Encounter Edu





A resource by Encounter Edu and Common Seas

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Design and Technology Association
Geographical Association









Common Seas

Common Seas is a not-for-profit enterprise that researches, designs and implements practical project-based solutions to our global plastic pollution crisis. Our mission is to quickly and significantly reduce the amount of plastic waste produced and stop it polluting rivers and seas.

Encounter Edu

Encounter Edu designs and runs STEM and Global Citizenship education programmes, which make use of virtual exchange, live broadcast and virtual reality. These technologies create classroom encounters that widen young people's world view. Learning is further underpinned by an online library of teacher resources and training. Combined, these provide children with the experience and knowledge to develop as engaged citizens and critical thinkers for the 21st Century.

Contents

Foreword

Overview

Ocean Plastics learning objectives

1

Scheme of work	page 5
Resource guidance	page 12
Lessons	
Lesson 1: What are plastics? Part one	section 1
Lesson 2: What are plastics? Part two	section 2
Lesson 3: Where are plastics? Part one	section 3
Lesson 4: Where are plastics? Part two	section 4
Lesson 5: What impact can plastic have? Part one	section 5
Lesson 6: What impact can plastic have? Part two	section 6
Lesson 7: What can I do? Part one	section 7
Lesson 8: What can I do? Part two	section 8
Lesson 9: Plastics - a design problem	section 9
Lesson 10: Plastics - a design solution	section 10

page 2

page 3

page 4

Welcome to the Ocean Plastics Academy



Marine plastic pollution is a visible and pervasive environmental issue affecting all oceans. Recent media coverage has raised awareness of the topic, encouraging politicians, businesses and the general public to take much-needed action.

Common Seas believes that education can be an important part of the solution to addressing marine plastic pollution. The recent popularity of the topic of marine plastics has meant that there is a wealth of information and ideas for action scattered across the internet and other media.

Common Seas uniquely provides teachers with a full suite of resources across science, geography, and design and technology across Key Stages 1 to 3, that are designed to fulfil the English National Curriculum teaching requirements. Providing teachers with off the shelf lesson plans, presentations and activities they can choose to deliver in their entirety or use sections as appropriate.

Supporting a more sustainable relationship with the environment is not a quick fix, but a multi-generational endeavour. This is why Common Seas works with a range of partners to move marine plastics education from an important side issue into the mainstream.

Jo Royle Managing Director Common Seas

About the Ocean Plastics Academy



What is the Ocean Plastics Academy?

Achieving the aim of plastic-free seas is likely to be a multi-generational endeavour. As with any environmental crisis, the important place to start is from a shared understanding of the problem and then move to solutions both in terms of individual behavioural change and advocating for changes at wider scales from the community-level upwards.

Literacy is the starting point for the education programme. A shared understanding of plastics across its entire life cycle including its impact on the marine environment is crucial in developing appropriate responses and informing action on a personal and community level. A plastics literate population will also be able to inform good governance, both as leaders and voters.

However you choose to address the issue of marine plastic pollution in your classroom, it can be hard to know what children should know. Common Seas has used the UNESCO Learning Objectives for the ocean¹ as a basis for creating a set of Ocean Plastics Learning Objectives to support educators in designing an appropriate set of learning opportunities for students. These learning objectives are listed in following section.

Literacy on its own is not enough and Common Seas will also be developing engagement tools that help to shift literacy into action, so do keep in touch!

How do I use the Ocean Plastics Academy?

These resources have been designed to be an off-the-shelf teaching tool for your classroom. Of course, you know your students better than anyone and may want to adapt and change to suit your needs.

You will find a suite of supporting multimedia resources online, and these are referenced throughout the lesson plans. It is assumed that you have access to a digital projector or interactive white board to display these resources and accompanying slideshows. Students with individual devices can also view multimedia without needing an account.

If this is the first time that you are teaching an oceans-related unit to your students, consider using the Ocean for beginners resources (https://encounteredu.com/teachers/units/oceans-for-beginners-x-curric-ages-7-11) to provide context.

Is the Ocean Plastics Academy curriculum aligned?

Ocean Plastics Academy are aligned to the National Curriculum for England programmes of study for science, geography and design and technology. As the Ocean Plastics Academy develops, we will align the resources to additional curricula and standards.

UNESCO Ocean literacy for all: a toolkit https://unesdoc.unesco.org/ark:/48223/pf0000260721 (see page 24)

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 7-11 X-Curric		Les								
Ocean Plastics learning objective	1	2	3	4	5	6	7	8	9	10
Cognitive learning objectives										
• 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 cycle¹. 		✓				✓	✓		✓	~
Socio-emotional learning objectives										
• 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. 							✓	✓		
Behavioural learning objectives										
• 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.										

¹ Including improved design, alternative materials, waste management and individual behaviour.

Applicable standards

National Curriculum for England Key Stage 2

KS2 Science						sons				
Element of the Science Programme of Study	_ 1	2	3	4	5	6	7	8	9	10
Properties and changes of materials										
 Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets 	✓	✓	✓	✓						
 Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic 	✓	✓	✓	✓						
 Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda 		✓	✓							
Animals including humans										
 Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat 					✓					
 Construct and interpret a variety of food chains, identifying producers, predators and prey 					✓					
Living things and their habitats										
 Recognise that environments can change and that this can sometimes pose dangers to living things 					✓	✓	✓	✓		
Working Scientifically										
 Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary 	✓	✓					✓	✓		
 Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate 	✓	✓					✓	✓		
 Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs 	✓			✓			✓	✓		
 Use test results to make predictions to set up further comparative and fair tests 	✓									
 Report and present findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations 	✓	✓		✓			✓	✓		

Applicable standards

National Curriculum for England Key Stage 2

KS2 Geography	Lessons											
Element of the Geography Programme of Study	1	2	3	4	5	6	7	8	9	10		
Human and physical geography												
 Describe and understand key aspects of physical geography, including: climate zones, biomes and vegetation belts, rivers, mountains, volcanoes and earthquakes, and the water cycle 			✓	✓		✓	✓	✓				
 Human geography, including: types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water 			✓	✓		✓	✓	✓				
Geographical skills and fieldwork												
 Use maps, atlases, globes and digital/computer mapping to locate countries and describe features studied 					✓							

KS2 English	Lessons									
Element of the English Programme of Study	1	2	3	4	5	6	7	8	9	10
Spoken language										
Listen and respond appropriately to adults and their peers	✓	✓	✓	\checkmark	✓	✓	\checkmark	✓		
Ask relevant questions to extend their understanding and knowledge	✓	✓	✓	\checkmark	✓	✓	✓	✓		
Articulate and justify answers, arguments and opinions	✓	✓	✓	\checkmark	✓	✓	✓	✓		
Give well-structured descriptions, explanations and narratives	✓	✓	✓	✓	✓	✓	✓	✓		
Maintain attention and participate actively in collaborative conversations	✓	✓	✓	✓	✓	✓	✓	✓		
 Use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas 	✓	✓	✓	✓	✓	✓	✓	✓		
 Participate in discussions, presentations, performances, role play, improvisations and debates 	✓	✓	✓	✓	✓	✓	✓	✓		
Consider and evaluate different viewpoints, attending to and building on the contributions of others	✓	✓	✓	✓	✓	✓	✓	✓		

KS2 Mathematics	Lessons										
Element of the Mathematics Programme of Study	_ 1	2	3	4	5	6	7	8	9	10	
Statistics											
 Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs 				✓							

Applicable standards

National Curriculum for England Key Stage 2

KS2 Design and technology	Lessons									
Element of the Design and Technology Programme of Study	1	2	3	4	5	6	7	8	9	10
Design										
 Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups 									✓	✓
 Generate, develop, model and communicate ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design 									✓	✓
Make										
 Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately 										✓
Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities									✓	✓
Evaluate										
Investigate and analyse a range of existing products									✓	✓
 Evaluate ideas and products against design criteria and consider the views of others to improve work 									✓	✓
 Understand how key events and individuals in design and technology have helped shape the world 										✓

Lesson 1: What are plastics? Part one

Overview

In this lesson students investigate the properties of materials and develop an understanding of why plastic is so widely used due to its versatility. They learn how plastic is produced and then go on to investigate which material is most effective for the purpose of insulation. The lesson concludes with an overview of the historical development of plastics where students identify significant events on a timeline.

Learning outcomes

- · Match materials to their properties
- Understand the process of plastic production
- · Describe why plastic is chosen over other materials
- · Investigate which materials are the best insulators
- · Review the historical development of plastics
- Reflect on why plastic is a versatile material

Resources



Slideshow 1:

What are plastics? Part one



Activity Overview la:

Insulation investigation



Student Sheet 1a:

Materials card match

Student Sheet 1b:

Insulations investigation

Student Sheet 1c: Innovation diary



Gallery:

PET bottle production



Thinglink:

Global plastics production

Lesson 2: What are plastics? Part two

Overview

In this lesson students continue to investigate different types of plastics, so that by the end of these first two lessons they are familiar with the seven types of plastic and what they are used for. Students identify why each type of plastic is well suited to its use. They go on to complete a practical to create their own plastic slime using borax and PVA glue (creating a polymer) and reflect on the variety of uses for plastics.

Learning outcomes

- · Understand how to identify the seven types of plastic
- · Describe the plastic production process
- · Describe the plastic recycling process
- · Create a polymer
- · Reflect on sustainable alternatives to plastic

Resources



Slideshow 2:

What are plastics? Part two



Activity Overview 2a:

Making plastic



Student Sheet 2a:

Plastic production



Gallery:

Where does plastic come from?

Gallery:

How is plastic recycled?



Thinglink:

Seven Types of plastic

Lesson 3: Where are plastics? Part one

Overview

In this lesson students follow the life-cycle of a PET bottle. Using Google Maps, students track the journey of a plastic bottle during its lifetime and map the possible outcomes of where it ends up. Students go on to discover how plastic is recycled into other plastics. They then reuse a plastic bottle by completing a craft activity where they make a snack box or bird feeder. It may be possible to organise a speaker to join this lesson, some local authorities offer schools programmes or outreach workshops.

Learning outcomes

- Explore what happens to a plastic bottle after its first and only use
- Map the journey of a plastic bottle from production to recycling or litter
- Understand the recycling process
- Demonstrate how single use plastics can be reused
- Explore alternative uses for a range of discarded plastics

Resources



⊳ Slideshow 3:





Activity Overview 3a: Google maps

Activity Overview 3b: Bird feeder

Activity Overview 3c: Snack box



Student Sheet 3a:

Life cycle of a plastic bottle



Thinglink:

How is plastic recycled?



Life cycle of a plastic bottle

Lesson 4: Where are plastics? Part two

Overview

In this lesson students discover some of the incredible uses for plastic and reflect on why single-use plastics have become unpopular. Students examine data from a sample of litter collected at Henderson Island. They go on to work out how and where the plastic litter could have come from and create a bar graph representing this data.

Learning outcomes

- · Examine data from Henderson Island
- · Create a bar graph demonstrating the amount of plastic litter collected
- Explore important uses of plastic
- · Create a poster demonstrating the pros and cons of plastics
- · Reflect on societies needs / wants related to plastics

Resources



Slideshow 4:

Where are plastics? Part two



Student Sheet 4a: Henderson Island



Gallery:

Fantastic plastic

Lesson 5: What impact can plastic have? Part one

Overview

In this lesson students are introduced to microplastics and ocean plastic pollution and begin to understand how and why it occurs through investigating one of three case studies. They go on to discover some of the dangers plastic pollution and microplastics can pose to marine life and consider how entire food webs are impacted.

Learning outcomes

- · Understand ocean plastic pollution statistics
- Investigate different ways plastic pollution affects marine life
- Explore three case studies related to ocean plastic pollution
- · Understand the impact of microplastics on food webs
- · Reflect on how plastic pollution impacts the wider food web

Resources



Slideshow 5:

What impact can plastic have? Part one



Activity Overview 5a:

Food webs



Student Sheet 5a:

Plastic pollution case studies



Gallery:

Marine plastic pollution

Gallery:

Coral life (advanced)

Lesson 6: What impact can plastic have? Part two

Overview

This lesson sees students investigate how plastics get into the oceans and affect marine life. Students discover how plastic pollution doesn't start when plastic enters the ocean. They go on to consider economic, political and social elements of human geography that impact ocean plastic pollution. Students examine case studies relating to plastic pollution at home and abroad to consider the social and economic impacts.

Learning outcomes

- Understand how plastics get into the ocean ecosystem
- · Describe three ways in which ocean plastic pollution can occur
- · Discover some of the ethical and social issues related to ocean plastic pollution
- Discuss and describe how plastics pollution is linked to economics, human rights and sustainability
- · Reflect on the sustainable development goals

Resources



Slideshow 6:

What impact can plastic have? Part two



Student Sheet 6a:

Plastic impact case studies

Student Sheet 6b:

Plastic profiles

Student Sheet 6c:

The sustainable development goals



Gallery:

Marine plastic pollution

Lesson 7: What can I do? Part one

Overview

The last two lessons in this unit challenge students to work collaboratively to create a campaign based on the 6 Rs. First students find out about innovation, development and policy changes that have recently occurred. They are then briefed on their mission – to reduce the amount of plastic consumption in their school community. In groups students then design and implement their campaign, planning and launching it over the following week.

An interim lesson can follow this lesson for students to continue to work on their campaigns, measure progress, make changes and / or work on promoting their cause. They might wish to conduct surveys during this time, analyse their data and make promotional materials.

Learning outcomes

- · Name the 6 Rs and explain what each one means
- Understand developments in technology and innovation regarding plastics pollution
- · Discover how recent policy has been proposed and enacted relating to plastics pollution
- Reflect on how they can make a difference
- · Work collaboratively to plan a plastics pollution campaign

Resources



Slideshow 7: What can I do? Part one



Student Sheet 7a:

Our plastics project

Lesson 8: What can I do? Part two

Overview

In the last lesson students review the success of their campaign and the impact it had on plastic consumption. They review their targets, reflect on what went well and decide what they would do differently. They then share their results and discuss what they could do going forward. The unit of work could end with an assembly for students to share their findings and continue to spread their message.

Learning outcomes

- · Review the impact of their campaign
- · Reflect on achievements and challenges
- · Share their findings and results with a wider audience
- Discuss what they plan to do next

Resources



Slideshow 8: What can I do? Part two

Lesson 9: Design Technology - The plastics problem

Overview

In this lesson students are posed with a problem; they need to design a product which can carry a number of items from one location to another. They should attempt to design a new product and consider its features including strength, usability and materials. Students go on to evaluate existing solutions to this product in terms of strength, cost, aesthetics, usability and sustainability. Finally, they conclude by evaluating whether a new product is required or whether there are already suitable alternatives.

Learning outcomes

- Understand design criteria
- · Develop and communicate ideas
- Discuss purpose, function and appeal of products
- · Investigate and analyse a range of existing products
- · Evaluate ideas and products

Resources



Slideshow 9:

The plastics problem



Student Sheet 9a: Solutions sheet

Student Sheet 9b: Product analysis



Thinglink:

What's your bag?

Lesson 10: Design Technology - The plastics solution

Overview

Students explore a range of products which have been redesigned with sustainability in mind. They then consider some of the other single-use plastics they know of and choose one to redesign focussing on sustainability. Students then develop their designs considering the materials they will use and how it will be manufactured, pitching their idea to the class and reflecting on feedback. At the end of these two lessons students can produce a prototype.

Learning outcomes

- · Understand key events which have shaped the redesign of plastic products
- · Research and develop an idea
- Model and communicate designs in a variety of forms
- Evaluate ideas against criteria and consider the views of others
- · Select a range of tools and materials to develop a product

Resources



Slideshow 10: The plastics solution



Student Sheet 10a: Product design

Teacher guidance

The Teacher Guidance for each lesson uses a set of icons as seen below to provide visual clues to support teachers:

Lesson activities



Explain

teacher exposition using slides or script to support



Demonstration / watch

students watch a demonstration or video



Student activity

activity for students to complete individually such as questions on a Student Sheet



Pair activity

activity for students to complete in pairs



Group work

activity for students to complete in groups



Whole class discussion

teacher conducts a whole class discussion on a topic or as a plenary review



Home learning

home learning exercise for after school or alternatively, a lesson extension

Teacher ideas and guidance



Assessment and feedback

guidance to get the most from AfL (Assessment for Learning)



Guidance

further information on how to run an activity or learning step



Idea

optional idea to extend or differentiate an activity or learning step



Information

background or further information to guide an activity or explanation



Technical

specific ICT or practical hints and tips



Health and safety

health and safety information on a specific activity

Lesson 1: What are plastics? Part one

This lesson focusses on materials and their properties with an emphasis on plastic. Students discover the history, versatility and qualities of plastic and investigate how it performs as an insulator.

Resources in this book:

Lesson Overview 1

Teacher Guidance 1

Activity Overview la: Insulation investigation

Student Sheet 1a: Materials card match

Student Sheet 1b: Insulation investigation

Student Sheet 1c: Innovation diary

Resources available online:

Slideshow 1: What are plastics? Part one

Gallery: How are plastic bottles made?

Thinglink: Global plastics production

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What are plastics? Part one



Age 7-11



60 minutes

Curriculum links

- Compare and describe the properties of materials
- Predict and draw conclusions on the uses of materials based on fair tests

Resources



Slideshow 1:

What are plastics? Part one



Activity Overview la: Insulation investigation



Student Sheet 1a:

Materials card match

Student Sheet 1b: Insulation investigation

Student Sheet 1c: **Innovation Diary**



Gallery:

How are plastic bottles made?



Thinglink:

Global plastics production

Extension or home learning

Students ask their parents or carers to help them make a list of items around the home that are made from plastic, that in the past were made from a different material. For example, UPVC window frames; window frames were traditionally made from wood. They can then share their findings with the class.

Lesson overview

How did plastic become so commonplace? In this lesson students explore the properties of different materials to see what makes plastic stand out. They learn how plastic is produced and then go on to investigate which material is most effective for the purpose of insulation. The lesson concludes with an overview of the historical development of plastics with students locating significant events on a timeline.

Lesson steps

Learning outcomes

production

1. Properties of materials (10 mins)

To recap prior knowledge students match material cards to their properties and uses.

2. How is plastic produced? (10 mins)

Students look at Gallery: PET bottle production illustrating how a plastic bottle is produced and then order the events.

3. Why plastic? (5 mins)

Discuss why plastic has become so popular, due to its versatility and low cost. Take feedback on what students know about the uses of plastics.

· Describe why plastic is chosen over other materials

· Match materials to their properties

· Understand the process of plastic

4. Investigation (20 mins)

Students conduct an experiment to find out which material is the best insulator. Using a hot drink, they make predictions, measurements and draw conclusions.

· Investigate which materials are the best insulators

5. Plastic timeline (10 mins)

Students discover how recently plastic was developed through studying a timeline of significant plastic events.

· Review the historical development of plastics

6. Innovation Diary (5 mins)

Students complete the first entry in their Innovation Diaries reflecting on the various uses of plastic, its versatility and development.

· Reflect on why plastic is a versatile material

Step Guidance

1 10



Step 1 recaps students' prior knowledge of materials and their properties.

- Explain that today students will be discussing the properties of materials.
- Use slides 1-6 to look at a variety of materials, pointing out the properties of each one.
- Slide 7 explains that on their tables students have a pile of cards with either materials or properties on them.
- Students match up the cards which go together i.e.,
 Clear Acrylic, with 'Transparent, hard and often used instead of glass for items such as kitchenware'.



Often the terms 'hard', 'strong' and 'tough' are commonly misunderstood. It is made more difficult by misinformation found online.

Hard - Material which does not scratch easily (e.g. brick, diamond)

Strong - A material which does not deform, or change shape, easily. (e.g. steel)

Tough - A material which does not fracture easily. Tough materials are often ductile and can be stretched out easily. (e.g. silly putty, spider's silk)

Resources

Slideshow 1: Slides 1-7

Student Sheet 1a: Materials card match

2

10

mins



Next students discover how PET bottles are produced. PET stands for polyethylene terephthalate and is most commonly used to make single-use plastic drinks bottles. Around 13 billion of these bottles are produced in the UK each year and recent government statistics suggest only around 7.5 billion are recycled.

- Look at the Gallery which illustrates the process of manufacturing a PET bottle.
- · Look at slide 9 and ask students to discuss in pairs which order the events go in.
- · Reveal the correct order on the following slide.
- Allow students an opportunity to ask questions and share reactions.

Slideshow 1:

Slides 8-10

Gallery:

How are plastic bottles made?

3

5 mins



In this step students discuss why plastic is so popular as a material choice.

- Using slide 11 discuss with students how versatile plastic is and how its low production costs have made it a popular choice for manufacturers.
- Ask students to share what they know about the uses of plastic, what products they know to be made from plastic and why they think plastic was chosen for that particular product.

Slideshow 1:

Slide 11

TEACHER GUIDANCE 1 (page 2 of 2)

Step Guidance

4





Step 4 sees students investigate which materials are the most effective insulators.

- Using slide 12 explain that students will be testing a range of materials to find out which is the most effective insulator.
- Recap vocabulary with students and demonstrate which materials are available for testing, ensuring products such as foam are understood to be types of plastic.
- Using Activity Overview 1a: Insulation investigation facilitate students running their own investigation.
- On Student Sheet 1b students record their predictions, method and conclusions during the investigation.
- Record student's findings on a flip-chart or whiteboard and as a class identify the most effective insulator.
- Explain that the versatility of plastic, for purposes such as insulation is one of the reasons it is so popular.
- · Discuss how this test could be made fairer.

Resources

Slideshow 1:

Slide 12-13

Activity Overview la: Insulation investigation

Student Sheet 1b:

Insulation investigation

5





Next students find out how recently plastic has become a commonplace material.

- Using Thinglink: Global plastics production review the significant developments in the history of plastic. Explain how plastic surged in popularity during the 20th century but has only been around for a relatively short period of time.
- · Ask students to think about how plastic influences their lives and what they think the most important use of plastic is.

Slideshow 1:

Slide 14

Thinglink:

Global plastics production

6





At the end of each lesson in this unit students write a brief entry in their Innovation Diaries.

· Ask students to reflect on the variety of uses for plastic, its versatility and development.

Slideshow 1: Slides 15-16

Student Sheet 1c: Innovation Diary

Insulation investigation



Age 7+ (adult supervision)



20 minutes

Details

What you need

- Student Sheet 1b
- · Plastic water bottles
- Hot liquid
- Thermometers
- Range of materials: cotton wool, newspaper, foil, polystyrene, bubble wrap, cloth, etc.
- · Paper towels

Safety and Guidance



Precautions

Water will be hot and so should be decanted by an adult. Great care should be taken when removing bottle lids to avoid spillages and burns.

- Remind students and demonstrate how to conduct investigation safely.
- It is advised not to use water hotter than 43°C.

Overview

In this activity students predict which materials will provide the best insulation for a hot drink then conduct a test using a range of materials, measuring the temperature throughout and concluding which is the most effective insulator.

Preparation

Ask students to bring in plastic water bottles in preparation. You will need hot water to be distributed into bottles by an adult as additional support may be necessary.

Running the Activity

Briefing

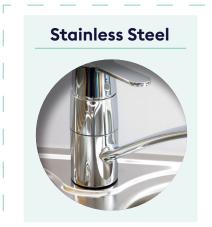
- 1. Explain that students will be testing which material is the most effective insulator. Recap prior knowledge and vocabulary. Ask students to explain how to conduct a fair test.
- Show students the range of materials available. Students make a prediction about which material will be the most effective insulator. Designate each group a material to test.
- 3. Each group takes a bottle of hot water and uses the thermometer to measure its temperature. The temperature of all the bottles does not need to be the same at the start of the test as students will be measuring the heat loss from the moment of insulation.
- 4. Students wrap their bottle in their designated material.
- **5.** Every two minutes students should carefully take the temperature of the water in the middle of the bottle and record.
- **6.** After ten minutes students take the final temperature and then calculate how much the temperature dropped from the moment of insulation.
- 7. Students then add their results to the class findings for discussion.

Expected results

 Students will find that some materials are more effective insulators than others.

Materials card match

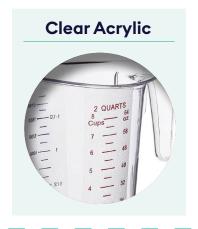




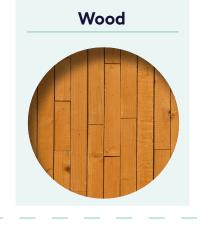




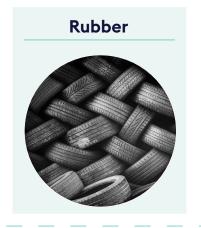












STUDENT SHEET 1a

Carbon Fibre



Iron



PET



Graphite



Glass



Strong and lightweight, used for soda and water bottles, cups, jars and trays.

Strong, dense and cheap, used for cleaning supply jugs, pool liners, twine and sheeting.

Cheap, soft material used to make pencils. Conducts heat and electricity. Relatively soft but heavy metal that rusts easily. Used to make steel.

Strong,
lightweight
material used to
make expensive
bicycles for
athletes and
bullet-proof
vests.

for building the bodies of aeroplanes. Does not rust.

Flexible and soft insulator that is cheap and easy to obtain.

STUDENT SHEET 1a

Cheap, used as insulation and packing material.

Strong alloy used to make the structures of buildings and vehicle bodies.

Does not rust easily.

An alloy, used to make musical instruments.

Tough material used to make the hulls of lightweight yachts.

Transparent, hard and often used instead of glass for items such as kitchenware. Readily available material used to build furniture and the frames of houses.

Clear, hard material used for windows and other products, and can be fragile when thin.

Insulation investigation



Name of material:

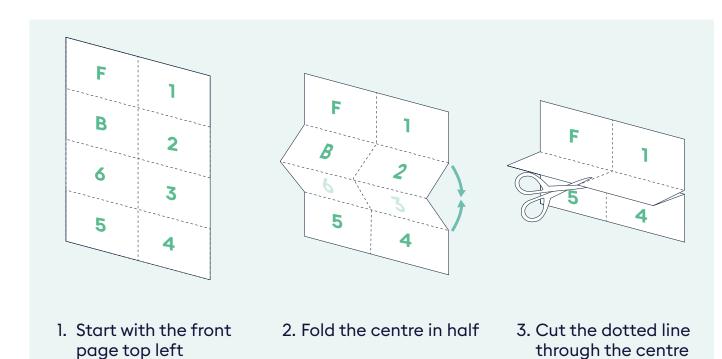
Things we will change	
Things we will keep the same	
Prediction	
Method	
Conclusion	Posults

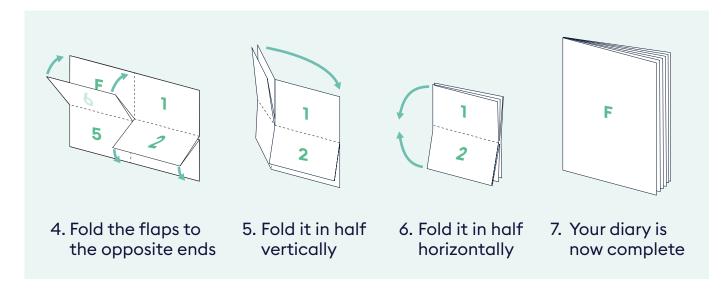
Time /r	minutacl	
Time (i	illilutes)	Temperature
0:00		
2:00		
4:00		
6:00		
8:00		
10:00		

Innovation Diary



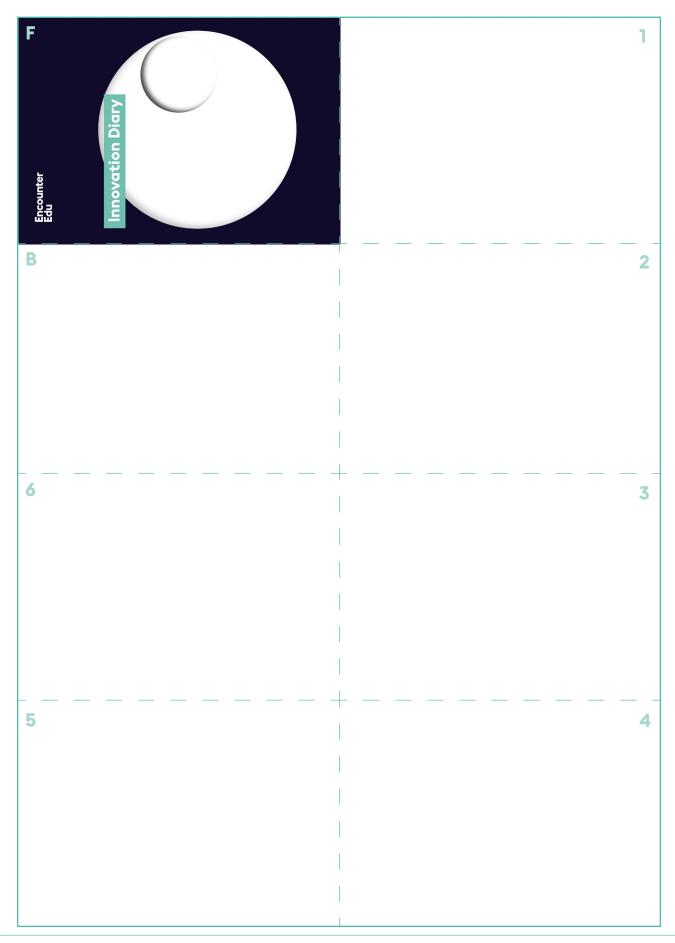
Folding instructions





To ensure the Innovation Diary has the correct proportions print on A3 paper.

STUDENT SHEET 1c



Lesson 2: What are plastics? Part two

This lesson focusses on identifying different types of plastic and understanding the process of plastic production and recycling. Students make their own plastic slime by creating a polymer using borax and glue.

Resources in this book:

Lesson Overview 2



Teacher Guidance 2



Activity Overview 2a: Making plastic slime



Student Sheet 2a: Plastic production

Resources available online:

□

Slideshow 2: What are plastics? Part two



Gallery: Where does plastic come from?

Gallery: How is plastic recycled?



Thinglink: Seven types of plastic

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What are plastics? Part two



Age 7-11



60 minutes

Curriculum links

- Investigate and understand how plastic is produced and recycled
- Investigate how to produce a polymer
- Reflect on sustainable alternatives to plastics

Resources



Slideshow 2:

What are plastics? Part two



Activity Overview 2a:

Making plastic slime



Student Sheet 2a:

Plastic production

Student Sheet:

Innovation Diary



Gallery:

Where does plastic come from?

Gallery:

How is plastic recycled?



Thinglink:

Seven types of plastic

Extension or home learning

Students conduct a brief survey of their friends and family investigating how many of them use a reusable coffee cup or water bottle. They can then share their findings with the class.

Lesson overview

Plastic is not just one product but comes in many different forms. In this lesson, students will learn about the different types of plastic and why each type might be useful. Students will then complete a practical activity creating their own plastic slime using PVA and borax (which makes a polymer) and reflect on the variety of uses for plastics.

Lesson steps

Learning outcomes

1. Plastic identification (10 mins)

Students understand that plastic comes in different forms and can often be identified by looking for a number, usually on the underside of a product. Students examine different plastics and group them accordingly.

• Understand how to identify the seven types of plastic

2. Plastic production (10 mins)

Students look at Gallery: Plastic production and discuss how plastics are produced (from crude oil to injection moulding). Students find out what is meant by monomer and polymer. They then order the significant events in this process.

Describe the plastic production process

3. Plastic recycling (10 mins)

Students look at Gallery: How is plastic recycled? which demonstrates how plastic is sorted, washed, shredded and reused in a down-cycling process.

Describe the recycling production process

4. Making plastic slime (20 mins)

Students complete Activity
Overview 2a: Making plastic slime,
in which they create a polymer
using borax and PVA glue.

· Create a polymer

5. Innovation Diary (10 mins)

Students consider alternatives for plastic bottles and discuss whether they are sustainable or not.

Reflect on sustainable alternatives to plastic

TEACHER GUIDANCE 2 (page 1 of 2)

Step Guidance

1 10



In step 1 students discover the different forms plastic takes.

- Explain that many plastic products can be identified by locating a number, usually on the underside of the product.
- Using slides 4-10 or the thinglink talk through each type of plastic and where it is commonly found.
- Give students a range of plastic products and ask them to identify the type of plastic they are made from.

Resources

Slideshow 2: Slides 1-10

Thinglink:

Seven types of plastic

2

10 mins



The next step sees students delve deeper into the process of plastic production.

- · Look at Gallery: Where does plastic come from?
- Using slides 11-14 discuss with students the process of plastic production from drilling for crude oil, through to injection moulding plastic bottles.
- · Explain what is meant by monomer and polymer.
- Ask students to look at the events on Student Sheet 2a and with a partner decide on the order they occur, based on the information in the gallery they just viewed.

Slideshow 2:

Slides 11-14

Student Sheet 2a:

Plastic production

Gallery:

Where does plastic come from?

3

10 mins



In step 3 students find out about the recycling process.

- Look at Gallery: Plastic recycling, which demonstrates how plastics are sorted, washed, shredded and then reformed into other products.
- Explain that the plastic that is reclaimed from the recycling process is down-cycled and does not create new PET bottles but is used in products such as polyester clothing and loft insulation.
- Ask students to list with a partner some of the items that are made from recycled PET bottles, based on what they saw in the gallery.
- Students feedback whether they are surprised by what they found out about plastic recycling.
- Using slide 17 explain that this type of plastic cannot be reused over and over due to the way that heat and light effect the structure of the plastic, causing it to leach harmful chemicals.

Slideshow 2:

Slides 15-17

Gallery:

How is plastic recycled?

TEACHER GUIDANCE 2 (page 2 of 2)

Step Guidance



20 mins



Step 4 sees students complete a practical activity to create a polymer and make plastic slime.

- Using Activity Overview 2a: Making plastic slime in groups students make a polymer by mixing PVA glue and borax.
- Explain how mixing the two ingredients creates a polymer and can take the form of both a liquid and a solid.
- Use slide 19 to discuss reversible and irreversible changes in plastics.

Resources

Slideshow 2: Slides 18-19

Activity Overview 2a: Making plastic slime

5 10 mins



Finally, students reflect on their learning in their Innovation Diaries.

- Ask students to reflect on what they now know about recycling plastic.
- They should consider the alternatives to PET bottles and say whether they are sustainable.

Slideshow 2: Slides 20-21

Student Sheet: Innovation Diary

+ 10

mins



Students conduct a brief survey of their friends and family investigating how many of them use a keep-cup or reusable water bottle. They can then share their findings with the class.

Making plastic slime



Age 7+ (adult supervision)



20 minutes

Details

What you need

- PVA glue
- · Cups / containers
- Food colouring
- Water
- Borax powder (available at most large grocery stores near the laundry detergent)
- Table spoon (for stirring and measuring)

Safety and Guidance



Precautions

Care should be taken to avoid spills. Do not ingest any of the ingredients.

• Remind students and demonstrate how to conduct the investigation safely.

Overview

Students combine borax and PVA glue to make a slime-like plastic which is a type of polymer and takes the form of both a liquid and a solid. Slime should be kept in a sealed bag when not in use as it can become quite messy.

Preparation

It may be preferable to run this activity in small groups with an adult as extra support may be required.

Running the Activity

Briefing

- 1. Fill one small cup with water and add a spoonful of the borax powder and stir it together. Set it aside.
- 2. Fill the other small cup with about 2.5 cm of glue.
- 3. Add three tablespoons (20 ml) of water to the glue and stir.
- 4. Add a few drops of the food colouring and stir it until mixed.
- Add one tablespoon of the Borax solution you made earlier and stir well. Watch the slime form.
- **6.** After the slime forms let it sit for about 30 seconds and then pull it off the spoon and play with it!

Expected results

In this activity students create a polymer that has the properties of both
a liquid and a solid. Solid molecules are close together, liquid molecules
are spread out, and polymer molecules chain themselves together.
Polymer molecules are found in things like rubber bands, trainer soles,
plastic water bottles and even chewing gum. The slime should take the
form of a liquid when placed in a beaker, yet has the properties of a solid
when handled, stretched and squeezed.

Plastic production



Cut out and place the events in the correct order

The petroleum is broken down into tiny parts called monomers. The crude oil is separated, or distilled, into different parts according to what it will be used for. Some will be used for heating fuel, motor fuel or to make chemicals. Some of the oil, called petroleum, is used to make plastic. Crude oil is mined from deep underground, often from below the sea. Plastic pellets can be formed into a range of objects by being heated, extruded (stretched) and moulded into different shapes. Chemicals are added to the monomers to join them together into long strings called polymers. These polymers can be used to make plastic pellets.

Lesson 3: Where are plastics? Part one

This lesson explores the journey and life-cycle of a single-use PET bottle and revises the recycling process. Students find out how to reuse single-use plastics by making a bird-feeder or snack box.

Resources in this book:

Lesson Overview 3



Teacher Guidance 3



Activity Overview 3a: Mapping a bottle

Activity Overview 3b: Bird feeder

Activity Overview 3c: Snack box



Student Sheet 3a: Life cycle of a plastic bottle

Resources available online:

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Slideshow 3: Where are plastics? Part one



Thinglink: Life cycle of a plastic bottle



Subject Update: Marine plastics

Subject Update: Marine plastics facts and figures

Subject Update: Alternatives to plastic

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

Where are plastics? Part one



Age 7-11



60 minutes

Curriculum links

- Investigate and understand how plastic bottles are recycled
- Create a new product by reusing a single-use bottle
- Reflect on sustainable alternatives to single-use plastics

Lesson overview

In this lesson students follow the life cycle of a PET bottle. Using Google Maps, students track the journey a plastic bottle goes on during its lifetime and map the possible outcomes of where it could end up. Students go on to consider some alternatives to recycling plastic, such as re-using it.

Resources



Slideshow 3:

Where are plastics?
Part one



Activity Overview 3a:

Mapping a bottle

Activity Overview 3b:

Bird feeder

Activity Overview 3c:

Snack box



Student Sheet 3a:

Life-cycle of a plastic bottle

Student Sheet:

Innovation Diary



Gallery:

How is plastic recycled?



Thinglink:

Life cycle of a plastic bottle



Subject Update:

Marine plastics facts and figures

Subject Update:

Alternatives to plastics

Learning outcomes

1. The PET bottle (10 mins)

Lesson steps

Students discuss what they think happens to plastic bottles once they've finished with them and explore some statistics about plastic use, recycling and litter.

bottle after its first and only use

• Explore what happens to a plastic

2. The plastic journey (20 mins)

Using Google Maps students plot the journey of a plastic bottle from the drilling of oil to the retailer, right through to its arrival at a recycling centre. Note: Students will require a Google account to complete this activity.

 Map the journey of a plastic bottle from production to recycling or litter

3. Bird-feeder / snack box (20 mins)

Students complete Activity 3b: Bird-feeder and / or Activity 3c: Snack box. They then consider the alternatives to throwing plastics away and evaluate their new product. • Demonstrate how single-use plastics can be reused

4. Alternative thinking (10 mins)

Students mind map ideas of alternative uses for single-use plastics.

• Explore alternative uses for a range of discarded plastics

Extension or home learning

Students research online and make an art project which uses plastic recycling to share with the class.

Guidance Step

1 10 mins



In step 1 students develop their understanding of what happens to a PET bottle after its one and only use.

- · Ask students what they think happens to PET bottles once they have been discarded.
- · Draw out answers related to landfill, recycling, litter
- · Using slides 3-11 discuss and contextualise some of the statistics around plastic use and recycling, using relatable examples.

Resources

Slideshow 3:

Slides 1-11

2

20 mins



Step 2 sees students use Google maps to track the journey of a PET bottle during its life.

- · Remind students that PET bottles are not recycled into new bottles but are down-cycled by looking at Gallery: How is plastic recycled?
- · Students then plot on a map a possible journey a PET bottle might go on during its life time using the information on Student Sheet 3a.
- · Using Activity Overview 3a: Google maps students can either plot the stages provided or can research local amenities to plot.

Slideshow 3:

Slides 12-13

Activity Overview 3a: Mapping a bottle

Student Sheet 3a:

Life-cycle of a plastic bottle

Gallery:

How is plastic recycled?

Thinglink:

Life cycle of a plastic bottle

3





Students now compete a practical activity which demonstrates two ways plastic bottles can be re-used.

- · Using Activity Overview 3b and 3c students make either a bird feeder or snack box, re-using a discarded plastic cola or milk bottle.
- · Use slide 16 to encourage students to evaluate their new product and give feedback to the class.

Slideshow 2:

Slides 14-16

Activity Overview 3b:

Bird feeder

Activity Overview 3c:

Snack box

4





In step 4 students reflect on alternatives uses for singleuse plastics.

· In their Innovation Diaries students reflect on some of the ways single-use plastics could be re-used before being discarded.

Slideshow 3:

Slides 17-18

Student Sheet:

Innovation Diary





Students research online some of the many ways plastic bottles can be reused for art projects. Students could either collect a variety of ideas and then make one in your art or D&T lesson the following week, or they could complete the activity at home and bring it in to share.

Mapping a bottle



Age 7+ (adult supervision)



15 minutes

Details

What you need

- Laptops or computers
- Google account

Find out more

The stages provided are based on the following facts. The UK imports most of its crude oil from Norway. Fawley Oil refinery is the largest in the UK. Hemswell in Lincolnshire is home to the largest PET bottled manufacturer in the UK. Nestle's new £35 million water bottling plant in located in Buxton, Derbyshire. Plastic recycling can be shipped as far away as China.

Find out more



www.encounteredu.com/cpd/ subject-updates/learn-morealternatives-to-plastic

Overview

This activity allows students to map the journey of a single-use plastic bottle from source to retailer and on to the recycling centre, or out to sea as litter.

Preparation

This activity works best on laptops or PCs so ensuring access in advance may be necessary. It would be advantageous if students are already familiar with Google maps, so you may wish to incorporate this into an ICT lesson. Students can work in pairs to support one another. A paper map of the area with place names has been provided on the following page. This can be used by students if IT is an issue.

Running the Activity

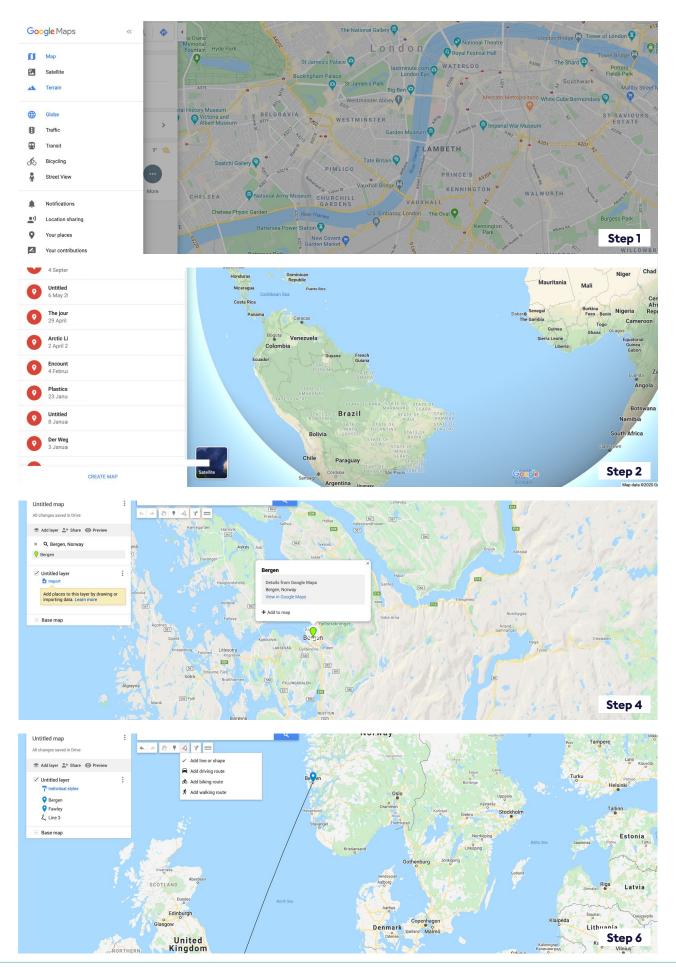
Briefing

- **1.** Go to www.google.com/maps.
- 2. Log into your Google account.
- 3. Go to the side bar menu and select 'your places', then 'maps' and click on 'create map'.
- 4. In the search bar add the first location i.e. Bergen, Norway and click 'add' to the map. You can now change the icon and the colour etc.
- Add the next location as above and repeat until you have added all your locations.
- 6. Click the 'Draw a line' icon under the search bar and link all the locations together. You can change the style or colour of the line by choosing the 'Select items' icon.
- 7. Edit the title and description of the map and choose which 'Base map' you wish to use.
- 8. You can then share it or print it.

Expected results

 Students will see how far a single- use plastic bottle travels, only to be used briefly before being discarded.

ACTIVITY OVERVIEW 3a



ACTIVITY OVERVIEW 3a



Bird feeder



Age 7+ (adult supervision)



20 minutes

Details

What you need

- Medium 500ml plastic drink bottle
- 2 wooden spoons
- String (30cm)
- Ruler
- Marker pen
- Scissors
- Tray
- · Bird seed

Safety and Guidance



Precautions

Great care should be taken when using scissors. You may wish to run this activity in small groups with closer adult supervision.



Overview

This activity shows how to make your own plastic bird feeder. Win-win for you and the environment.

Preparation

It may be preferable to run this activity in small groups with an adult as extra support may be required. Ask students in advance to bring in the materials required such as bottles and spoons.

Running the Activity

- 1. Prepare work space by clearing desks and laying newspaper down.
- 2. Wash the bottle out with water.
- **3.** Measure about 10cm up the bottle and draw a small circle. It needs to be about the same size as the handle of your wooden spoon.
- **4.** On the opposite side draw a larger circle, about the size of a big coin. The bottom of the circles need to be at the same height.
- **5.** Squeeze the bottle together and carefully cut the circle out. Do not try to poke a hole in the bottle.
- **6.** Put the wooden spoons into the bottle. The big end of the spoon needs to go snugly in the big hole.
- 7. Put the lid on the bottle.
- 8. Use string to make a loop so you can hang the bird-feeder.
- 9. In a tray at home, fill the bottle with seeds. The tray will stop the seeds making a mess.

Expected results

Students will have reused a plastic bottle which would normally be discarded. They can then consider the advantages and disadvantages of plastic as a material and evaluate their product by asking:

Who would want to use it?
Why is plastic good for this?
What is good about your product?
What could you to do make your product better?
Why is it important to reuse plastic?

Snack box



Age 7+ (adult supervision)



20 minutes

Details

What you need

- 1 litre / 2 pint plastic milk bottle
- · Self-sticking velcro pads
- Stickers (for decorating)

Safety and Guidance



Precautions

Great care should be taken when using scissors. You may wish to run this activity in small groups with closer adult supervision.

 Remind students and demonstrate how to conduct activity safely.



Overview

This activity shows how to make your own snack box from plastic.

Preparation

It may be preferable to run this activity in small groups with an adult as extra support may be required. Ask students to bring in the milk bottles in advance.

Running the Activity

Briefing

- 1. Prepare your area by clearing your desk, laying newspaper down and collecting the materials. Don't forget to wash out the bottle before use.
- 2. Take the pen and draw a horizontal line around the bottle, approximately 10cm from the bottom. Then draw out a semi-circle above this line on each side and the front of the milk carton. These will be the flaps on your box
- 3. On the back, i.e. opposite the handle, measure up a further 10cm and draw a semi-circle above this line. In the picture on the left, you can see how the back section will fold over to be your lid.
- **4.** Squeeze the milk carton together at the top and cut into it. Then cut around the edges of each semi-circle.
- 5. Fold the flaps and the lid along the ridge in the milk bottle.
- Stick a velcro pad to the front of the bottle, just below the folded semi-circle.
- 7. Attach the velcro pads together, removing the backing from the second pad and close the lid. This will stick the second pad in the right place.
- 8. Check and make sure your pads are on securely.
- 9. Put in your snacks!

Expected results

Students will have reused a plastic bottle which would normally be discarded. They can then consider the advantages and disadvantages of plastic as a material and evaluate their product by asking:

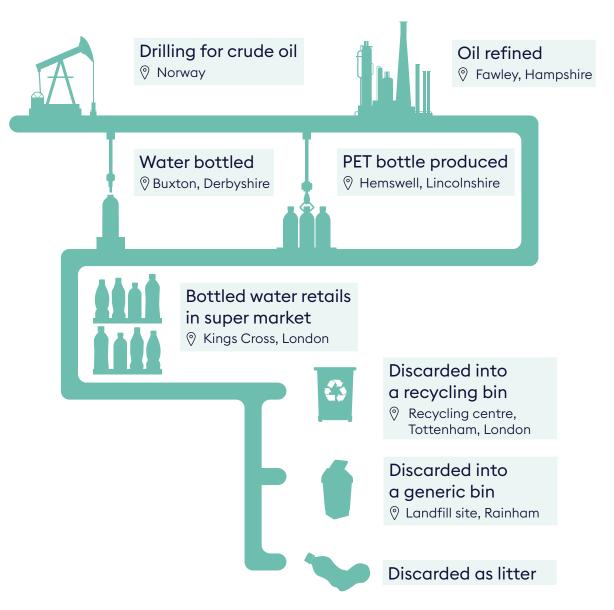
Who would want to use it?
Why is plastic good for this?
What is good about your product?
What could you to do make your product better?
Why is it important to reuse plastic?

Life-cycle of a plastic bottle



Using Google Maps plot the journey a single-use PET bottle might take during its life.

Below is an example route you can use, or you might wish to research a possible journey for a bottle distributed in your local area.



Can you suggest a possible route the bottle might take, to end up in the ocean?

Lesson 4: Where are plastics? Part two

This lesson starts by demonstrating how much plastic rubbish was collected on Henderson Island in 2017. Students then go on to consider whether we need plastic and reflect on the pros and cons of a variety of plastic products.

Resources in this book:



Lesson Overview 4



Teacher Guidance 4



Student Sheet 4a: Henderson Island trash survey

Resources available online:



Slideshow 4: Where are plastics? Part two



Gallery: Fantastic plastic

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

Where are plastics? Part two



Age 7-11



60 minutes

Curriculum links

- Present and interpret data
- Weigh up the pros and cons of a variety of plastics
- Reflect on the impact of plastics on society

Resources



Slideshow 4:

Where are plastics? Part two



Student Sheet 4a: Henderson Island

Student Sheet: Innovation Diary



Gallery:

Fantastic plastic

Extension or home learning

Students select the most important possession they have which is made of plastic and write a paragraph explaining why plastic is the most effective material for this product and why they value it so highly. Students can then share their ideas later in the week.

Lesson overview

In this lesson students discover some of the incredible uses for plastic i.e. medical science and space exploration and reflect on why single-use plastics have become unpopular. Students examine data from a sample of litter collected on Henderson Island. They go on to consider where the plastic litter could have come from and create a bar graph representing this data.

Lesson steps

Learning outcomes

1. Beach litter survey (10 mins)

Students examine the data from the beach survey at Henderson Island in the Pacific and discuss how various items could have arrived there.

2. Data analysis (10 mins)

Using this data students create a bar graph demonstrating what percentage of the pollution is plastic and draw conclusions about its origin.

3. Fantastic plastic! (10 mins)

Students look at Gallery: Fantastic plastic to discover some of the fascinating ways plastic is used to improve our health, life and

scientific endeavours.

4. Pros and cons (15 mins)

Students choose two uses of plastic that they feel represent the pros and cons of plastics and create a poster illustrating these uses and their impacts.

5. Who needs plastic? (15 mins)

Students write an entry in their Innovation Diary, summarising how they feel about the different uses for plastics, which are important and which are unnecessary.

· Examine data from a beach clean up

· Create a bar graph demonstrating the amount of plastic litter collected

· Explore important uses of plastic

• Create a poster demonstrating the pros and cons of plastics

· Reflect on the pros and cons of plastics

TEACHER GUIDANCE 4 (page 1 of 2)

Step Guidance

1 10



In step 1 students are introduced to Henderson Island, where a 2017 study collected and analysed over 55,000 pieces of litter.

- Using slides 3-5 introduce students to the location of Henderson Island and ask them to locate it on maps or globes.
- Explain that researchers collected over 55,000 pieces of plastic to analyse their composition and origin.
- Ask students to discuss how some of the plastic pieces of litter might have ended up there.

Resources

Slideshow 4: Slides 1-5

Student Sheet 4a: Henderson Island

2 10 mins



Step 2 sees students use this data to create a bar graph representing a portion of the data.

- · Using Student Sheet 4a, students select the items they would like to represent on their bar graph.
- · Ask students to think about the most appropriate increments to use, for example students could label the x axis with the types of rubbish and the y axis with increments of 25.
- · They then answer questions on Student Sheet 4a.

Student Sheet 4a: Henderson Island

3 10 mins



The next step reminds students that not all plastic is bad, some of it is incredible and we rely on it for all sorts of fascinating reasons.

- · Look at Gallery: Fantastic plastic to discover some of the incredible uses of plastic.
- Using slides 6-7 explain that without plastics we would not have developed many medical, technological and innovative procedures that are of huge scientific importance.

Slideshow 4: Slides 6-7

Gallery:

Fantastic plastic

4 15

mins



In step 4 students reflect on the pros and cons of plastics.

- Ask students to choose one important use of plastic and one unnecessary use and create a poster outlining the ways in which we need plastic and the ways we could reduce plastic use.
- · On plain paper students create posters, individually or in groups.

TEACHER GUIDANCE 4 (page 2 of 2)

Guidance Step Resources The last step in today's lesson is for students to reflect on Slideshow 4: 5 Slides 8-9 the pros and cons of plastics. 15 · Ask students to write in their Innovation Diaries **Student Sheet:** mins reflecting on how they currently feel about plastic as a **Innovation Diary** material, where it is vital and where it is unnecessary. Students select the most important possession they have which is made of plastic and write a paragraph explaining 20 why plastic is the most effective material for this product and why they value it so highly. Students can then share their ideas later in the week.

Henderson Island trash survey





Henderson Island lies halfway between New Zealand and Chile in the South Pacific. No one lives there, yet in 2017 researchers collected nearly 55,000 pieces of trash from the beach to analyse their composition and origin. Plastic fragments were found to have come from Russia, the United States, Europe, South America, Japan, and China.

The table below details the frequency of each item collected on Henderson Island. Choose ten items and create a bar chart which represents the data.

2 pieces of plastic cutlery	486 plastic bottle tops and lids	3,336 plastic fishing cords / ropes	16 pieces of polystyrene	
10 plastic drinking straws	43 pieces of melted plastic	220 plastic fishing line	48,121 plastic fragments	
3 plastic tiling spacers	24 plastic lollipop sticks	16 plastic glow sticks	642 plastic strapping	
2 plastic tooth brushes	60 plastic bags	50 plastic buoys	207 plastic netting	
6,774 plastic pellets	27 plastic pipes	25 plastic buckets	121 plastic fencing	
115 plastic bottles	5 pieces of metal	4 shoes	245 plastic crates	
10 plastic pen caps	3 plastic lighters	4 plastic razors	4 foam buoys	
16 aluminium buoys	10 lightbulbs	8 glass bottles	67 glass fragments	

STUDENT SHEET 4a

Title										
Number										
of items collected										
on the island in 2017										
Plastic Item										
How do you	think it	ems su	ch as fi	shing lii	ne and I	netting	end up	on the	island?	
How might i	tems su	ıch as t	oothbr	ushes a	nd plas	tic cutl	ery end	l up her	e?	
Which items	do you	ı think d	are easi	est to r	educe?					
How could t	his be a	chieve	d?							

Lesson 5:

What impact can plastic have? Part one

This lesson introduces students to microplastics and the effect of ocean plastic pollution on three animals; the albatross, the Galapagos green turtle and zooplankton. Students go on to explore how plastic pollution can impact entire food webs.

Resources in this book:

Lesson Overview 5

Teacher Guidance 5

X

Activity Overview 5a: Food webs

国

Student Sheet 5a: Plastic pollution case studies

Resources available online:

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Slideshow 5: What impact can plastic have? Part one

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Gallery: Coral life (advanced)

Gallery: Marine plastic pollution

Subject Update: Food webs

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What impact can plastic have? Part one



Age 7-11



60 minutes

Curriculum links

- Understand the impact of plastic pollution on marine life
- Reflect on how plastic pollution impacts food webs

Resources



Slideshow 5:

What impact can plastic have? Part one



Activity Overview 5a:

Food web



Student Sheet 5a:

Plastic pollution case studies



Gallery:

Marine plastic pollution

Gallery:

Coral life (advanced)

Extension or home learning

Students make a postcard to raise awareness about ocean plastic pollution and the impact it can have on marine life. These can be used as part of their campaign in lessons seven and eight.

Lesson overview

In this lesson students are introduced to microplastics and ocean plastic pollution and begin to understand how and why it occurs through investigating three case studies. They go on to discuss some of the dangers ocean plastic pollution and microplastics can pose to marine life and consider how entire food webs are affected.

Lesson steps

Learning outcomes

1. Plastic stats (10 mins)

Students explore some of the recent statistics relating to ocean plastics pollution and begin to understand the scale of the problem. Contextualise and understand ocean plastic pollution statistics

2. The plastic pollution problem (10 mins)

Using Gallery: Marine plastic pollution students are introduced to some of the ways in which marine life can be adversely affected by plastics.

• Investigate different ways plastic pollution affects marine life

3. Case study (15 mins)

Students examine one of three case studies outlining how the albatross, turtle and zooplankton have been found to be threatened by different types of plastic pollution. • Explore three case studies related to ocean plastic pollution

4. Food webs (15 mins)

Students explore how species are interdependent through creating an ocean food web. This illustrates that when one species is threatened, it has an impact on the wider ecosystem.

• Understand the impact of microplastics on food webs

5. Innovation Diary (10 mins)

Students summarise what they learnt and reflect on what had the most impact.

 Reflect on how plastic pollution impacts the wider food web

TEACHER GUIDANCE 5 (page 1 of 2)

Step Guidance

1 10



Step 1 presents and contextualises some statistics about plastic pollution.

 Go through slide 3 discussing each statistic and encouraging students to feedback and share their thoughts and reactions.

Resources

Slideshow 5: Slides 1-3

2





In step 2 students see some of the devastating affects plastic pollution has on marine life.

- · Look at Gallery: Marine plastic pollution.
- Using slides 5-7 talk through the effects of plastic pollution on marine life.
- Some of the images are upsetting, so check the images first and use your discretion as to whether appropriate for your class.

Slideshow 5:

Slides 4-7

Gallery:

Marine plastic pollution

3

15 mins



Next students investigate one of three case studies.

- · Using slide 8, explain that students will be allocated either the Albatross, Galapagos Turtle or Zooplankton case studies to investigate.
- · In groups students read the information and then explain to other groups what they've discovered.
- Encourage students to share their thoughts and feelings while completing this step.

Slideshow 5:

Slide 8

Student Sheet 5a:

Plastic pollution case studies

4

15 mins



In step 4 students discover how species are interdependent through constructing a food web. They go on to consider how threats to any of the creatures in the food web have wider implications for other marine animals.

- Look at Gallery: Coral life (advanced) to demonstrate the interdependence of organisms within an ecosystem.
- Using slides 10-12 look at a variety of food chains.
 Students can order the species on mini white-boards.
- · Ask students to reflect on what happens to the food chain if one creature is threatened.
- Use Activity Overview 5a: Food web to demonstrate species interdependence.

Slideshow 5:

Slides 9-13

Activity Overview 5a:

Food web

Gallery:

Coral life (advanced)

TEACHER GUIDANCE 5 (page 2 of 2)

Guidance Step Resources Students reflect on what they've learnt today. Slideshow 5: 5 Slides 14-15 \cdot In their Innovation Diaries, students write an entry 10 outlining how they felt about the three case studies. mins **Student Sheet:** \cdot They should then write a sentence which explains how **Innovation Diary** threats to one species can impact a whole food web. Students make a postcard to raise awareness about +

20



ocean plastic pollution and the impact it can have on marine life. These can be used as part of their campaign in lessons seven and eight.

Food web



Age 7+ (adult supervision)



20 minutes

Details

Each pair will need

- Cardboard
- Scissors
- Tape
- Wool or string

Safety and Guidance



Precautions

This activity requires cutting out a cardboard ring and making holes in the cardboard. These will need to be done using adult supervision or, for younger children, an adult can create the cardboard template for children and allow them to connect the different species using string.

Find out more



www.encounteredu.com/cpd/ subject-updates/learn-more-foodwebs

Overview

It is often quite tricky to 'see' all the relationships between the different plants and animals in an ecosystem and so scientists use the idea of a food web to show how different life in the ocean is connected. As you start to connect life in the ocean with wool or string, you will start to see the web develop. A healthy ocean requires a balance between the different living things. If any of the individual animals or plants is affected by human activity or natural events, then the whole ecosystem is affected.

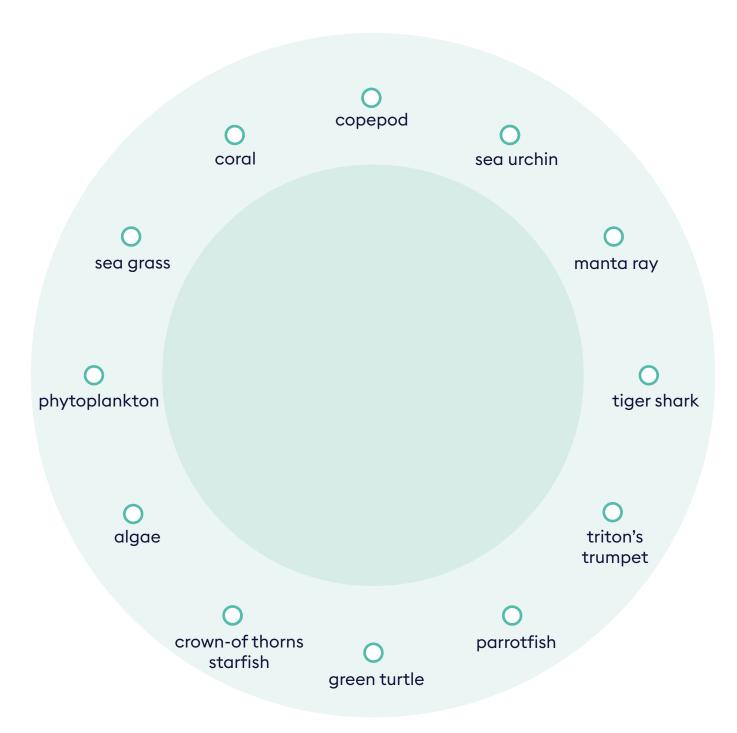
Running the Activity

- 1. Cut out a ring of cardboard at least 20 cm in diameter (or two rings and stick together to make stronger).
- Punch 12 holes around the ring at evenly spaced intervals like a clock face.
- **3.** Write the names of the following species next to the holes: coral, sea grass, phytoplankton, algae, crown of thorns starfish, green turtle, parrot fish, triton's trumpet, tiger shark, manta ray, sea urchin, copepod.
- 4. Cut some wool or string.
- 5. Tie the wool to a producer.
- **6.** Link this producer to the next organism along the food chain by passing the string through each hole, e.g. link algae to sea urchin and then to triton's trumpet or crown-of-thorns starfish.
- 7. When you have reached the top predator, tie the wool or string again, to end the chain.
- **8.** Repeat this process for all the producers, until you have created a food web.
- 9. Use Gallery: Coral life (advanced) to help you.

Expected results

 Students will understand how many different species are dependent on one another in the ocean and discover that if one is affected by plastic pollution this has an impact on other species and the wider food chain.

ACTIVITY OVERVIEW 5a



Plastic pollution case studies







Albatross

The albatross is a seabird found in the Southern Ocean and North Pacific. They are among the largest flying birds with the Great Albatross having a wingspan of up to 3.7m. They feed on squid, fish and krill by either scavenging, surface seizing or diving. They are colonial birds nesting on remote oceanic islands. Pair bonds between males and females last several years, pairs use ritualised dances to recognise each other and strengthen bonds. Both parents help raise the young; taking turns to incubate the egg and go fishing to bring food back for the chicks.

Of the 22 species of albatrosses, three species are critically endangered, five are endangered, seven species are threatened and seven are vulnerable. Threats include introduction of non-indigenous predators, hunting for feathers, over fishing and becoming caught on fishing equipment. As well as plastic ingestion.

A study of Laysan Albatross chicks in 2009 on Midway Island in the Pacific Ocean found large amounts of plastic in the stomachs of deceased chicks. Plastic takes up space in the albatross's stomach that should be for food or can cause an obstruction meaning no food can get through, which causes the bird to starve to death. Adults often regurgitate plastic for chicks to eat which means the chicks never eat enough nutrients and do not survive to adulthood.

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49







Galapagos Green Turtle

Galapagos Green Turtles are found in subtropical waters in the Pacific Ocean and are the only species of green sea turtle to nest on the beaches of the Galapagos Islands. They differ from other marine turtles as they have serrated lower jaw and scales which cover their eyes, like eyelids. They can grow to 84cm long and weigh up to 136kg. Galapagos Green Turtles are extremely fast swimmers, their powerful flippers allow them to travel at speeds up to 35mph. They mainly feed on molluscs, crustaceans and seaweed, but also eat jellyfish and fish eggs.

Females return to the same beaches where they hatched to lay their eggs, laying between 50 and 200 eggs in nests dug out of the sand. After approximately two months the hatchlings emerge and immediately head for the sea. Those who make it can take up to twenty years to mature and return to lay their own eggs. Males can spend their whole lives at sea.

They are an endangered species. Many turtles ingest plastic bags mistaking them for jellyfish, causing fatal blockages in their guts or starving them because they feel full. Turtles also face the risk of becoming entangled in plastic debris such as plastic twine and nylon fishing lines, causing fatal injuries or drowning as they cannot surface to breath.







Zooplankton

Zooplankton are organisms drifting in oceans, seas and bodies of fresh water. The word zooplankton comes from the Greek zoon, meaning animal and planktos, meaning wanderer or drifter. Zooplankton are usually microscopic – copepods, a type of zooplankton could fit on the head of a pin. However, some such as jellyfish are larger and visible to the naked eye. They have hard shells and antennae to sense predators. Some copepods can move very quickly through the water at speeds up to one hundred times faster than Usain Bolt, relative to their size.

Zooplankton are found in surface waters where food is abundant, they feed on bacterioplankton, phytoplankton (tiny plants) and other zooplankton as well as 'marine snow' (tiny pieces of organic matter including dead animals). They are found in abundance across the ocean, their numbers are affected by water salinity and temperature.

They play a vital role in aquatic food webs as they are eaten by many higher consumers such as fish.

Recent research into copepods has been investigating whether ingestion of microplastics affects the health of these tiny creatures, which may then affect the carbon cycle and whether there are wider implications for animals further up the food chain who eat them.

Lesson 6: What impact can plastic have? Part two

In this lesson students discover the variety of ways plastics can enter the ocean. They then go on to debate and discuss some of the ethical and social issues related to the plastics problem, ultimately reflecting on who is responsible.

Resources in this book:

Lesson Overview 6

Teacher Guidance 6

Student Sheet 6a: Plastic impact case studies

Student Sheet 6b: Plastic profiles

Student Sheet 6c: The sustainable development goals

Resources available online:

Slideshow 6: What impact can plastic have? Part two

Gallery: Marine plastic pollution

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What impact can plastic have? Part two



Age 7-11



60 minutes

Curriculum links

- Understand the variety of ways plastics can enter the ocean
- Debate, discuss and reflect on the social, ethical and sustainable issues related to plastics pollution

Resources



Slideshow 6:

What impact can plastic have? Part two



Student Sheet 6a:

Case Studies

Student Sheet 6b:

Plastic profiles

Student Sheet 6c:

The sustainable development goals

Student Sheet:

Innovation Diary



Gallery:

Marine plastic pollution

Extension or home learning

Students write a tweet that they would send to one of the major coffee retailers expressing their concerns and suggesting how to improve the disposal cup issue. These can be written on post-it notes and form part of a display.

Lesson overview

This lesson sees students investigate how plastic gets into the ocean and affects marine life. Students discover how plastic pollution doesn't start when plastic litter enters the ocean. They go on to consider economic, political and social elements of human geography that impact ocean plastic pollution. Students examine case studies relating to plastic pollution at home and abroad to consider the various elements that contribute to the problem.

Lesson steps

Learning outcomes

How does plastic enter the ocean? (10 mins)

Students follow the process of plastic production and discover that plastic enters the ocean in many ways.

Understand how plastics get into the ocean ecosystem

2. How does plastic pollution occur? (10 mins)

Students discuss different ways in which ocean plastic pollution can occur and how this might affect marine life.

Describe three ways in which ocean plastic pollution can occur

3. Case studies (15 mins)

Through exploring the case studies students discover some complex social and ethical issues which affect the plastic pollution problem.

 Discover some of the ethical and societal issues related to ocean plastic pollution

4. How does this affect the global community? (15 mins)

Students consider the perspectives of different stakeholders and debate how economics, human rights and sustainability all influence plastics pollution.

They then create soundbites from some of the individual characters involved.

 Discuss and describe how plastic pollution is linked to economics, human rights and sustainability

5. Innovation Diary (10 mins)

Students review the sustainable development goals and reflect on how ocean plastic pollution is related to many of the goals.

Reflect on the sustainable development goals

TEACHER GUIDANCE 6 (page 1 of 2)

Step Guidance

1 10



Step 1 demonstrates that plastic production can impact the ocean in a number of ways.

- Using slides 3-7 explain how plastic production can impact the ocean from drilling for fossil fuels, through the chemicals involved in production, through littering and our throw-away culture, to microfibers and microbeads being washed down our drains.
- After each slide encourage students to share their thoughts on what they have learnt.

Resources

Slideshow 6: Slides 1-7

2 10



In step 2 students consider how each of the events in step 1 could affect marine life.

- Using slide 8 in small groups students discuss each element involved in plastics pollution and make suggestions of how this could impact marine life.
- · Students suggest three ways this might occur.
- Mind map student's ideas on a flip-chart or whiteboard.
- Look at Gallery: Marine plastic pollution to remind students of the devastating effect of plastics on wildlife.

Slideshow 6:

Slides 8-9

Gallery:

Marine plastic pollution

3 15



The next step involves students studying one of three case studies, exploring some of the social and ethical issues around plastics.

- In groups students read the information in their allocated case study and share their initial thoughts.
- They then write their responses to the talking points on the left of Student Sheet 6a.

Slideshow 6:

Slide 10

Student Sheet 6a:

Case studies

4 15



Step 4 asks students to consider the perspectives of a variety of individuals affected by the plastic issue.

- In groups students look at Student Sheet 6b: Plastic profiles and discuss what stake each person has in the plastics issue.
- These stakeholders have been designed to show a variety of perspectives and may raise some sensitive ethical issues. Remind students to be respectful and thoughtful in their responses and try to empathise with each individual.
- Ask students in groups to write a sentence for each person which illustrates how they might feel about the issues and how it might affect them.
- Groups can then share one profile each with the rest of the class.

Slideshow 6: Slide 11

Student Sheet 6b:

Plastic profiles

TEACHER GUIDANCE 6 (page 2 of 2)

Guidance Step

5

10 mins



The last step in this lesson asks students to reflect on the sustainable development goals and how they relate to this issue.

- · Students examine Student Sheet 6c: The sustainable development goals in pairs.
- · They should then write a brief entry in their Innovation Diaries outlining which of the goals is directly or indirectly related to ocean plastic pollution, and how.
- · For example, students should see a link between 'life below water' and the plastics issue but might require some guidance as to how 'decent work and economic growth' could be affected.

Resources

Slideshow 6:

Slides 12-14

Student Sheet 6c:

The sustainable development goals



Students write a tweet that they would send to one of the major coffee retailers expressing their concerns and suggesting how to improve the disposal cup issue. These can be written on post-it notes and form part of a display.

Plastic impact: case studies



What do you think?

Should disposable cups be banned?

Is it up to the shops, the government or consumers?

What should be done?

Did you know?



99.75% of coffee cups are not recycled!

Case study 1: Disposable coffee cups in the UK

You might think that because most disposable coffee cups are paper that they are recycled. Well, you'd be wrong! The mixture of paper and plastic in the inner lining, which makes it both heat and leakproof causes great difficulties in the recycling process. They have to be taken to specialist recycling plants, only three of which exist in the UK.

Some of the biggest retailers of coffee in the UK including Costa and Starbucks say they have started recycling coffee cups – but you must return them to the store. Throwing your disposable coffee cup in public bins or even in your recycling bin at home contaminates the other rubbish and ultimately ends up in land-fill or being burnt. This results in plastic fragments entering the water system and eventually polluting rivers and oceans.

Cafe Nero, Greggs, Starbucks and Costa all offer a 25p discount to those who bring their own reusable coffee cups; Pret a Manger offers 50p discount. In 2018 the Environmental Audit Committee proposed a 25p "latte levy" on throw-away cups but ministers rejected the proposal saying it was better for shops to offer voluntary discounts to customers who bring their own cups.

Did you know?



Some of the rivers which are responsible for contributing the most plastic into the ocean are in developing countries, such as the Mekong river which flows through China, Myanmar, Laos, Thailand, Cambodia and Vietnam.

What do you think?

Who is to blame? Who can help? What should be done?

Case study 2: 10 rivers

Imagine an ordinary day and the amount of disposable plastic you consume. Every time you finish a product such as shampoo, toothpaste, bread, yoghurts, crisps, soft drinks and milk the packaging or container is thrown away, hopefully recycled if possible. Imagine if you didn't have bins outside your house. You know - the big ones that they come and collect once a week. Where would you put all that rubbish? What would you do with it if you couldn't dispose of it in the weekly refuse collection? Where are you going to put it? Maybe on the street? In your garden? Imagine the rubbish, every day piling up, getting bigger and bigger and no one taking it away.

Millions of people all over the world are faced with this dilemma. Developing countries often do not have regular refuse collections and implementing them would cost a huge amount for governments who have few resources and other great financial challenges, like tackling hunger and fighting disease. Nobody wants rubbish piling up in or around their homes. Sometimes rubbish is disposed of by burning it however this isn't ideal as it releases toxic fumes in to the atmosphere. Often rubbish ends up being publicly dumped and then makes its way into rivers and water ways, where it is carried away from densely populated areas.

Without the infrastructure to effectively dispose of rubbish, people are left with a difficult choice about what to do. No one wants rubbish on their door step.

Did you know?



In many countries people make a living collecting, sorting and selling plastic trash. In Bangladesh waste pickers earn about £2 a day.

What do you think?

Who should change their behaviour?

Are there doublestandards in how we view consumerism?

Case study 3: Consumerism, sustainability and double standards

Until 2018 China bought 45% of the world's plastic trash. It's cheaper for governments like the USA and UK to ship plastic rubbish to developing countries than to deal with it themselves. China purchased the plastic trash to recycle and use in manufacturing. However, in 2018 they closed their doors as the world's plastic dumping ground due to environmental concerns and the fact that they do not have the infrastructure to cope with the amount of trash they were receiving.

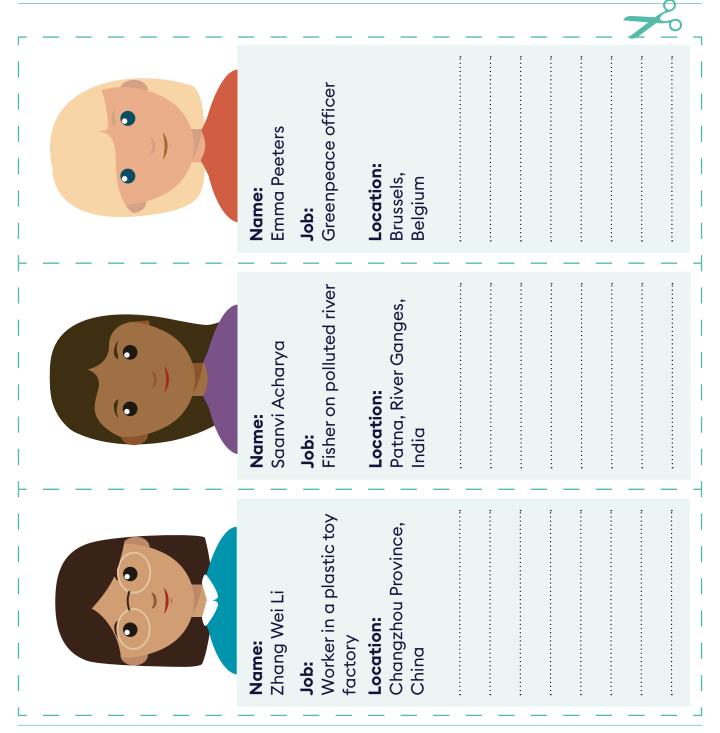
China is the largest producer of plastic, it accounts for more than a quarter of the global total. They manufacture 70% of the world's plastic toys, and are also the leading manufacturers of computer components, phone parts, textiles and trainers. They may be producing most of the plastic, but who is buying it? Multinational companies manufacture in China because labour and material costs tend to be low.

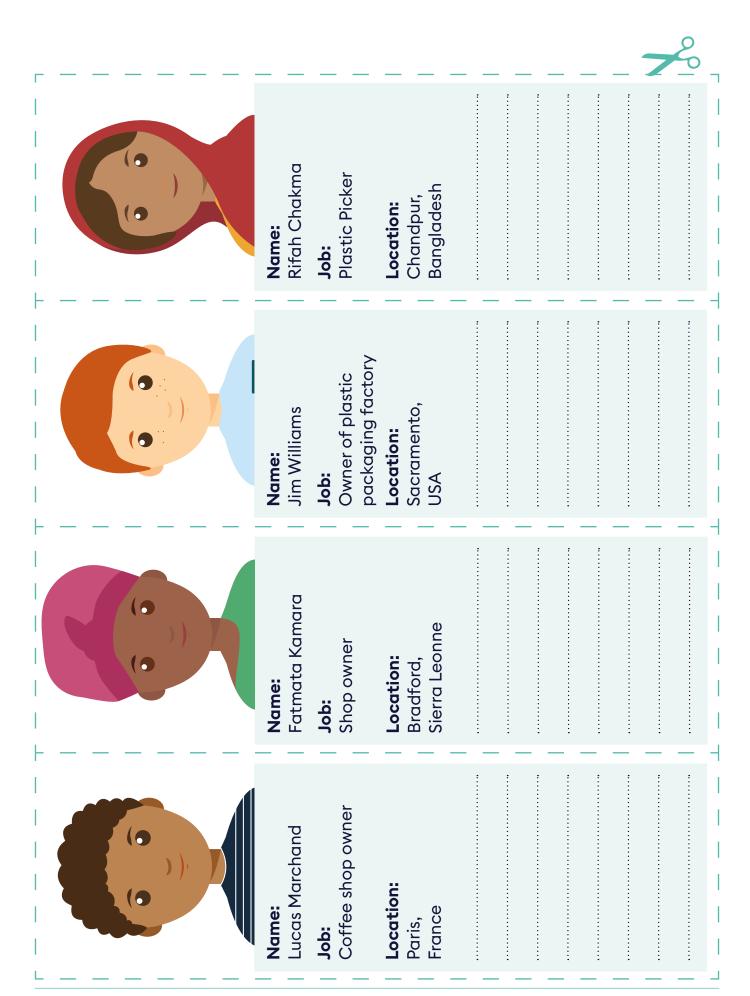
Around the world multinational companies produce small single-use sachets of products such as shampoo, detergents, condiments and even coffee which are inexpensive to buy meaning people in developing countries can also afford to enjoy these products. However, single-use sachets are not recyclable and therefore not worth collecting. Should single-use sachets be banned? Who is responsible for collecting this sort of plastic?

Plastic profiles

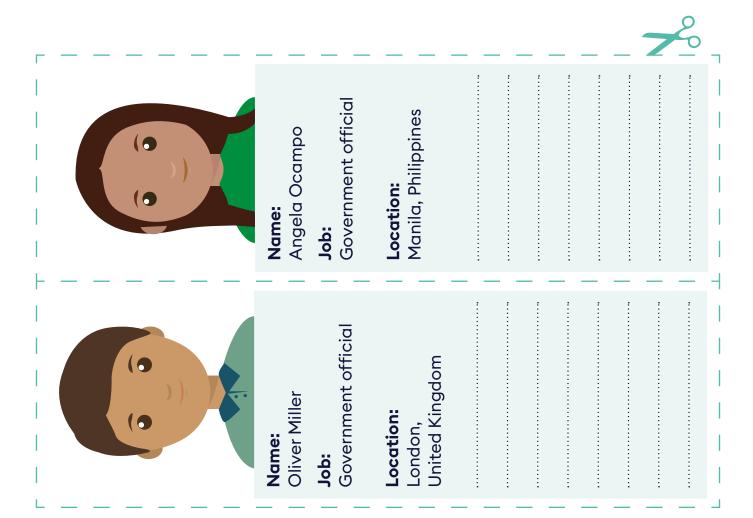


In groups consider the perspective of each of these individuals. What would they say about the plastic problem?





STUDENT SHEET 6b



The sustainable development goals



Look at the Sustainable Development Goals and consider how the plastic pollution problem affects each one.

The 17 sustainable development goals are targets set by countries across the world to help everyone to grow and live on a sustainable and healthy planet. Can you link each goal to plastic pollution?



Everyone has enough to live



No-one goes hungry



Everyone is healthy



Everyone can learn



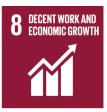
All genders are equal



Drinking water is clean



Electricity is clean and green



People have good jobs



Technology is growing



Everyone can learn



Cities are safe and sustainable



Everything we use can be re-used



Stop global warming



Protect the ocean and use it sustainably



Protect different habitats on land



Peace and justice for everyone



Promote all the goals on this page



Lesson 7: What can I do? Part one

In this lesson students discover the 6 Rs and find out about some of the innovative ways young people have been making a difference. They then go on to develop their own plastics campaign to implement in their school community.

Resources in this book:



Lesson Overview 7



Teacher Guidance 7



Student Sheet 7a: Our plastics project

Resources available online:



Slideshow 7: What can I do? Part one

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What can I do? Part one



Age 7-11



60 minutes

Curriculum links

- Understand the 6 Rs and how each one can be put into practice
- Plan and execute a collaborative campaign to reduce plastic consumption

Resources



Slideshow 7:

What can I do? Part one



Student Sheet 7a:

Our plastics project

Student Sheet: Innovation Diary

Extension or home learning

Students can use this opportunity to make resources for their campaigns. This may involve making posters, postcards, blogging, planning a speech or spending time canvassing their peers. A record of what they have accomplished can be kept in their Innovation Diaries.

Lesson overview

The last two lessons in this unit challenge students to work collaboratively to create a campaign based on the 6 Rs. First students find out about innovation, development and policy changes that have recently occurred. They are then briefed on their mission – to reduce the amount of plastic consumption at school. In groups students then design and implement their campaign, planning and launching it over the following week.

Lesson steps

Learning outcomes

1. The 6 Rs (5 mins)

Students find out about each of the 6 Rs and make suggestions of how they could do more of each one.

- 2. Innovation and technology (10 mins)
 - Students find out about some recent innovations designed to improve plastics pollution, focussing on young people's contributions.
- 3. Plastic policy (5 mins)

Students discover the changes to policy that have been recently enacted and discuss whether they believe enough has been done.

4. Now it's your turn! (10 mins)

Students will be enacting real change in their school environment. They receive their brief and mind map their ideas.

5. Plan your campaign (30 mins)

In groups students begin to plan their campaign, create a 'to do' list and allocate responsibilities. They can then begin working collaboratively on their tasks.

- Name the 6 Rs and explain what each one means
- Understand developments in technology and innovation regarding plastics pollution
- Discover how recent policy has been proposed and enacted relating to plastics pollution
- Reflect on how they can make a difference
- Work collaboratively to plan a plastics pollution campaign

TEACHER GUIDANCE 7 (page 1 of 2)

Step Guidance

1 5



In step 1 students find out what each of the 6 Rs stand for and discuss how they can implement change in their own lives. Slideshow 7: Slides 1-10

Resources

- · Using slides 3-10 go through the 6 Rs: Reduce, reuse, recycle, refuse, rethink, repair.
- After each slide ask students to suggest how they could to do each one.

2

mins



Step 2 introduces students to some of the innovations around plastics young people have recently made.

- Use slide 11 to go through the profiles of young entrepreneurs who have come up with innovative ways to reduce plastics consumption, tackle the use of single-use plastics and design products which aim to improve ocean health.
- Ask students to share their impressions of each person and the work they've done.

Slideshow 7: Slide 11

3

5 mins



The next step summarises some of the changes that have been made to legislation and asks students to reflect on these efforts.

- Using slides 12-14 read through the recent policy changes that governments have enacted.
- Ask students to consider whether they think enough has been done in each case and if not, what more is required.
- Explain that this is background information they will need to know in preparation for the next task.

Slideshow 7:

Slides 12-14

4 10



Step 4 introduces students to their task for the next few lessons.

- Explain that in groups students will be designing and implementing a campaign to reduce plastic use in the school community.
- Using slides 15-16 talk through some of the possibilities and options they have for running their campaign, such as a reward for the class with the least plastic waste, or a competition to see which year group have the most reusable plastics in their lunches etc.
- · Slide 17 explains how students must find a way to measure success and makes some further suggestions for elements they may wish to use in their campaigns such as posters and speeches in assembly etc.
- Explain that students will be working in groups for this project and divide students accordingly.

Slideshow 7: Slides 15-17

TEACHER GUIDANCE 7 (page 2 of 2)

Step Guidance

5

30 mins



The final step this lesson is for students to start planning their campaign.

- Using Student Sheet 7a: Our plastics project, students begin by deciding what their main aims are, and begin the planning process.
- You may wish to structure this activity by allowing students five minutes for discussion and then asking for feedback before moving on to the next section.
- It would be ideal if students could meet again before the end of the unit to make resources, plan their next steps and monitor progress, therefore an interim lesson could be allocated.
- · Finally, students can share with the rest of the class their organisation name and what their main objective during the campaign will be.

Resources

Slideshow 7: Slides 18-19

Student Sheet 7a: Our plastics project

Student Sheet: Innovation Diary

+ 20 mins



Students can use this opportunity to make resources for their campaigns, this may involve making posters, postcards, blogging, planning a speech or spending time canvassing their peers. A record of what they have accomplished can be kept in their Innovation Diaries.

Our plastics project



Mind-map your ideas

STUDENT SHEET 7a

Decide which idea to focus on
What would you like to do?
What impact do you think it will have?
How will you measure impact?
What are your three main action points?
What will you need?
Do you need support from your teacher? If so, what?
How will you ensure everyone is involved?

STUDENT SHEET 7a

First point of action		
Time frame		
Second point of action		
Time frame		
Third point of action		
Time frame		
By next lesson we hope to h	ave achieved:	
Organisation name		
Members		

Lesson 8: What can I do? Part two

In this lesson students reflect on the progress of their campaign by sharing how much impact they have had on plastic consumption in their school community. They deliver a brief presentation highlighting their achievements and the challenges they encountered.

Resources in this book:



Lesson Overview 8



Teacher Guidance 8

Resources available online:



Slideshow 8: What can I do? Part two

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

What can I do? Part two



Age 7-11



60 minutes

Curriculum links

- Review and reflect on achievements and challenges during their campaign
- Prepare and deliver a presentation

Resources



Slideshow 7: What can I do? Part two

Student Sheet: Innovation Diary

Lesson overview

In the last lesson students review the success of their campaign and the impact it had on plastic consumption. They review their targets, reflect on what went well and decide what they would do differently. They then share their results and discuss what more they could do going forward. The unit of work could end with an assembly for students to share their findings and continue to spread their message.

Lesson steps

Learning outcomes

1. Review (10 mins)

In groups students discuss their experiences, what they discovered, their results and anything that surprised them.

Review the impact of their campaign

2. Achievements and challenges (10 mins)

They then go decide what has been their greatest achievement and what challenges they've encountered. Reflect on achievements and challenges

3. Presentation (30 mins)

In groups students prepare a brief presentation to share with a wider audience telling the story of their campaign and highlighting what they achieved, what they found challenging and what they would do differently.

- Share findings and results with a wider audience
- Reflect on how they can make a difference

4. The future (10 mins)

In a whole class discussion, students reflect on the future of their campaigns and their thoughts on the future of ocean plastic pollution. · Discuss what they plan to do next

TEACHER GUIDANCE 8

Step Guidance

1 10



Step 1 encourages students to discuss their experience of running a campaign.

- Using slides 1-3 ask students to reflect on the experience of running a campaign, what surprised them and their achievements.
- Encourage students to talk through each question with a partner.

Resources

Slideshow 8: Slide 1-3

2 10 mins



Step 2 focusses on what the main challenges have been during the campaign.

 Using slide 4 students continue to discuss with their partner, focusing on the challenges they faced and any barriers they encountered. Slideshow 8:

Slide 4

30 mins



In step 3 students work in their groups to create a presentation about their experiences.

- Explain that students will be working with their campaign group to create a brief presentation which outlines what they did, what they achieved, what challenges they faced and what they would do differently.
- · Use slide 5 to structure the presentation.
- Explain that the groups will now have 20 minutes to prepare their presentation for the class.
- Students can gather any materials they may require for their presentation, including their campaign materials to show case.
- After 20 minutes allow each group to present to the class.
- · Encourage feedback from other groups.

Slideshow 8: Slide 5

4 10



In the last step students engage in a whole class discussion about the future of their campaigns and the oceans plastics problem.

- Ask groups to make suggestions of how they could carry their campaign forward.
- Ask individuals to reflect on what they have taken from this unit of work and how they have changed their behaviour.
- · Finally, ask students to reflect on what they predict the future holds for the plastics problem and our oceans.
- Students may wish to make some final observations or reflections in their Innovation Diaries to conclude.

Slideshow 8: Slides 6-8

Student Sheet: Innovation Diaries

Lesson 9: Design Technology - The plastics problem

Students attempt to solve a problem by evaluating existing solutions and designing a more sustainable product.

Resources in this book:

Lesson Overview 9

Teacher Guidance 9

Student Sheet 9a: Solutions sheet

Student Sheet 9b: Product analysis

Resources available online:

Slideshow 9: Design Technology - The plastics problem

Thinglink: What's your bag?

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

Design Technology - The plastics problem



Age 7-11



60 minutes

Curriculum links

- Develop and communicate design ideas
- Evaluate existing products

Resources



Slideshow 9:

The plastics problem



Student Sheet 9a: Solutions sheet

Student Sheet 9b: Product analysis



Thinglink:

What's your bag?

Extension or home learning

Students consider a range of single use plastic products and research sustainable alternatives already in development. Share findings with the class.

Lesson overview

In this lesson students are posed with a problem; they need to design a product which can carry several items from one location to another. They should attempt to design a new product and consider its features including strength, usability and materials. Students go on to evaluate existing solutions to this product in terms of strength, cost, aesthetics, usability and finally sustainability. They conclude by evaluating whether a new product is required based on the existing alternatives.

Lesson steps

Learning outcomes

1. Design criteria (10 mins)

Students are posed with a problem; transporting a number of medium sized goods (tins of beans) from point A to point B.

• Understand design criteria

2. Developing ideas (15 mins)

In groups students discuss possible solutions to this problem, sharing and building on ideas.

• Develop and communicate ideas

3. Specifications (15 mins)

Students then consider in greater detail the strength, usability, materials and aesthetics of their designs.

Discuss purpose, function and appeal of products

4. Analyse existing products (10 mins)

Students investigate a variety of existing similar products and analyse their strength, cost, aesthetics and usability.

 Investigate and analyse a range of existing products

5. Evaluate existing products (10 mins)

They then evaluate the sustainability of each of these products (and their own) and conclude whether a new product is required based on the existing alternatives.

Evaluate ideas and products

TEACHER GUIDANCE 9 (page 1 of 2)

Guidance Step

1 10 mins



In step one students are presented with a problem; they must transport several items from one point to another.

- · Using slides 1-5 talk through the problem and ask students for their initial ideas on how they could solve the problem.
- · Explain that they should think beyond products they already know of and try to come up with a novel way of completing the task.

Resources

Slideshow 9: Slides 1-5

2 15 mins



In groups students then discuss possible solutions to the problem.

- · Ask students to discuss the problem with their group and share initial ideas.
- · Encourage students to think outside the box and share the most unusual solutions with the whole class.
- · Using Student Sheet 9a students sketch and annotate three ideas.

Student Sheet 9a: Solutions sheet

3

15 mins



In Step 3 students further develop their ideas through considering the design specifications of their product.

- · Using slides 6-8 ask students to suggest the materials their product could be made from.
- · Explain that they should avoid using products such as single-use plastics, to develop a more sustainable product.
- · Students should also consider the strength, usability and aesthetics of their design, adapting where necessary.

Slideshow 9:

Slides 6-8

Student Sheet 9a: Solutions sheet

4





Step 4 demonstrates some existing solutions and asks students to evaluate each product.

- · Using slides 9-12 share some of the existing solutions to the problem and ask students to comment on the strength, usability, aesthetics and sustainability of each product.
- · As you go through the slides ask students to compare their own design against each criterion.

Slideshow 1:

Slides: 9-13

Thinglink:

What's your bag?

TEACHER GUIDANCE 9 (page 2 of 2)

Step Guidance

5

10 mins



Step 5 asks students to make a detailed comparison of each existing product with their own, specifically focussing on sustainability and environmental impact.

- Explain that students should complete Student Sheet lb, commenting on each aspect of the design and comparing the sustainability and environmental impact.
- They then conclude by writing a paragraph summing up their findings and stating whether a new product is needed or whether there are already enough sustainable solutions.
- Explain that in the next lesson they will be looking at a design process in more detail to develop a new product to replace a single-use plastic.
- · Look at Diagram: A design process, to illustrate.

Resources

Slideshow 1:

Slides 14-17

Student Sheet 9b: Product analysis

Diagram:

A design process

Solutions sheet



How will you transport your items from one place to another? In groups suggest three different ways. Sketch your ideas and comment on the material, strength, usability, aesthetics and sustainability.

Product analysis





Strength:
Usability:
Aesthetics:
Sustainability:



Strength:
Usability:
Aesthetics:
Sustainability:



Strength:
Usability:
Aesthetics:
Sustainability:



Strength:
Usability:
Aesthetics:
Sustainability:

STUDENT SHEET 9b



Strength:	
Usability:	
Aesthetics:	
Sustainability:	

Strength:	
Usability:	
Aesthetics:	
Sustainability:	

Is a new product needed? Explain why.

Lesson 10:

Design Technology - The plastics solution

In this lesson students review some alternatives to single-use plastics. They then go on to plan, design and develop an idea for a sustainable alternative to single-use plastics.

Resources in this book:



Lesson Overview 10



Teacher Guidance 10



Student Sheet 10a: Product design

Resources available online:



Slideshow 10: Design Technology - The plastics solution

All resources can be downloaded from: encounteredu.com/teachers/units/ocean-plastics-x-curric-ages-7-11

Design Technology - The plastics solution



Age 7-11



60 minutes

Curriculum links

- Investigate a range of designs
- Research and develop a sustainable product

Resources



Slideshow 10:The plastics solution



Student Sheet 10a: Product design

Extension or home learning

Students gather materials for their prototype at home to bring in to school for the practical lesson.

Alternatively, the prototype can be set as a home learning project and later shared with the class.

Lesson overview

Students discover a range of products which have been redesigned with sustainability in mind. They then consider some of the other single-use plastics they know of and choose one to redesign using a sustainable alternative. Students then develop their designs considering the materials they will use and how it will be manufactured, pitching their idea to the class and reflecting on feedback. At the end of these two lessons the students can produce a prototype.

Lesson steps

Learning outcomes

- 1. Single-use alternatives (10 mins)
 - Students investigate a range of sustainable alternatives to singleuse plastics and reflect on their specifications.
- 2. Redesigning single-use plastics (10 mins)

They then consider a range of single-use plastics and decide which to re-design focussing on sustainability.

3. Developing ideas (15 mins)

Working in groups students model their design and develop a pitch to share with others.

4. Reflect and develop (15 mins)

Upon receiving feedback on their initial idea students regroup and fine tune their designs.

5. Prototype production (10 mins)

Students then create a product specification and design a prototype, researching tools and materials required for production. Populating a list of required materials.

- Understand key events which have shaped the redesign of plastic products
- Research and develop an idea
- Model and communicate design ideas in a variety of forms
- Evaluate ideas against criteria and consider the views of others
- Select a range of tools and materials to develop a product

TEACHER GUIDANCE 10 (page 1 of 2)

Step Guidance

1 10



Step one introduces students to some recent innovations in design technology, aimed at reducing plastic use.

- Remind students of the design process with Gallery:
 A design process, before introducing the learning outcomes.
- Use slide 4 to demonstrate some alternatives to singleuse plastics.
- Ask students to share their reactions to these products, reflecting on the design specifications for each, such as strength, longevity, sustainability.

Resources

Slideshow 10: Slides 1-4

10 mins



Next students review a variety of commonly used singleuse plastics and decide which they will redesign.

- Go through slide 5 which demonstrate a number of single-use plastics in common use today. Discuss with students the design specifications of each and how they are met, discussing cost and ease of production.
- Ask students to think of any other single-use plastics and list their ideas.
- Explain that although these products are very efficiently designed for their purpose, they are environmentally unsustainable. Reviewing knowledge from the whole Ocean Plastics unit task. Ask students to share what they know about why these products are unsustainable.
- Students then select a single-use product and explain why they think this particular product needs redesigning.

Slideshow 10:

Slide 5

3





Step 3 sees students begin to develop their design idea.

- Once students have selected (or you have allocated) which product they will redesign, group them accordingly so they can develop their ideas collaboratively.
- Explain that students have 15 minutes to come up with an alternative design to meet the same specification.
 Or, an improved version of the existing product which has less environmental impact.
- Use Student Sheet 10a to work through the design specification.
- Explain that at the end of this time they will pitch their ideas to another group and take feedback.

Slideshow 10: Slide 6

Student Sheet 10a: Product design sheet

TEACHER GUIDANCE 10 (page 2 of 2)

Step Guidance



15 mins



In step 4 students share their ideas with an audience and take constructive feedback.

- Ask students to join with another group and spend a few minutes talking through their design.
- Explain that the audience group should give constructive feedback, such as scrutinising cost or availability of materials. Slide 7 provides guidance on the process of giving constructive feedback.
 The groups should then swap roles so both received feedback.
- After both groups have shared and received feedback they can regroup and adapt their designs accordingly.

Resources

Slideshow 10: Slide 7

5 10



Step 5 involves students planning what they require to make a prototype.

- · Using Student Sheet 10b students finalise their design, annotating and adding details.
- Explain that they will then need to consider what materials they will require to construct a prototype, including any tools they will need for its construction.
- Once students have populated a list for the materials and tools, they can complete Student Sheet 10a, explaining why they believe their design will be effective and how it improves on existing designs.
- If you would like your students to construct their prototype you will need to allocate adequate time and budget for sourcing materials.
- · A follow up practical lesson will develop student's practical and construction skills.
- You may wish to exhibit these prototypes or share during an assembly or parents evening. This could also coincide with the presentation at the end of lesson 8.

Slideshow 10: Slides 8-10

Student Sheet 10a: Product design



This is one of ten lessons which make up the Ocean Plastics 7-11 cross-curricular unit. If you have taken students on the journey of the full unit we would recommend creating space for students to reflect on their learning and the future of the plastic problem.

You may want to ask students, what do you think the ocean will look like in the future? Or, do you think we can remove the plastics that has already entered the ocean? A great example of creative engineering, which you can introduce to students, is Boyan Slat's floating boom (https://theoceancleanup.com/) which is a device designed to remove plastic debris from the ocean.

Product design

What are you planning to design?



Who are you designing it for?

Before developing your idea think about who you are designing for and why you are designing / redesigning this product.

Why are you designing this product?			
Design criteria			
Agree on the criteria for your design and explain why below.			
•			
•			
•			
•			
•			

STUDENT SHEET 10a

STUDENT SHEET 10a

Production plan

Use the boxes below to plan how to make your product. Make a list of the materials and tools you will need.				
Materials and tools:				
Conclusion				
What is effective about your design? How does it improve on existing products?				

This book and associated resources can be accessed from encounteredu.com/teachers/units/ocean-plastics-x-curric-7-11





(Videos and interactive diagrams



Individual lesson and resource downloads



Live broadcasts with scientists and innovators



Subject Updates and training courses

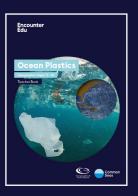
Other books in this series



Ocean Plastics X-Curric



Ocean Plastics Science 11-14



Ocean Plastics Geography 11-14



Ocean Plastics D&T 11-14

Photo credits

Cover Plastic beach: Dustan Woodhouse

Plastic waste: Peter Clarkson

Student Sheet 1a Soda can: Rustic USA

Stainless steel, Fibreglass, Rubber, Glass: PXhere

Polystyrene: JensRS Twine: Annca

Brass: Conger Design
Carbon fibre: Struffel Productions

Iron: Piro4D PET: Maxpixel Pencil: Moritz320

Student Sheet 1b Cup: Maria Vernigora Student Sheet 2a Plastic production: Pashminu Student Sheet 3a Bottles: Jonathan Chng

Student Sheet 4a Plastic beach: US Fish and Wildlife Service

Student Sheet 5a Clownfish: Catlin Seaview Survey Student Sheet 5b Albatross chick: Kklinzing Dead albatross: Chris Jordan

Green turtle: Bill C Swimming turtle: Jeremy Bishop Turtle on beach: HHach Zooplankton: University of Exeter

Student Sheet 6a Coffee: Bruce Mars

Waste cups: PXhere Rubbish: John Cameron Waste beach: Hermes Rivera

Student Sheet 7a Hands: Rawpixel Student Sheet 9a Spices: Glaucio Guerra Student Sheet 9b White plastic bag: Kjell Meek Brown paper bag: Lisa Fotios Totes: Daria Shevtsova

All other photos Encounter Edu



Ocean Plastics 7-11 is a cross-curricular unit of work encompassing science and geography which also develops skills in mathematics, citizenship and spoken language. The unit addresses four key questions; what are plastics, where are plastics, what impact can plastics have and what can I do?

These questions are answered by developing students understanding of properties of materials, living things, habitats and human and physical geography.

The unit explores the pros and cons of a variety of plastic products, investigates how plastic finds its way to the ocean and looks at what changes can be made on a local and global scale. Students understand the complex issues surrounding oceans plastics through this units optimistic and innovative approach to challenging attitudes and behaviour.

Where Learning Meets The World

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Encounter Edu and Common Seas have partnered to create the Ocean Plastics Academy. We believe that equipping young people with the knowledge, experience and courage to address plastic pollution is an important part of the solution. Ocean Plastics Academy supports educators by providing them with an authoritative and standards-linked set of resources aligned with the national curriculum to support students to build their knowledge on related topics year on year. www.commonseas.com