping skills to describe key processes
- Evaluate the threat caused to Kenya's economy by plastic waste
- Describe how actions at a range of scales are addressing plastic pollution
- Evaluate the threat caused to Kenya's economy by plastic waste

### Resources



**Slideshow 3:**  
Plastic case study - tourism in Kenya



**Student Sheet 3a:**  
Lamu tourism brochure

**Student Sheet 3b:**  
Holiday heaven or paradise lost to plastic?

**Student Sheet 3c:**  
Lamu mapping

**Student Sheet 3d:**  
Flipflop case study



**External Link:**  
Yes We Can! Shela to Kipungani Beach Cleanup

**External Link:**  
DePollutionizing Shela Beach

## Lesson 4: How can we deal with all the plastic waste?

### Overview

With plastic production already exceeding 300 million tonnes per year, the mountain of waste has the potential to grow and grow. This lesson looks at whether recycling can be a solution, before examining three different economic models to see if we need to change the way we look at plastic and plastic products. The lesson asks students to consider the impact of managed, unmanaged and mismanaged waste.

### Learning outcomes

- Analyse the rapid growth in global plastic production
- Describe the different paths that plastic can take after disposal
- Consider how effective the UK is at recycling
- Decide whether a linear economy is fit for purpose in the 21st century
- Reflect on artistic works showing the plastic problem

### Resources



**Slideshow 4:**  
How can we deal with all the plastic waste?



**Student Sheet 4a:**  
Recycling cards

**Student Sheet 4b:**  
A new economy

**Student Sheet 4c:**  
What happens to plastic waste in Asia and Africa?



**Diagram:**  
Global plastic production interactive diagram

**Diagram:**  
Life cycle of a plastic bottle

# SCHEME OF WORK

## Lesson 5: The global journey of plastic waste

### Overview

The UK exports over half a million tonnes of recovered plastic packaging each year. Historically, much of this was to China, but with a ban on waste imports other solutions and destinations have been sought. Students start by mapping the destinations of plastic waste exports before and after China's ban. Then students consider the UK's options, before ranking these and creating a proposal for action.

### Learning outcomes

- Map the global destinations of UK recycling over time
- Describe how these destinations have changed over time
- Review information on the current state of UK plastic waste management
- Evaluate options for the future of UK plastic waste management

### Resources



#### Slideshow 5:

The global journey of plastic waste



#### Student Sheet 5a:

Plastic export maps

#### Student Sheet 5b:

Waste management futures info

#### Student Sheet 5c:

Waste management futures pyramid

#### Student Sheet 5d:

Whose waste is it anyway?

## Lesson 6: Approaches to reducing ocean plastic pollution

### Overview

Experts agree on the need for urgent action to tackle the issue of marine plastic pollution but disagree on the what methods should be prioritised. Students will look at two main schools of thought: 'turn off the taps', stopping plastic from entering the ocean by reducing plastic pollution, limiting single-use plastic use, improving waste management, and introducing alternative products; and 'bail out the bath', removing plastic waste from the ocean and beaches. Students engage in a silent debate followed by a group discussion to focus on what they believe is the most effective solution.

### Learning outcomes

- Understand the human use of natural resources has caused an environmental situation which needs a solution
- Evaluate different solutions to the problems, which work at different scales
- Apply skills of data gathering from a number of sources
- Debate the positive and negative features of each possible solution
- Communicate geographical information through extended writing

### Resources



#### Slideshow 6:

Approaches to reducing ocean plastic pollution



#### Student Sheet 6a:

How can we rethink plastic to solve the problem of ocean plastics?

#### Student Sheet 6b:

Plastic bag ban in Kenya

#### Student Sheet 6c:

The Ocean Cleanup

#### Student Sheet 6d:

Plastic straws

#### Student Sheet 6e:

Reusing packaging

#### Student Sheet 6f:

Beach clean-ups

#### Student Sheet 6g:

Recycling

#### Student Sheet 6h:

Reusable alternatives



# SCHEME OF WORK

## Lesson 7: Plastic decision making exercise

### Overview

Students work through an end of unit assessment that includes short answer questions, data interpretation questions and a decision making exercise. The decision making exercise uses information that students will have gathered during the silent debate in Lesson 6.

### Learning outcomes

- Understand the human use of natural resources has caused an environmental situation which needs a solution
- Understand that there are different solutions to the problems, which work at different scales
- Understand that each possible solution has positive and negative features
- Practise skills of data gathering from a number of sources; processing, interpretation, analysis, information communication and extended writing

### Resources



**Slideshow 7:**  
Decision making exercise



**Student Sheet 7a:**  
Ocean plastics assessment



**Mark scheme 7a:**  
Ocean plastics assessment

## Lesson 8: Plastics fieldwork (school grounds)

### Overview

This lesson provides a framework for conducting plastics fieldwork in the school grounds. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

### Learning outcomes

- Plan fieldwork including risk assessment
- Plan and carry out data collection
- Represent data using tables, charts and maps
- Analyse fieldwork data and draw conclusions
- Evaluate fieldwork methods and results
- Suggest ways of improving the area in terms of reducing plastic pollution

### Resources



**Slideshow 8:**  
Plastic fieldwork (school grounds)



**Student Sheet 8a:**  
Plastics fieldwork record sheet

**Student Sheet 8b:**  
Plastics fieldwork report frame

**Student Sheet 8c:**  
Plastics fieldwork evaluation

## Lesson 9: Plastics fieldwork (local area)

### Overview

This lesson provides a framework for conducting plastics fieldwork in the local area. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

### Learning outcomes

- Plan fieldwork including risk assessment
- Plan and carry out data collection
- Represent data using tables, charts and maps
- Analyse fieldwork data and draw conclusions
- Evaluate fieldwork methods and results
- Suggest ways of improving the area in terms of reducing plastic pollution

### Resources



**Slideshow 9:**  
Plastic fieldwork (local area)



**Student Sheet 9a:**  
Plastics fieldwork record sheet

**Student Sheet 9b:**  
Plastics fieldwork report frame

**Student Sheet 9c:**  
Plastics fieldwork evaluation

## Mapped against National Curriculum for England Key Stage 3, Design & Technology

KS3 Design and technology Element of the curriculum	Lessons					
	1	2	3	4	5	6
<b>Aims</b>						
• Identify and solve their own design problems and understand how to reformulate problems given to them	✓	✓	✓	✓	✓	✓
• Analyse the work of past and present professionals and others to develop and broaden their understanding	✓					
• Investigate new and emerging technologies	✓					
• Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists	✓					
• Use research and exploration, such as the study of different cultures, to identify and understand user needs		✓	✓	✓	✓	
• Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses		✓	✓	✓	✓	
• Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations						✓

# Applicable standards

## National Curriculum for England Key Stage 2

### Lesson 1: What can we do to reduce ocean plastic pollution?

#### Overview

This first lesson in this design and technology Key Stage 3 (KS3) unit introduces students to ocean plastic pollution. Students learn how the waste hierarchy is used to encourage a reduction in plastic use. Using the various teacher resources students will link the waste hierarchy to the life cycle of plastic, thinking about how the methods used in recycling link to those used in the redesign processes and how those affect the lifetime of plastic products.

#### Learning outcomes

- List the uses of plastics
- Discuss the importance of plastic
- Define the 6 Rs
- Evaluate the effectiveness of recycling in the UK
- Describe the life cycle of plastic

#### Resources



##### Slideshow 1:

What can we do to reduce ocean plastic pollution?



##### Student Sheet 1a:

What are the 6 Rs?

##### Student Sheet 1b:

Is recycling rubbish?

##### Student Sheet 1c:

Life cycle of a plastic bottle

##### Student Sheet 5d:

Waste hierarchy research

### Lesson 2: Why should we recycle?

#### Overview

In this design and technology Key Stage 3 (KS3) lesson, students identify why they should recycle and how to encourage others to recycle more. Included are teacher resources for students to apply user centred design principles to redesign a recycling bin to encourage recycling.

#### Learning outcomes

- Identify what can and cannot be recycled
- Describe how you currently recycle
- Analyse trends in recycling behaviours
- Examine the different ways to recycle different materials
- Design a new method of recycling based on user centred design

#### Resources



##### Slideshow 2:

Why should we recycle?



##### Student Sheet 2a:

Recycling questionnaire

##### Student Sheet 2b:

What happens when we recycle?

##### Student Sheet 2c:

Design a user-centred bin

##### Student Sheet 2d:

Recycling diary



##### Gallery:

How is plastic recycled?



##### External Link:

The world's deepest bin

##### External Link:

Bottle bank arcade

# SCHEME OF WORK

## Lesson 3: How do we reduce, reuse and refuse plastic products?

### Overview

In this design and technology Key Stage 3 (KS3) lesson, students will learn how real-world companies have approached reduce, reuse, refuse principles. This lesson is focussed on students understanding and applying principles of reduce, reuse, and refuse. Included are teacher resources for students to design their own sustainable fashion brand where they are empowered to apply their understanding of reduce, reuse or refuse practices.

### Learning outcomes

- Describe world population trend from a graph
- Recognise resources as finite
- Describe examples of how to reduce, reuse and refuse
- Interpret data and identify trends
- Create a design for a new product

### Resources



#### Slideshow 3:

How do we reduce, reuse and refuse plastic products?



#### Student Sheet 3a:

Buzz stations

#### Student sheet 3b:

Design your own fashion label

## Lesson 4: Should we repair?

### Overview

In this design and technology Key Stage 3 (KS3) lesson, students learn how many products are designed to become obsolete and the impact this has on the environment. This lesson is focussed on students finding solutions to make it easier to repair products. Included are teacher resources that allow students to design a modular phone that can be updated and repaired easily.

### Learning outcomes

- Describe what products can be easily repaired
- Create a modular design for easy repair
- Explain the environmental implications of products that can be easily repaired
- Define repair

### Resources



#### Slideshow 4:

Should we repair?



#### Student Sheet 4a:

Modular phone information

#### Student Sheet 4b:

Design a modular phone

# SCHEME OF WORK

## Lesson 5: Can redesigning products help?

### Overview

In this design and technology Key Stage 3 (KS3) lesson, students learn how sustainable redesign can reduce ocean plastic waste. This lesson is focussed on students conducting a product life cycle analysis on a household object before redesigning it. Included are teacher resources that allow students to critique examples of redesigns, conduct a product life cycle assessment, and redesign a product.

### Learning outcomes

- Define redesign
- Critique product redesigns
- Analyse the product life cycle of a household object
- Redesign a product

### Resources



**Slideshow 5:**  
Can redesigning products help?



**Student Sheet 5a:**  
Cryptogram

**Student Sheet 5b:**  
Redesign gallery

**Student Sheet 5c:**  
Product analysis



**External Link:**  
Edible six pack ring

## Lesson 6: Design task

### Overview

In this the final design and technology Key Stage 3 (KS3) lesson, students will apply their understanding of the 6 Rs. The focus of this lesson is to design an ocean friendly product. Students will work in groups to research, design, and pitch. Included are teacher resources which structure students independent and group activities.

### Learning outcomes

- Define sustainable design
- Design an ocean friendly product
- Draw your product design
- Reflect and evaluate your product design

### Resources



**Slideshow 6:**  
Design task



**Student Sheet 6a:**  
Design template

**Student Sheet 6b:**  
Product pitch