

**Encounter
Edu**

Ocean Plastics

Design & Technology | Ages 11 - 14

Teacher Book



A resource by Encounter Edu and Common Seas

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With thanks to

Design and Technology 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.

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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

OVERVIEW

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/ocean-plastics-science-ages-11-14>) 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.

¹ 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 learning objective	Lessons					
	1	2	3	4	5	6
Cognitive learning objectives						
<ul style="list-style-type: none"> 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						
<ul style="list-style-type: none"> 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. 			✓			
<ul style="list-style-type: none"> 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. 	✓			✓		✓
<ul style="list-style-type: none"> 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. 					✓	
<ul style="list-style-type: none"> 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						
<ul style="list-style-type: none"> 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. 						
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<ul style="list-style-type: none"> 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. 	✓				✓	
<ul style="list-style-type: none"> 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 3

KS3 Design and Technology Element of the curriculum	Lessons					
	1	2	3	4	5	6
Design						
• Use research and exploration, such as the study of different cultures, to identify and understand user needs		✓				
• Identify and solve their own design problems and understand how to reformulate problems given to them		✓				✓
• Develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations					✓	✓
• Use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses		✓		✓	✓	
Make						
• Select from and use a wider, more complex range of materials, components and ingredients, taking into account their properties				✓	✓	
Evaluate						
• Analyse the work of past and present professionals and others to develop and broaden their understanding			✓		✓	
• Understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists	✓		✓	✓		

SCHEME OF WORK

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

Overview

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

Learning outcomes

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

Resources

**Slideshow 1:**

What can we do to reduce ocean plastic pollution?

**Student Sheet 1a:**

What are the 6 Rs?

Student Sheet 1b:

Is recycling rubbish?

Student Sheet 1c:

Life cycle of a plastic bottle

Student Sheet 1d:

Waste hierarchy research

Lesson 2: Why should we recycle?

Overview

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

Learning outcomes

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

Resources

**Slideshow 2:**

Why should we recycle?

**Student Sheet 2a:**

Recycling questionnaire

Student Sheet 2b:

What happens when we recycle?

Student Sheet 2c:

Design a user-centred bin

Student Sheet 2d:

Recycling diary

**Gallery:**

How is plastic recycled?

**External Link:**

The world's deepest bin

External Link:

Bottle bank arcade

SCHEME OF WORK

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

Overview

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

Learning outcomes

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

Resources



Slideshow 3:

How do we reduce, reuse and refuse plastic products?



Student Sheet 3a:

Buzz stations

Student sheet 3b:

Design your own fashion label

Lesson 4: Should we repair?

Overview

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

Learning outcomes

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

Resources



Slideshow 4:

Should we repair?



Student Sheet 4a:

Modular phone information

Student Sheet 4b:

Design a modular phone

Lesson 5: Can redesigning products help?

Overview

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

Learning outcomes

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

Resources

**Slideshow 5:**

Can redesigning products help?

**Student Sheet 5a:**

Cryptogram

Student Sheet 5b:

Redesign gallery

Student Sheet 5c:

Product analysis

**External Link:**

Edible six pack ring

Lesson 6: Design task

Overview

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

Learning outcomes

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

Resources

**Slideshow 6:**

Design task

**Student Sheet 6a:**

Design template

Student Sheet 6b:

Product pitch

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 can we do to reduce ocean plastic pollution?

Students to develop their knowledge and understanding of sustainability and what we can do to reduce ocean plastic pollution.

Resources in this book:



Lesson Overview 1



Teacher Guidance 1



Student Sheet 1a: What are the 6 Rs?

Student Sheet 1b: Is recycling rubbish?

Student Sheet 1c: Life cycle of a plastic bottle

Student Sheet 1d: Waste hierarchy research

Resources available online:



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

All resources can be downloaded from:

encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

What can we do to reduce ocean plastic pollution?



Age 11-14



60 minutes

Curriculum links

- Investigate new and emerging technologies
- Understand developments in design and technology, its impact on individuals, society and the environments

Resources



Slideshow 1:

What can we do to reduce ocean plastic pollution?



Student Sheet 1a:

What are the 6 Rs?

Student Sheet 1b:

Is recycling rubbish?

Student Sheet 1c:

Life cycle of a plastic bottle

Student Sheet 1d:

Waste hierarchy research

Extension or home learning

Students research ways that the 6 Rs can be used to make a product more sustainable. Students annotate Student Sheet 1d with their findings.

Lesson overview

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

Lesson steps

1. Introduction (5 mins)

Students start the unit of work by thinking about what plastic they have used today.

2. Why is plastic a concern? (10 mins)

Students learn about the importance of plastic. Students will then complete a true or false quiz, which looks at the scale of plastic production.

3. What is the waste hierarchy? (15 mins)

Independently students study the waste hierarchy and the 6 Rs, considering what actions are required for the various levels of the hierarchy.

4. What is the product life cycle of plastic? (20mins)

Students complete a decision making exercise. After reading some information and statistics about UK recycling, students consider the positives and negatives.

5. Sustainability? (10 mins)

Students will draw a flow chart that shows the product life cycle of plastic.

Learning outcomes

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

TEACHER GUIDANCE 1 (page 1 of 2)

WHAT CAN WE DO TO REDUCE OCEAN PLASTIC POLLUTION?

Step Guidance

Resources

1
5
mins



Step 1 is the introduction to the lesson, with students reviewing the whole unit and learning objectives for the lesson.

- Students start the lesson by either making a list in their books or discussing with a peer what plastic products they have used today.
- Choose one or two students to share their list with the rest of the class.
- Read through the titles of the lessons in this unit of work. Students understand what they are expected to learn during this unit of work.
- Ask 4 different students to read through the learning objectives.

Slideshow 1:
Slides 1-4

2
10
mins



Step 2 focuses on developing the knowledge and understanding of plastic.

- Using slides 5 and 6 go through the positives of plastics, this should discourage some misconceptions students have. Plastic is a very important product and we will never be able to completely stop using plastic - it is throwaway culture and the culture of single use plastic that needs to be eradicated.
- Use slide 5 to go through some basic information about plastics with the students. This gives them an insight into the many positives of plastics.
- Slide 6 shows a number of products which have had huge impacts on modern society. Ask students to list other important plastic products.
- Talk through the significance of the different products using the information below.
- As mentioned before, it is the disposing of plastic which has caused a number of issues, particularly in our oceans. Use slide 7 to express this to the students.
- Quiz student on their knowledge of plastic production using the true or false quiz on slides 8 to 27.

Slideshow 1:
Slides 5-27



- Tupperware and other food packaging – this allows food to be kept fresh for longer, which reduces waste by reducing the amount of food that is discarded.
- Car – the lightweight and durable nature of plastic means it is perfect for manufacturing cars and other vehicles. Many aspects of a car are now made from plastic, making the weight of the car lighter and more fuel-efficient.
- Medical equipment – syringes, tubing, medicine bags and many other pieces of medical equipment are plastic, this means they are more hygienic, more efficient and safer. The use of plastic has allowed medical practices to evolve.

TEACHER GUIDANCE 1 (page 2 of 2)

WHAT CAN WE DO TO REDUCE OCEAN PLASTIC POLLUTION?

Step Guidance

Resources

3

10
mins



Step 3 moves on to look at the waste hierarchy.

- Introduce students to the waste hierarchy. Talk through the different stages, asking student to define what each method in the waste hierarchy means.
- Ask students to draw the waste hierarchy in their books.
- Hand out Student Sheet 1a.
- Using slide 29, ask students to match up the definitions to the key words on Student Sheet 1a.
- The answers are on slide 30.
- Go through the answers, giving students a chance to check their answers and make changes.

Slideshow 1:
Slides 28-30

Student sheet 1a:
What are the 6 Rs?



Recycle - Recycling a plastic drinks bottle after use.
Reuse - Using a plastic bottle multiple times after first use.
Reduce - Minimising the amount of times you buy a plastic bottle.
Refuse - Not buying any drinks which come in plastic bottles.
Repair - Fixing an older reusable bottle and using that instead.
Redesign - Starting afresh and creating a new, more sustainable drinks bottle

4

20
mins



Step 4 encourages students to evaluate the effectiveness of recycling in the UK.

- Hand out Student Sheet 1b.
- Students to read the information and statistics about UK recycling.
- Following this students evaluate the effectiveness of recycling in the UK - they are to identify the positive and negatives of the systems used in the UK. They should then suggest what could be improved upon.

Slideshow 1:
Slide 31

Student Sheet 1b:
Is recycling rubbish?

5

10
mins



Step 5 introduces the product life cycle of plastic to the students.

- Using slide 32, share the product life cycle of plastic with the class. Talk through the different stages.
- Hand out Student Sheet 1c.
- Students to draw a flow chart showing the product life cycle of a plastic bottle with annotations.

Slideshow 1:
Slides 32

Student Sheet 1c:
Life cycle of a plastic bottle

+

20
mins



Students research ways that the 6 Rs can be used to make a product more sustainable. Students annotate Student Sheet 1d with their findings.

Student Sheet 1d:
Waste hierarchy research

What are the 6 Rs?



Match the 6 Rs with their descriptions below.

Theory	Description
RECYCLE 	B - Don't use a material or buy a product if you think you don't need it or if it is unsustainable.
REDUCE 	A - Take an existing product that has become waste and use the material or parts of it, for another purpose, without processing it.
REUSE 	F - Minimise the amount of energy and materials you use.
REFUSE 	D - Take an existing product that has become waste and reprocess the material to use in a new product.
REPAIR 	E - Recreate a product to be more environmentally friendly and still meet its function
REDESIGN 	C - When a product breaks down or doesn't function properly, try to fix it rather than throw it away.

Is recycling rubbish?



Using the information below evaluate the effectiveness of recycling in the UK.

40% of Europe's plastics are used once and then thrown away.	Only 22% of households can recycle black plastic.
There are 39 different recycling schemes in the UK.	Only 18% of households in the UK have access to recycling for carrier bags.
Only 74% of household can recycle yoghurt pots.	You must wash or rinse all plastic items before you put them in the recycling.
It has been estimated that nearly 5 billion plastic straws are thrown away in England each year.	Approximately 13 billion plastic bottles are used each year in the UK, that's nearly 200 per person.
57% of plastic bottles are recycled in the UK, 15 million are still sent to landfill, incinerated or littered every day.	Making mistakes and putting wrong things in the recycling bin is one reason why items cannot be recycled.

Consider the pros and cons of UK recycling and suggest what could be improved.

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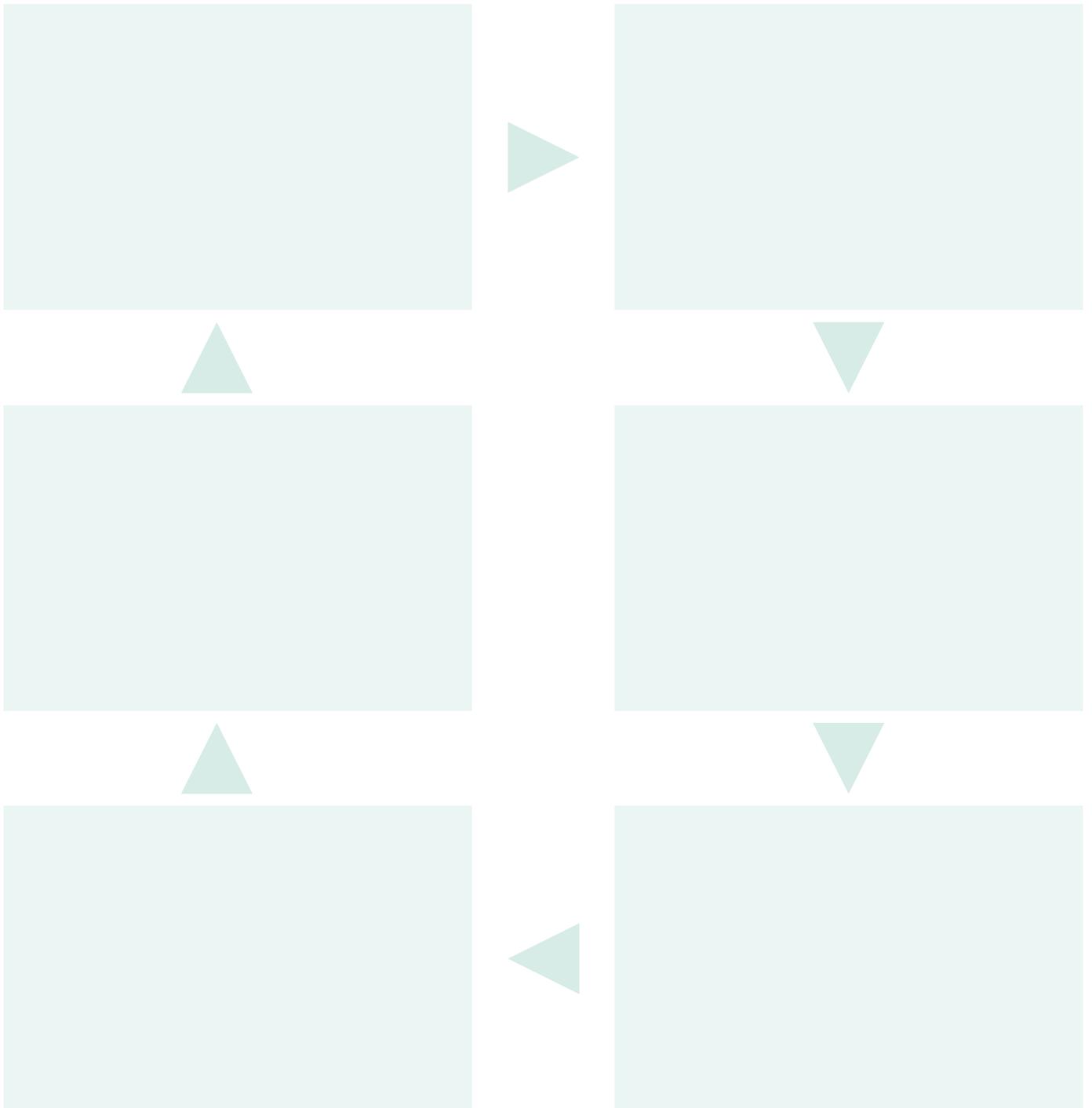
.....

.....

Life cycle of a plastic bottle



Draw the life cycle of a plastic bottle, including annotations.



Waste hierarchy research



Find one example of a strategy for each of the 6 Rs on the waste hierarchy below.

REDESIGN

.....

REPAIR

.....

REFUSE

.....

REDUCE

.....

REUSE

.....

RECYCLE

.....

Lesson 2: Why should we recycle?

Students learn how their own recycling habits can impact the environment. Students then apply user centred design principles to create a recycling bin that encourages recycling.

Resources in this book:



Lesson Overview 2



Teacher Guidance 2



Student Sheet 2a: Recycling questionnaire

Student Sheet 2b: What happens when we recycle?

Student Sheet 2c: Design a user centred bin

Student Sheet 2d: Recycling diary

Resources available online:



Slideshow 2: Why should we recycle?



Gallery: How is plastic recycled?



External Link: The world's deepest bin

External Link: Bottle bank arcade

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

Why should we recycle?



Age 11-14



60 minutes

Curriculum links

- Use survey data to analyse trends in recycling behaviour
- Apply market research to redesign a recycling method based on user centred design

Resources



Slideshow 2:
Why should we recycle?



Student Sheet 2a:
Recycling questionnaire

Student Sheet 2b:
What happens when we recycle?

Student Sheet 2c:
Design a user-centred bin

Student Sheet 2d:
Recycling diary



Gallery:
How is plastic recycled?



External link:
The world's deepest bin

External link:
Bottle bank arcade

Lesson overview

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

Lesson steps

1. What things can I recycle? (10 mins)

Students look at images of objects and group them into things that they believe can and cannot be recycled.

2. How do you recycle? (10 mins)

Students complete survey on what they do and do not recycle. They then tally a score to find out how good they are at recycling compared to their peers.

3. What happens when we recycle? (10 mins)

Recycling has lots of steps. Students investigate how to mechanically recycle a plastic bottle by ordering each step.

4. What would a user-centred recycling bin look like? (25 mins)

Applying new knowledge of what can and cannot be recycled, alongside the survey data of recycling behaviours, students design a user centred recycling bin.

5. What can be recycled? (5 mins)

Students complete a quiz testing their knowledge of what can be recycled.

Learning outcomes

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

Extension or home learning

Students keep a recycling diary for the week.

They should write down all the products they recycle, including how they have been recycled. Each day they should estimate how much they have recycled in grams.

TEACHER GUIDANCE 2 (page 1 of 2)

WHY SHOULD WE RECYCLE?

Step Guidance

Resources

1
10
mins



In step 1, students recall prior knowledge to put plastic items into two categories, recyclable and non-recyclable.

- Using slide 1, students will sort the eight items as either recyclable or non-recyclable.
- Using slide 2, reveal the answers. Note that technologies for recycling are always being developed. This means that some items listed as non-recyclable may be recyclable in some locations.
- Using slides 3 to 5, introduce the lesson and learning outcomes.

Slideshow 2:
Slides 1-5

2
10
mins



In step 2, students will be asked to think critically about their own recycling habits by completing a questionnaire. This will provide market research, shaping their product design task later in the lesson.

- Hand out Student Sheet 2a.
- Ask students to complete the questionnaire independently.
- Ask students to give themselves a rating for their recycling. This number will be between six and eighteen, based on what their responses were to questions one to six on the questionnaire.

Slideshow 2:
Slide 6

Student Sheet 2a:
Recycling questionnaire



In the world of market research, young people are notorious for giving false or exaggerated responses. Remind students to answer honestly. Moreover, it is important that their responses are not biased. Ask students to complete the survey independently to ensure that they do not copy their peers.



Go further by enrolling one or two students to tally up the class total for each question then divide by the number of responses to give an average. This can be presented to the class before they design their user centred bin later in the lesson.

3
10
mins



In step 3, students work in groups to reorder the steps involved in the mechanical recycling of a plastic bottle.

- Using slide 7, link to the Gallery: How do we recycle plastics to show students the steps involved in making plastics. You may want to choose a student to be project leader, whereby they control the computer and select individuals to read the steps aloud.
- Hand out Student Sheet 2b.
- Students reorder the steps involved in recycling plastics.
- Using slide 8, reveal the correct order to students.

Slideshow 2:
Slides 7-8

Student Sheet 2b:
What happens when we recycle?

Gallery:
How do we recycle plastics?

TEACHER GUIDANCE 2 (page 2 of 2)

WHY SHOULD WE RECYCLE?

Step Guidance

Resources

4
20
mins



In step 4, students use the market research obtained from their survey to apply user centred design principles to create a bin which promotes recycling.

- Use slide 9 to present the question: “Plastic bottles are made of PET plastic. It is 100% recyclable. Yet only 7% is recycled in the UK. Why don’t people recycle?”
- Through a whole class discussion encourage students to identify barriers to recycling. Examples may include difficulty washing plastics before recycling, ignorance of what is and is not recyclable, and recycling bins taking up too much space.
- Using slide 10, introduce students to a user centred approach. Explain that products are designed with people in mind. Continue by explaining that the user centred approach asks for user feedback at each step of the development process. Link this back to the survey conducted earlier in the lesson.
- Use slides 11 to 13 to introduce the following design task.
- Hand out Student Sheet 2c.
- Circulate assisting students to develop their design ideas further.



The two videos are hosted on YouTube and you may need to unblock this service, liaising with your IT department.

The link for video example one is:
The world’s deepest bin
<https://youtu.be/cbEKAwCoCKw>

The link for video example two is:
Bottle bank arcade
<https://youtu.be/zSiHjMU-MUo>

Slideshow 2:
Slides 9-13

Student Sheet 2c:
Design a user centred bin

External Link:
The world’s deepest bin

External Link:
Bottle bank arcade

6
5
mins



In step 6, students answer a series of true and false questions. The questions centre around real world examples of companies promoting recycling.

Slideshow 2:
Slides 14-20

+
20
mins



Students keep a recycling diary for the week. They should write down all the products they recycle, including how they have been recycled. Each day they should estimate how much they have recycled in grams.

Student Sheet 2d:
Recycling diary

Recycling questionnaire



This recycling questionnaire is designed to find out how you recycle. You must not discuss your answers with anyone else. Answer honestly.

Do you wash and recycle containers from meals?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Do you put uneaten or gone off food in a food waste bin?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Do you recycle waste from your bedroom and bathroom?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Do you buy drinks in plastic bottles and cans?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Do you put these in a recycling bin, or carry them home to recycle?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Do you recycle used paper and old books at school?			
Usually	<input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>

What would make recycling easier for you?

.....

What do you think would encourage other people to recycle more?

.....

Add up your score from the questionnaire. Every 'usually' scores a 3, 'sometimes' a 2, and 'never' a 1. The higher the score, the better you are at recycling

MY
SCORE -

What happens when we recycle?



Below is the eight step process of recycling a plastic bottle.
Cut them out and sort them into the correct order.

Shredding

Once your recycling bin has been picked up it is first shredded into many tiny pieces. This allows excess liquids to leave bottles and containers.

Heating

The tiny little fragments now need to come together. The plastic is heated to 270 degrees Celsius. This allows it to form one spaghetti like string of plastic.

Sieving

The plastic is forced through a sieve (mesh with holes). This forms lots of long strands. It is heated and stretched several times.

Drying

Once washed, the now clear plastic needs the moisture removing. They are placed in a giant steel drum for approximately 10 hours.

Sorting

Once shredded the pieces of plastic are wrapped in cellophane and stacked in bales. They are now ready to be distributed to specialised recycling plants.

Tearing

The long thin strands are then torn apart. This forms a fluffy material which looks like cotton wool. However, the polyester is a completely man made material.

Spinning

The fluffy material is first rolled together to form felt. The material is then pulled out and twisted. This forms long strands which are spun around a bobbin (a cylinder, which looks a bit like a toilet roll). After this has been repeated many times you have a thread.

Washing

To remove the excess liquid the bottles and containers used to hold the plastic is washed. The plastic is put in a corrosive chemical which removes the colour from the bottles. Less dense plastics, such as bottle caps, float and are extracted by workers.



Design a user-centred bin



User-centered designs focus on removing the barriers and introducing useful features to add value for the user.

Your user is a young person aged 11-14.

List barriers to using a recycling bin.

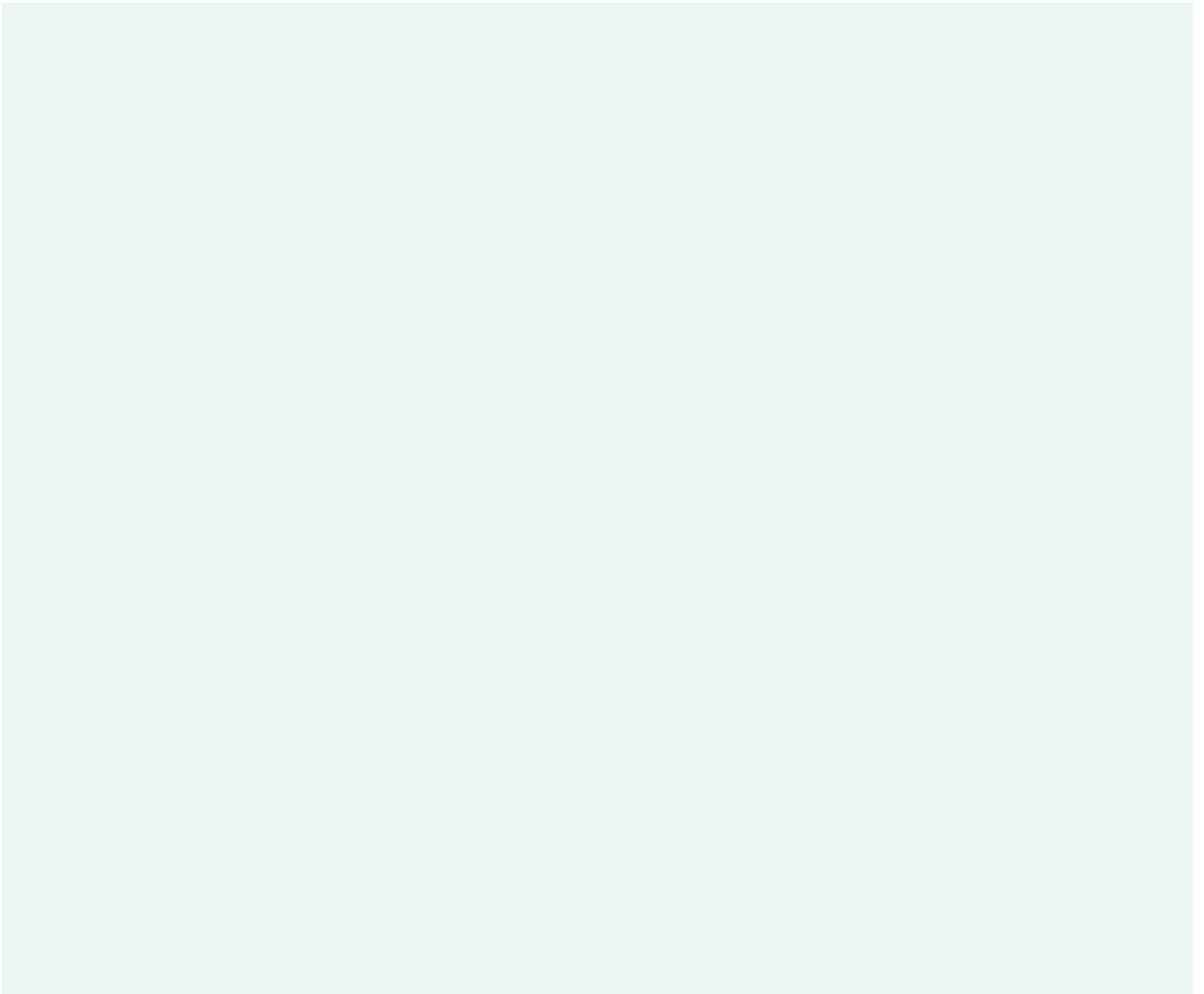
Empty space for listing barriers to using a recycling bin.

List features you could add that would make them want to use it more.

Empty space for listing features to improve the recycling bin.

STUDENT SHEET 2c

Draw and label your design



Look at your design - what three questions would you like to go and ask your user?

-
.....
-
.....
-
.....

STUDENT SHEET 2d

RECYCLING DIARY

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Home							
School							
Other							
Weight estimate (grams)							

Lesson 3:

How do we reduce, reuse and refuse plastic products?

Students will learn how real-world companies apply strategies to reduce, reuse and refuse. Students then apply their understanding to designing their own fashion brand.

Resources in this book:



Lesson Overview 3



Teacher Guidance 3



Student Sheet 3a: Buzz stations

Student Sheet 3b: Design your own fashion brand

Resources available online:



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

All resources can be downloaded from:

encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

How do we reduce, reuse and refuse plastic products?



Age 11-14



60 minutes

Curriculum links

- Using real-world examples define terms reduce, reuse, refuse
- Create a sustainable fashion brand which applies the 6 Rs

Resources



Slideshow 3:

How do we reduce, reuse and refuse plastic products?



Student Sheet 3a:

Buzz stations

Student Sheet 3b:

Design your own fashion label

Extension or home learning

Research a fashion brand and find out what it does, or has done, in terms of reduce, reuse and refuse. Prepare one side A4.

Lesson overview

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

Lesson steps

1. What is happening to the world's population? (10 mins)

Students interpret a graph forecasting the world population growth. Students link rising population with an increase in consumerism and identify finite (non-renewable) resources.

2. How can we reduce reuse and refuse? (15 mins)

Students move between five buzz (talking) stations in groups. Each station is based on an example where real-world companies have applied reduce, reuse, refuse principles to a product or initiative. Students discuss each example.

3. Defining terms (5 mins)

Students generate their own definitions of reduce, reuse and refuse.

4. Design your own fashion brand (20 mins)

Students create their own fashion brand by selecting styles and materials based on their understanding of the 6 Rs.

5. Pitch (10 mins)

Students pitch their designs.

Learning outcomes

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

TEACHER GUIDANCE 3 (page 1 of 3)

HOW DO WE REDUCE, REUSE AND REFUSE PLASTIC PRODUCTS?

Step Guidance

Resources

1
10
mins



Students are invited to consider the bigger issues which make the 6 Rs so important.

- Using slide 1, students can visualise the changing world population.
- In pairs, students discuss the questions displayed on the board.
- The questions are reviewed by the teacher, as a mini plenary.
- Using slide 2, students are introduced to the term “finite” in terms of resources. Explain that the resources on Earth are fixed but with a growing population, there are more people they must be shared with.
- Using slides 3-5 introduce the lesson and learning outcomes.

Slideshow 3:
Slides 1-5



A common misconception is that the Earth can not sustain a growing population. However, the main issue is that we have a growing number of consumers. For example, as countries develop their lower class becomes middle class and begin to eat meat, buy cars, travel more and purchase more consumables.

Some researchers believe that the Earth could sustain 9 billion people sustainably if everyone lived more modestly.



You can demonstrate the change in wealth/consumption in the classroom. Place 7 post it notes on the board. Tell students they represent the 7 billion people on Earth.

Explain that 1 billion people save up for holidays each year, 1 billion save up to afford a car, 3 billion invest their money in maintaining a moped or bicycle, and the last 1 billion save their money to afford shoes.

This can be presented on the board by placing the post-it notes (from top to bottom) as 1,1,3,2. However this is changing. Begin to move all the post it notes to the top two rows. Explain that as people become wealthier, they consume more.

2
15
mins



In step 2, students explore how the 6 Rs have been applied to real-world examples.

- Place Student Sheet 3a around the classroom.
- Introduce the buzz (talking) stations.
- Explain that students will move in groups to each station and discuss the four questions presented on slide 6.
- Put students in working groups and let them know both an estimate of how long they will spend at each station and the station order.
- Circulate while students discuss the station content.

Slideshow 3:
Slide 6

Student Sheet 3a:
Buzz stations

TEACHER GUIDANCE 3 (page 2 of 3)

HOW DO WE REDUCE, REUSE AND REFUSE PLASTIC PRODUCTS?

Step Guidance

Resources



Depending on your institute's policy, consider allowing students to use their phones to search each company's websites and online adverts, linked at the bottom of each station sheet. If this is not possible you could place a laptop or tablet computer at each station.

3
5
mins



In step 3, students apply what they have gained from their discussions to define the lesson's key words.

- Using slide 7, ask students to independently define reduce, reuse, refuse.
- To allow students to have time to formulate their ideas, insist 30 seconds silence before collecting in answers.
- Take in the students' responses.

Slideshow 3:
Slide 7

4
20
mins



In step 4, students create their own sustainable clothing brand. They are empowered to make real business decisions, to improve the sustainability of their product at the cost of reducing their margins.

- Hand out Student Sheet 3b and sheets of scrap or blank paper - this is for students to draw out their designs.
- Put students in pairs or groups.
- Explain to students what they are expected to do on Student Sheet 3b.
- Circulate the classroom as students complete the task.
- Students first select the materials and dyes they want to choose, given the information provided. Students will quickly recognise that the materials which are more environmentally sustainable are more expensive.
- Students then populate the table where they fill in their material options, calculate their manufacture cost, decide on a retail price, then calculate their margin using the equation provided.
- Finally, students answer the summary which encourages them to consider the trade off between sustainability and margins in the clothing industry.

Slideshow 3:
Slide 8

Student Sheet 3b:
Create your own fashion brand

Scrap or blank paper



Margins are used in the fashion industry on all products. Most designer stores in the UK operate on a margin between 75-85%.

TEACHER GUIDANCE 3 (page 3 of 3)

HOW DO WE REDUCE, REUSE AND REFUSE PLASTIC PRODUCTS?

Step Guidance

Resources

5
10
mins



Students now prepare to share their designs with their peers.

- Invite students to the front to present their work.
- Model the presentation routine.
- Once a group has presented it may be worth asking the students in the class to respond with feedback. Ask students to feedback one thing they liked and one thing to be improved upon.

Slideshow 3:
Slide 8

Student Sheet 3b:
Create your own fashion brand

+
20
mins



Ask students to research a fashion brand of their choice. They need to find out what it does, or has done, in terms of reduce, reuse, recycle.

Students can choose their favourite brands or unknown international brands. Applications of the 6 Rs can be in the form of products but also initiatives.

Students must prepare one side A4 detailing what they have found out.

Subject Update:
How to: Improve students' online research skills

Buzz station 1

Vivo barefoot



Vivo barefoot is a shoe making company that created a range of vegan shoes.

By 2020 they aim to use 90% sustainable materials across their entire product range



Website:

<https://www.vivobarefoot.com/uk>

Buzz station 2

H&M garment collection



H&M offer a garment collection service at every UK store.

“Bring a bag of old garments, of any brand, to a store and receive a £5 voucher.”



Website:

https://www2.hm.com/en_gb/ladies/shop-by-feature/16r-garment-collecting.html

Buzz station 3

Bare & Bobo nappies



Bare and Boho create nappies with a difference. These are reusable.

Instead of parents spending lots of money on disposable nappies /diapers, they can by these reusable designer cloth alternatives.



Website:

<https://bareandboho.com.au/>



Promo videos:

https://youtu.be/jHhSY_xJuVw

Buzz station 4

Vintage market



Celebrities such as Kim Kardashian and Meghan Markle have been seen wearing vintage clothing.

Consumers are increasingly buying vintage clothing because it is fashionable.

Highstreet retailers have noticed the trend and beginning to feature vintage clothing ranges online and instore. Companies like ASOS, H&M, and Arket have already begun selling vintage ranges.



Website:

<https://www.theguardian.com/fashion/2019/apr/25/the-vintage-come-back-is-it-the-solution-to-sustainable-shopping>

Buzz station 5

Finisterre



Finisterre is a British clothing brand. It prides itself on a functional design which is sustainably made.

Finisterre has created a new material called Econyl which they use on their swimsuits and jackets.

Econyl is made from recycled plastics from land fill, such as old carpets and fishing nets.



Website:

<https://finisterre.com/blogs/fabric-of-finisterre/econyl-regenerated-nylon>



Promo videos:

<https://vimeo.com/215217462>

Design your own fashion brand



Materials and dyes

You are going to design a sustainable clothing brand. You will design 6 products for your new designer brand. Start by choosing your materials and dyes to colour them.

Polyester	Recycled Polyester	Cotton
A synthetic (man-made) petroleum based fibre.	This is recycled from plastic bottles made from PET plastic.	This is grown on plants and is a natural, renewable material.
Natural dyes can not be used.	Natural dyes can not be used.	Natural dyes can be used.
Cost per garment for materials:	Cost per garment for materials:	Cost per garment for materials:
Jumper - £5 Top - £1 Dress - £5	Jumper - £7 Top - £3 Dress - £7	Jumper - £12 Top - £5 Dress - £12

Synthetic Dyes

Synthetic dyes are made in a factory from industrial chemicals. They stick to clothes for a long time maintaining colour. However, if leaked into the local environment they can be harmful to people and the environment.

Cost per garment for materials:
Jumper - £4 materials
Top - £2
Dress - £4

Natural Dyes

Natural dyes are made from plants, insects, or minerals. They are safer if they leak into the local environment where the clothes are made.

Cost per garment for materials:
Jumper - £4 materials
Top - £2
Dress - £4

STUDENT SHEET 3b

Fill in the table

Once you have calculated your manufacture cost, and chosen your retail price, you can calculate your margin. This is the % you make on each product sold.

$$\text{Margins} = \frac{(\text{retail price} - \text{product manufacture cost})}{\text{Retail price}} \times 100$$

Product	Material	Dye (S/N)	Manufacture cost	Retail price	Margins
Jumper					
Jumper					
Dress					
Dress					
Top					
Top					

1. Which material and dyes have you chosen? Explain why.
2. How is your designer brand sustainable? For example, have you used any of the Rs? (recycled, reduced, reused, refused)
3. How did you decide on your retail prices for the garments?
4. Predict how your margins would be different if you had chosen different materials or dyes.
5. Why don't all clothing retailers use recycled polyester or cotton in all their products?
6. On a separate sheet, design your range. This should include two jumpers, two dresses and two tops.

Lesson 4: Should we repair?

In this lesson, students investigate how many products are designed to become obsolete. Students apply the modular design to the mobile phone as a solution to making it more repairable.

Resources in this book:



Lesson Overview 4



Teacher Guidance 4



Student Sheet 4a: Modular phone information

Student Sheet 4b: Design a modular phone

Resources available online:



Slideshow 4: Should we repair?

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

Should we repair?



Age 11-14



60 minutes

Curriculum links

- Investigate the benefits and drawbacks of repair
- Apply modular design as a solution to sending devices to landfill
- Design and review a modular mobile phone

Resources



Slideshow 4:
Should we repair?



Student Sheet 4a:
Modular phone information

Student Sheet 4b:
Design a modular phone

Extension or home learning

List all the different materials found in a mobile phone.

In 150 words describe how they can harm our oceans.

Lesson overview

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

Lesson steps

Learning outcomes

- 1. What have you thrown away? (10 mins)**
Students list items which they have thrown away and consider which could have been repaired.

 - Describe what products can be easily repaired
- 2. How have phones changed? (10 mins)**
Students order phones from oldest to newest and compare how designs have changed over time.

 - Describe what products can be easily repaired
- 3. Why are things not repaired? (10 mins)**
Students investigate how planned obsolescence is used in industry.

 - Describe what products can be easily repaired
- 4. Design a modular phone (20 mins)**
Students are introduced to a modular design. They are tasked with building their own modular phones.

 - Create a modular design for easy repair
 - Explain the environmental implications of products that can be easily repaired
- 5. Would you buy a repairable phone? (5 mins)**
Students discuss the question, "Would you rather buy a repairable phone or the latest Apple phone?" This encourages students to explain how environmental implications do or do not impact their attitudes.

 - Explain the environmental implications of products that can be easily repaired
- 6. Defining today's keyword (5 mins)**
Students use a definition grid to help them define the word repair.

 - Define repair

TEACHER GUIDANCE 4 (page 1 of 4)

SHOULD WE REPAIR?

Step Guidance

Resources

1
10
mins



In step 1, students recall what they have thrown away in the past.

- Using slide 1, students begin to list items they have thrown away in the past as a settler activity.
- Review student responses, listing some examples on the board. Pose the question to students: “Which can be repaired easily?”
- Using slides 2-4, introduce the lesson and learning objectives.

Slideshow 4:
Slides 1-4

2
10
mins



In step 2, students are asked to compare how mobile phones have changed over time. This will require them to distinguish differences they can see from images given.

- Direct students to slide 5.
- Ask students to work in pairs or a group to reorder the phones displayed, numbered 1-9, in order of oldest to newest.
- Students write down a list of numbers in their workbook.
- Ask one or two groups to feedback their order of numbers. Write these predictions on the class board.
- Using slide 6, reveal the actual order of the phones from oldest to newest.
- Begin a discussion by asking students, “What can you see has changed over time?” Students ought to list lots of physical characteristics they can observe.
- Develop the discussion by asking, “What do you think mobiles can do today that they couldn’t do before?”

Slideshow 4:
Slides 5-6

TEACHER GUIDANCE 4 (page 2 of 4) SHOULD WE REPAIR?

Step Guidance

Resources

3

10
mins



In step 3, students gain an awareness of how manufacturers have designed phones to become obsolete quickly and how this contributes to the e-waste dumped on landfill.

- Using slide 7, introduce the statement “The average Briton throws away 25-50kg of e-waste a year”. Then ask students, “Why are things not repaired?” Remember to allow a 5 second think time before accepting students’ answers.
- If students are struggling, follow up with the questions shown on the board: “Why might we not want to repair something?”, and “Why might a mobile company not want us to repair?”
- Once you have elicited the idea that manufacturers have different motivations to the consumer, introduce planned obsolescence on slide 8.
- Using slide 8, first outline that planned obsolescence is where manufacturers design a product with the intention that it will become obsolete. Therefore, the consumer purchases more goods.
- Outline the 4 main types of obsolescence shown on slide 8. Further details provided below in information section.
- Using slide 9, explain to students that phones are made of both useful and harmful metals and chemicals. When sent to landfill these react in the air and rainwater. Toxic metals and chemicals dissolve in water and enter water sources through the ground. Eventually, these can reach the ocean and harm marine organisms.

Slideshow 4:
Slides 7-9



There are four main types of obsolescence students will be introduced to.

1. **Contrived durability:** Explain that most phones now have a touch screen which, although improves user experience, is easily broken and often requires specialists to fix.
2. **Prevention of repairs:** Explain that many phones now have in built batteries therefore cannot be easily replaced by the consumer. Furthermore, some tech brands have used specialised screws so most people cannot open and repair their phones.
3. **Perceived obsolescence:** Explain that most things from phones to cars come in models that are released yearly. This means that consumers perceive – think – that their phone has less value because it is an older model. This increases tech being discarded and the number of new purchases.
4. **Systemic obsolescence:** Explain that old tech often becomes outdated because it can not receive new updates. This means that it cannot create or receive information sent from newer devices, even though the machine’s hardware still functions.

TEACHER GUIDANCE 4 (page 3 of 4)

SHOULD WE REPAIR?

Step Guidance

Resources

4
20
mins



Students now recognise how manufacturers can purposefully design products with planned obsolescence to drive profits. Students also understand the negative impact this can have on the environment. In step 4, students are introduced to modular design which they apply to create their own modular mobile.

- Using slide 10, explain to students that there is a solution to the design issue. Introduce modular design by referencing the examples shown pictorially on the slide. Explain that modular design is used in houses, cars, and furniture. This type of design allows for easy assembly, repairing, and recycling.
- Print Student Sheet 4a and place the different sheets around the room for the design a modular phone activity.
- Hand out Student Sheet 4b.
- Using slide 11, ask students to go to each station and choose the specification they would like to include on their phone, the cost for each component, and explain why they chose it.
- Instruct students to sit down once finished.
- Students then draw a labelled diagram of their product and complete summary questions.
- Once most students are finished review the summary questions.



To ensure that designs are varied you may want to give students different budgets to build their phones. Split the class in three groups. Group one has up to £300, group two has up to £400, and group three has up to £600.

Slideshow 4:
Slides 10-11

Student Sheet 4a:
Modular phone information

Student Sheet 4b:
Design a modular phone

5
5
mins



Students now understand what modular design is and how it may be able to reduce ocean plastics by making products more repairable. Now students think critically how environmental implications do/do not impact their attitudes.

- Showing slide 12 pose the question, “Would you rather buy a repairable phone or the latest Apple phone?”
- Facilitate a discussion among students, prompting them to explain the economic, environmental, and social reasons.
- A good discussion format is ABC (agree, build, challenge). Using this model, students first respond to another person’s point by either stating they agree, would like to build on that point, or that they would like to challenge the previous point made.

Slideshow 4:
Slide 12

TEACHER GUIDANCE 4 (page 4 of 4)

SHOULD WE REPAIR?

Step Guidance

Resources

6
5
mins



In step 6, students have opportunity to think critically about what it means to repair.

- Using slide 13 introduce the definition grid. Explain that the main word goes in the centre. Show students the 4 boxes surrounding the centre titled: 'definitions', 'characteristics', 'examples', and 'non-examples'. Then instruct students to draw the grid into their own books, put the word 'repair' in the centre, and populate.



The definition grid is very good at making students think more deeply about concepts. However, it can be particularly challenging when defining a verb as opposed to a noun. If students are struggling, perhaps break the task into two segments, asking them to complete two boxes first. Review these as a whole class. Then ask them to complete the next two boxes.

Slideshow 4:
Slide 13

+
20
mins



The lesson has mostly been focused on the solution to the ocean plastic problem. This homework is designed to remind students of the problem that modular design fixes. Ask students to go home and research the different materials which make up a mobile phone. Students list the materials then, using approximately 150 words, describe how they can harm our oceans.

Subject Update:
How to: Improve students' online research skills

Modular phone information



	Low tier	Middle tier	Top tier
Storage	32 GB You have to stream all music and videos. £40.00	128 GB You want to store photos, videos music and videos. £80.00	256 GB You want to create a large library of photos, videos, music and videos. £120.00
Camera	1 Megapixel Photos you take will look good on a small phone screen. £40.00	4 Megapixels Photos you take will look good on a computer screen. £80.00	15 Megapixels You can print your photos very large and view them on any screen. £120.00
Battery	5,000 mAh Five hours talk time. £40.00	10,000 mAh Ten hours talk time. £80.00	20,000 mAh Twenty hours talk time. £120.00
Processor	0.5 GHz You can only run one app at a time. £40.00	2 GHz You can run multiple apps at the same time. £80.00	3 GHz You can run many intensive apps at the same time and stream HD video. £120.00
Screen	Buttons Difficult for using with apps and slow to type. £40.00	LCD touch screen Good for using apps and watching videos. £80.00	OLED touch screen Great for watching videos in HD quality. £120.00

Design a modular phone



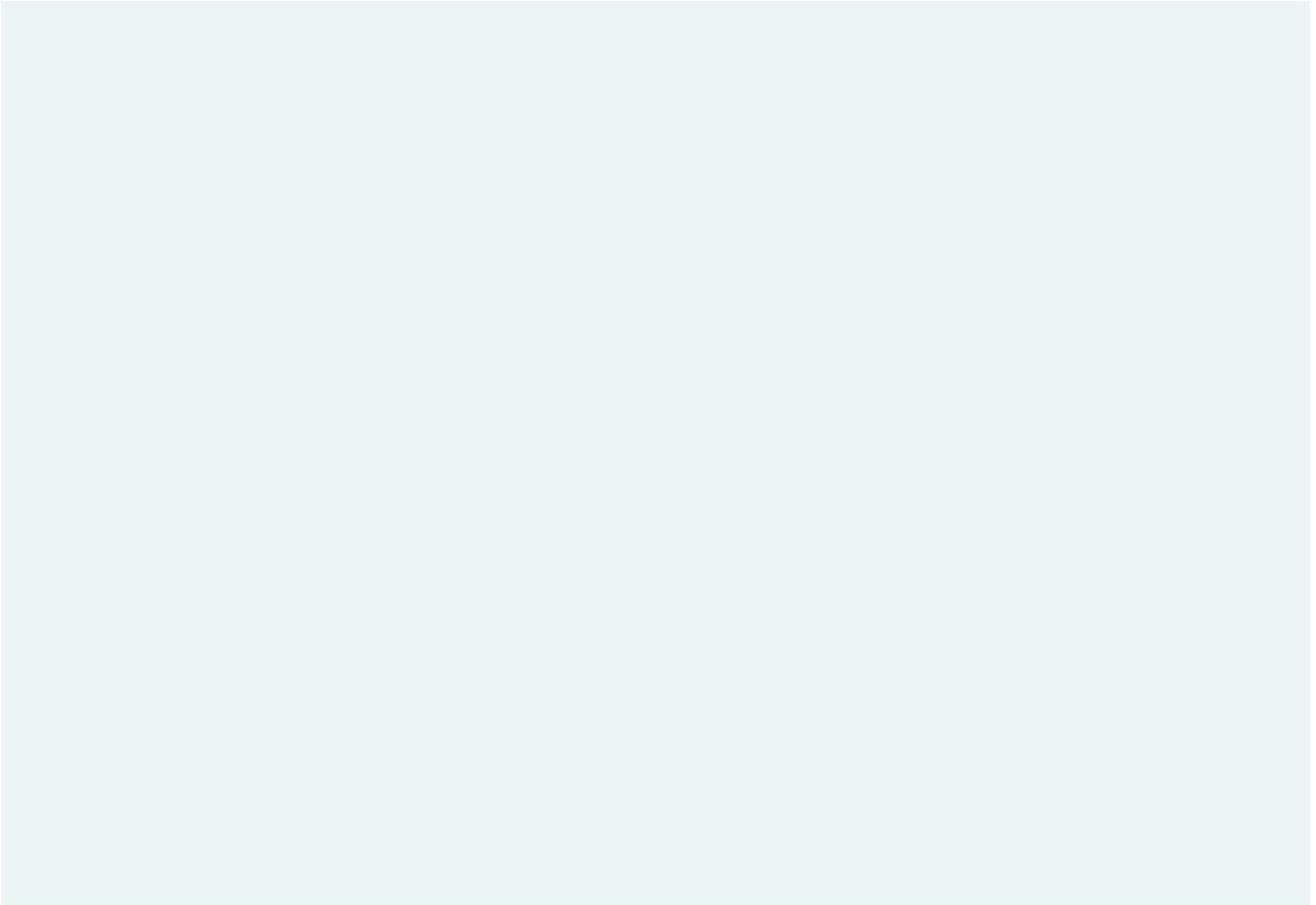
Fill in the table

Move around the room and choose which components you will add to your modular phone.

Feature	Specification	Cost	Why did you choose this?
Storage 			
Camera 			
Battery 			
Processor 			
Screen 			
Total cost: 			

STUDENT SHEET 4b

Draw and label your phone design



Summary Questions

1. How is a modular phone easier to repair?

.....

.....

2. Why is it important we repair or recycle electronics, instead of putting them on landfill?

.....

.....

3. Predict why most electronic companies do not use modular designs?

.....

.....

Lesson 5:

Can redesigning products help?

In this lesson students will evaluate how redesigns can reduce ocean plastic waste. Students will conduct a Product Life Cycle on a household object before applying what they have learnt into redesigning the product.

Resources in this book:



Lesson Overview 5



Teacher Guidance 5



Student Sheet 5a: Cryptogram

Student Sheet 5b: Redesign gallery

Student Sheet 5c: Product analysis

Resources available online:



Slideshow 5: Can redesigning products help?



External Link: Edible six pack ring



Subject Update: Improve student's online research skills

All resources can be downloaded from:

encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

Can redesigning products help?



Age 11-14



60 minutes

Curriculum links

- Evaluate how redesigns can reduce ocean plastics.
- Analyse the product life cycle of a household object and apply learnings to a redesign.

Resources



Slideshow 5:
Can redesigning products help?



Student Sheet 5a:
Cryptogram

Student Sheet 5b:
Redesign gallery

Student Sheet 5c:
Product analysis

External Link:
Edible six pack ring

Extension or home learning

Students research sustainable designs. Pick their favourite. In 100 words students explain why they like it.

Lesson overview

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

Lesson steps

- 1. Definition cryptogram (5 mins)**
Students complete a cryptogram to uncover the meaning of the lesson.
- 2. What is sustainable redesign? (5 mins)**
Students look at an example of sustainable redesign and understand how it applies to the 6 Rs.
- 3. Redesign gallery (15 mins)**
Students move around the room, like a gallery, and critique redesigns, stating which of the 6 Rs each design has used.
- 4. Product analysis (15 mins)**
Students choose one of three household items to analyse and redesign. Students analyse the product life cycle using the 6 Rs.
- 5. Redesign (10 mins)**
Students choose one of three things highlighted in the assessment, which they would like to change. Students redesign the product.
- 6. Unintended consequences (10 mins)**
Students discuss unintended consequences of sustainable redesign. Then students predict what unintended consequences may arise from their redesigns.

Learning outcomes

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

TEACHER GUIDANCE 5 (page 1 of 3)

CAN REDESIGNING PRODUCTS HELP?

Step Guidance

Resources

1
5
mins



In step 1 students decode a cryptogram to discover what they will be learning about in the lesson.

- Hand out Student Sheet 5a.
- Using slide 1, instruct students to decode the cryptogram.
- Using slides 2-4, introduce the lesson and learning outcomes.



For some classes, who may not have encountered a cryptogram, you may have to model how to complete it. For these classes you can motivate them to complete it by offering a reward to the first 3 to raise their hands and show the correct answer.

Alternately, some classes may find the task simple. In which case you can stretch them by asking them to give examples of sustainable design / redesign.

Slideshow 5:
Slides 1-4

Student Sheet 5a:
Cryptogram

2
5
mins



Introduce the importance of sustainable design using an example.

- Using slide 5, play the video.
- The video shows a redesign of the plastic 6 pack ring with an edible alternative.
- Ask students, “How is this better for the ocean?” Continue by asking students to identify which of the 6 Rs relate to this product. They ought to align this with refuse.
- You may want to go further by asking, “Do you think the edible six pack rings will be as good? Will it be as cheap to make? Could there be any unintended consequences?”



This video is hosted on Vimeo and you may need to unblock this service, liaising with your IT department.

The link for the video is:

Edible six pack ring

<https://vimeo.com/167207255>

Slideshow 5:
Slide 5

External Link:
Edible six pack ring

3
15
mins



In step 3, students explore examples of sustainable redesign and evaluate the social, economic, and environmental impacts.

- Print Student Sheet 5b and place the five models around the room. Depending on class size you may need two copies of each.
- Using slide 6, introduce the activity as a ‘redesign gallery’.

Slideshow 5:
Slide 6

Student Sheet 5b:
Redesign gallery

TEACHER GUIDANCE 5 (page 2 of 3)

CAN REDESIGNING PRODUCTS HELP?

Step Guidance

Resources

- Instruct students to move around the room – like an art gallery – and critique each redesign in small groups.
- At each station, students will identify which of the 6 Rs have been applied.
- After students have been to all 5 stations, stop students and ask for their attention. Instruct them on the count of 10 to stand by their favourite design.
- Once students are in position, target students and ask them why they have chosen that product and not the others.



The art gallery is a nice method of transmission. However, some groups may find it more challenging than others. To resolve this, you can add more structure by including some gallery rules. Examples of gallery rules include:

- Always whisper to other gallery visitors.
- No more than 3 people per artwork.
- No photography or phones permitted.

4
15
mins



In step 4, students choose one of 3 household items to analyse and redesign. Students analyse the product life cycle using the 6 Rs.

- Hand out student sheet 5c.
- Using slide 7, direct students to complete the student sheet.

Slideshow 5:
Slide 7

Student Sheet 5c:
Product analysis



Ideally give students access to computers and the internet to research their product. This way they can accurately identify the materials which they are made from.

5
10
mins



Once students have analysed the product, they will have identified opportunities to redesign. This may involve changing the materials the product it is made from. It may also include making the design more modular, so it is both easier to repair and recycle.

In step 5, students apply their learnings to creating a redesign.

- Before directing students to begin their redesign you may want to ask students to share the product they have chosen and some redesign ideas they have thought of from step 4. This will support other students to make progress.
- Instruct students that they have 10 minutes to redesign their product.
- Students may complete their redesign either on paper or, if computers are available, using any suitable software.

Slideshow 5:
Slide 7

TEACHER GUIDANCE 5 (page 3 of 3)

CAN REDESIGNING PRODUCTS HELP?

Step Guidance

Resources

6
10
mins



In step 6, students are encouraged to consider the unintended consequences of their designs.

- Using slide 8, show the graph: “How many times do you need to reuse a reusable bag to make it more sustainable than a single-use carrier bag?”
- Ask students, “Are you surprised by this?” And, “Why do you think you need to reuse these items so many times?” Students should begin to think about the differences in manufacturing.
- Using slide 9, introduce the idea that some materials are better than others for a function. Refusing to use materials can impact user experience. Slide 6 shows the example of straws made from different materials. Ask students, “Which do you prefer and why?” This may develop into a debate.

Slideshow 5:
Slides 8-9



The unintended consequences of sustainable design are quite challenging to understand. This is a great opportunity to stretch students.

Slide 8 shows how many times a carrier bag must be reused to make it more sustainable than a conventional single-use plastic carrier bag. This is based on the items ‘global warming potential’ that will factor in emissions produced in the manufacture of the bags. To put it in context, a cotton carrier bag will only have contributed fewer emissions if used more than 131 times.

Slide 9 gives opportunity to discuss how the material impacts the user’s experience. Many fast food chains have moved from plastic straws to paper straws to have a more sustainable brand image. However, some people have criticised how effective the paper straws are.

More information can be found using the link below:
Environment Agency 2006:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291023/scho0711buan-e-e.pdf

+
20
mins



Encourage students to discover designs themselves. In this task ask students to research sustainable designs. They must then find their favourite sustainable design and explain why they like it in 100 words.

Subject Update:
How to: Improve students’ online research skills

Cryptogram

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
21			1	3			6	8						17				11	13	25					

S U S T A I _ _ A _ _ E _ _ E D E S I _ _ _ I S
 11 25 11 13 21 8 7 21 12 16 3 10 3 1 3 11 8 22 7 8 11

D E S I _ _ _ I _ _ _ S O _ _ E T H I _ _ _ A _ _ A I _ _
 1 3 11 8 22 7 8 7 22 11 17 9 3 13 6 8 7 22 21 22 21 8 7

S O I T H A S _ _ E _ _ E _ _ _ E _ _ A T I _ _ E
 11 17 8 13 6 21 11 14 3 20 3 10 7 3 22 21 13 8 18 3

I _ _ _ A _ _ T S O _ _ T H E E _ _ I _ _ O _ _ _ E _ _ T
 8 9 19 21 24 13 11 17 7 13 6 3 3 7 18 8 10 17 7 9 3 7 13



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
21			1	3			6	8						17				11	13	25					

S U S T A I _ _ A _ _ E _ _ E D E S I _ _ _ I S
 11 25 11 13 21 8 7 21 12 16 3 10 3 1 3 11 8 22 7 8 11

D E S I _ _ _ I _ _ _ S O _ _ E T H I _ _ _ A _ _ A I _ _
 1 3 11 8 22 7 8 7 22 11 17 9 3 13 6 8 7 22 21 22 21 8 7

S O I T H A S _ _ E _ _ E _ _ _ E _ _ A T I _ _ E
 11 17 8 13 6 21 11 14 3 20 3 10 7 3 22 21 13 8 18 3

I _ _ _ A _ _ T S O _ _ T H E E _ _ I _ _ O _ _ _ E _ _ T
 8 9 19 21 24 13 11 17 7 13 6 3 3 7 18 8 10 17 7 9 3 7 13



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
21			1	3			6	8						17				11	13	25					

S U S T A I _ _ A _ _ E _ _ E D E S I _ _ _ I S
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D E S I _ _ _ I _ _ _ S O _ _ E T H I _ _ _ A _ _ A I _ _
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S O I T H A S _ _ E _ _ E _ _ _ E _ _ A T I _ _ E
 11 17 8 13 6 21 11 14 3 20 3 10 7 3 22 21 13 8 18 3

I _ _ _ A _ _ T S O _ _ T H E E _ _ I _ _ O _ _ _ E _ _ T
 8 9 19 21 24 13 11 17 7 13 6 3 3 7 18 8 10 17 7 9 3 7 13

Redesign gallery 1

Edible cups and straws



A company called Loliware has created edible cups and straws which are both edible and biodegradable.

- How does this impact costs?
- How does this impact people?
- How does this impact the environment?

Redesign gallery 2

Minimalist furniture



Pearson Lloyd is a furniture design company. They have created their designs to use the smallest amount of material without compromising sturdiness.

- How does this impact costs?
- How does this impact people?
- How does this impact the environment?

Redesign gallery 3

Luken by Paola Calzada



This is a Mexican company which recycles bottles into furniture. The furniture is flat packed and does not require glue or nails (fewer materials needed).

- How does this impact costs?
- How does this impact people?
- How does this impact the environment?

Redesign gallery 4

Cycling jeans



Levi made a commuter pair of jeans to promote people to cycle. These were water resistant, had a strap to hold a bike lock, and included a reflective strip for safety.

- How does this impact costs?
- How does this impact people?
- How does this impact the environment?

Redesign gallery 5

Optimist toaster



This toaster is called the optimist. It is made out of 100% recycled aluminium that can be recycled at the end of its life. It has few moving parts so is unlikely to break and easy to repair. A counter allows users to see how much toast they have made during the toasters life.

- How does this impact costs?
- How does this impact people?
- How does this impact the environment?

Product analysis



Pick one of the following products to analyse and redesign



Kettle



Remote control



Toothbrush

Reduce

1. Which materials is your product currently made of?

.....

.....

.....

2. Can you reduce any of these materials? Or can you reduce the energy needed to make or use it?

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.....

Recycle

3. Which parts of the product can you recycle?

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4. Are the parts easy to separate for recycling?

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.....

.....

Refuse

5. Are there any materials you can refuse to make it out of?

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.....

.....

Repair

6. Can it be broken into small parts or its compartments to be replaced or fixed easily?

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Redesign

7. Looking at the analysis above, give 1-3 things you could do to make your product more sustainable.

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-
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-
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Lesson 6: Design task

Students apply the 6 Rs to design their own ocean friendly product which they pitch to their peers.

Resources in this book:



Lesson Overview 6



Teacher Guidance 6



Student Sheet 6a: Design template

Student Sheet 6b: Product pitch

Resources available online:



Slideshow 6: Design task



Subject Update: Improve students' online research skills

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14

Design task



Age 11-14



60 minutes

Curriculum links

- Formulate solutions to design problems
- Create an ocean friendly product design and justify with the 6 Rs

Resources



Slideshow 6:
Design task



Student Sheet 6a:
Design template

Student Sheet 6b:
Product pitch

Lesson overview

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

Lesson steps

Learning outcomes

1. Introduction (5 mins)

Students define what they consider to be sustainable design.

- Define sustainable design

2. Sustainable design (30 mins)

Students choose a product which they will design to make ocean friendly. They research the current product, identify why it is not ocean friendly, design their product, then explain how it solves the problem.

- Design an ocean friendly product

3. Pitch carousel (20 mins)

Student move around the room and listen to other groups pitch their new product.

- Draw your product design

4. Reflection (5 mins)

Students must practise metacognition by imagining the feedback they would receive from a seahorse, a retailer, and their competitor.

- Reflect and evaluate your product design

TEACHER GUIDANCE 6 (page 1 of 2)

DESIGN TASK

Step Guidance

Resources

1
5
mins



For the final lesson in this unit students will begin to consider what sustainable design means.

- Using slide 1, direct students to an image of a banana wrapped in packaging. Ask students, “Is this sustainable product design?” Through further questioning, encourage students to define what sustainable design is.
- Using slides 2-4, introduce the lesson and learning outcomes.

Slideshow 6:
Slides 1-4

2
30
mins



In step 2, students choose a product to redesign to be ocean friendly.

- Direct students to slide 5, pose the question, “What products can we redesign to be more sustainable?” If students find this question challenging, first encourage them to consider what products are damaging the oceans. From there ask how they can be redesigned to be more ocean friendly.
- Using slide 6, inform student that they will be designing an ocean friendly product. They can design either ocean friendly sportswear, an ocean friendly drinks bottle, ocean friendly take away packaging, or an ocean friendly product of their choice.
- Hand out Student Sheet 6a and put students into groups (groups of three is preferable).

Slideshow 6:
Slides 5-6

Student Sheet 6a:
Design template



Students will have acquired enough knowledge from lessons earlier in the topic, to complete this task independently. For students who require extra support below are a few examples of how these products have been made ocean friendly.

Sportswear:

Adidas has teamed up with Parley to create a range called Adidas x Parley. These trainers are from plastic that has been collected from beaches in remote locations.

Packaging:

Lolliware has created a range of edible cups and straws. EcoSoulife is another company which specialises in sustainable containers. Their single use products are made of biodegradable materials.

Drinks bottle:

Reusable bottles can be made from plastic, metal or wood. Students may choose to make their product from recycled materials but there may be issues with contamination that they should research further. Ask students to research how many times their bottle must be used to be more sustainable than a single-use plastic bottle.



For the first part of Student Sheet 6a, students will be asked to research their product. To facilitate this, you will need to either book a computer room or order laptops to the classroom.

TEACHER GUIDANCE 6 (page 2 of 2)

DESIGN TASK

Step Guidance

Resources

3
20
mins



Students have applied prior learning to create an ocean friendly product. Now students justify their designs in a pitch carousel.

- Get the class to put chairs in a circle. Initially students sit in their groups.
- Hand out student sheet 6b.
- Using slide 7, inform students that they will be doing a 'pitch carousel'.
- One of their team members will stay in a fixed position and explain their product to other groups. They must keep the group's completed Student Sheet 6a.
- The others will move clockwise to the other group's representative. While they are with the other group's representative, they must complete Student Sheet 6b.
- After a fixed time, the teacher will tell students to move to the next group, continuing to move in a clockwise direction.



The pitch carousel can be very fun. However, moving tables and chairs can be challenging. On the class board draw a box and a circle, respectively representing the classroom and where you would like the circle of chairs. Then, ask for a volunteer to be project manager in reorganising the room. They will be responsible for giving others instructions. You can turn the lesson transition into a game further by putting a timer on the board and setting a time limit.

Slideshow 6:
Slide 7

Student Sheet 6b:
Product pitch

4
5
mins



Students have designed an ocean friendly product and shared their ideas with their peers. Now they must consider how other people may perceive their design ideas.

- Using slide 8, ask students "What would you think of your new product if you were: seahorse, a retailer / store owner, a competitor?"
- Students formulate a response in silence.
- After students have had at least 30 seconds to think of a response, the teacher encourages students to share their ideas.

Slideshow 6:
Slides 8-9

+
20
mins



To extend students interest, ask them to find a news article on ocean plastics. Tell them they must evaluate how good it is as a source.



The subject update is available online at the following link.

How to: Improve students' online research skills

<https://encounteredu.com/cpd/subject-updates/how-to-improve-students-online-research-skills>

Subject Update:

How to: Improve students' online research skills

Design template



Research examples of your product.

What do they have in common? What shape are they? What materials are they made from? Who are the leading brands / companies?

Large empty light blue rectangular area for student research notes.

What are the design issues?

How do these products contribute to ocean waste?

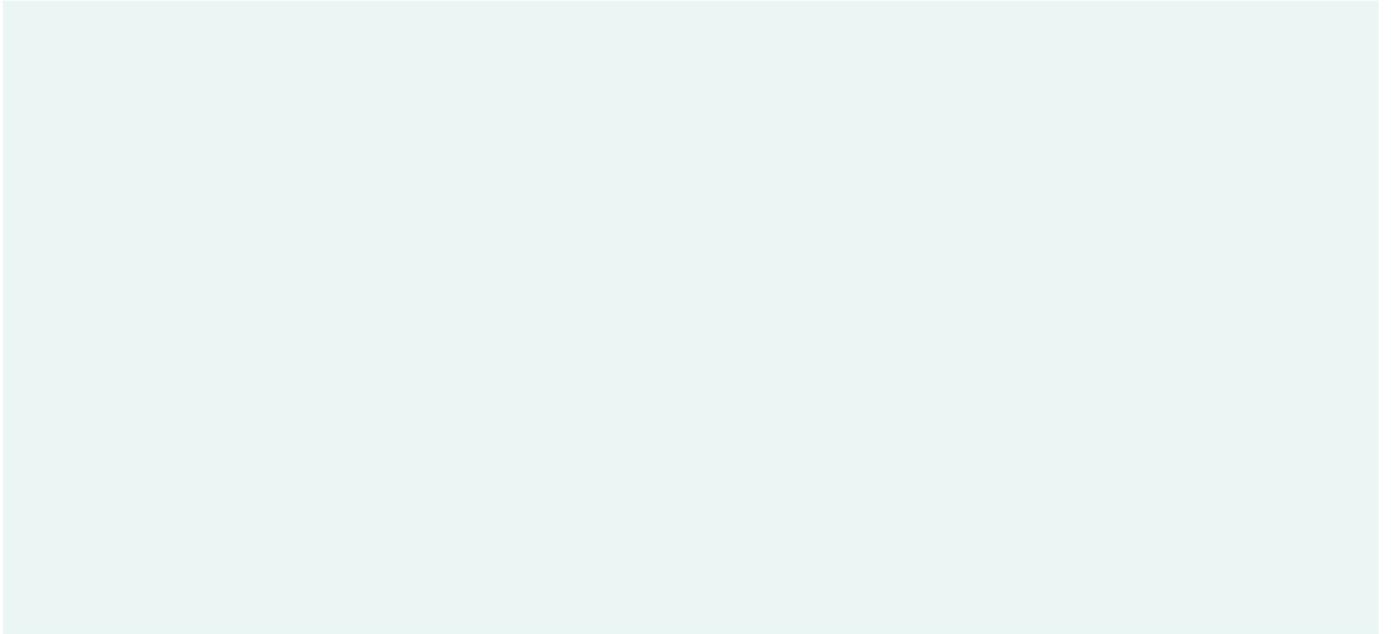
Are they single-use? Do the fabrics release plastic fibres when being washed?

Large empty light blue rectangular area for student notes on design issues.

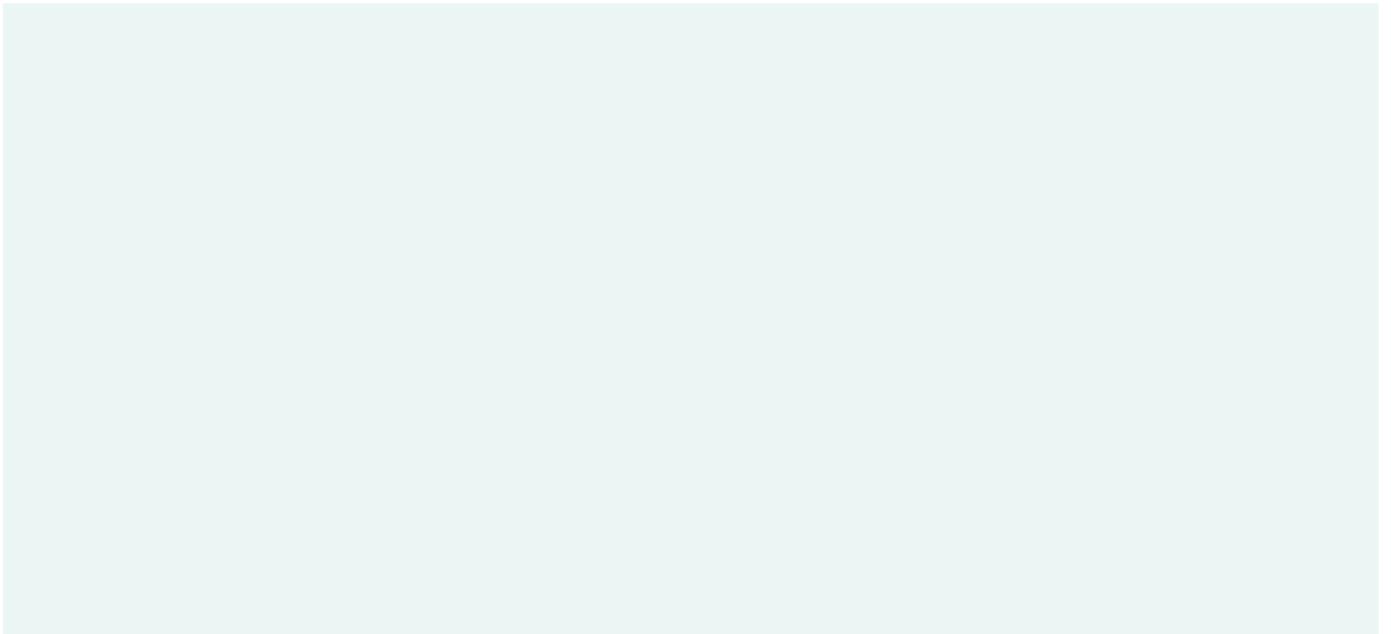
STUDENT SHEET 6a

Design your product to make it more ocean friendly.

Create two different design ideas. Draw your products from two angles and label.
Design one:



Design two:



Explain how your new designs solve the problem. Apply 6Rs.

.....

.....

.....

.....

Product pitch



Group	Product	How have they made it ocean friendly?	Rating
			/10
			/10
			/10
			/10
			/10
			/10
			/10

This book and associated resources can be accessed from <https://encounteredu.com/teachers/units/ocean-plastics-design-and-technology-ages-11-14>



-  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
5-7



Ocean Plastics X-Curric
7-11



Ocean Plastics Geography
11-14



Ocean Plastics Science
11-14

Photo credits

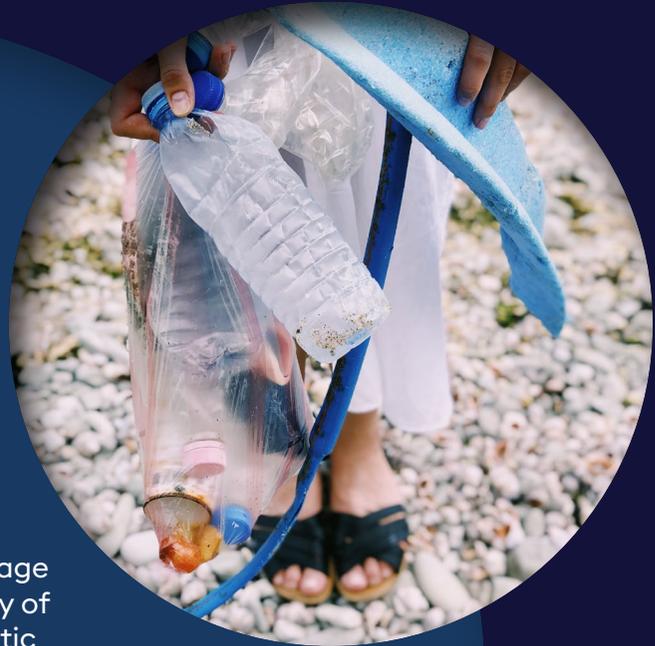
Cover

Student Sheet 1a
Student Sheet 1b
Student Sheet 1c
Student Sheet 1d
Student Sheet 2a
Student Sheet 2b
Student Sheet 2c
Student Sheet 3a

Student Sheet 3b
Student Sheet 4a
Student Sheet 4b
Student Sheet 5a

Student Sheet 6a
Student Sheet 6b
All other photos

Plastic beach: Bilyjan
Pens and paper: Maxpixel
Plastic cups: Meinereserampe
Recycling bins: Imordaf
Bottles on sand: Isidingo
Overflowing bin: Hans
Plastic cutlery: Alexas_Foto
Plastic granules: Bigstock
Full bin: Atranias
Vivo Barefoot
H&M
Bare&Boho Nappies
Vintage market: Garry Knight
Finisterre
Pencil: Moritz320
Broken phones: Andrea Huyoff
Phonebloks: Dave Hakkens
Edible cups: Lollaware
Minimalist furniture: Pearson Lloyd
Luken: Paola Calzada
Cycling jeans: Levi Strauss
Optimist Toaster: The Agency of Design
Plastic on beach: Bilyjan
Plastic pollution: Bilyjan
Encounter Edu



Ocean Plastics Design and Technology is a Key Stage 3 (KS3) resource. Students are taken on the journey of how the 6 Rs can be applied to reduce ocean plastic pollution. Students will learn the science behind what makes plastics both brilliant for everyday purposes and devastating to our oceans and marine life.

Exploring the 6 Rs students innovate product designs which creatively solve the problem of ocean plastics.

Included in this topic are teacher resources that promote students to problem solve through creative design. Students will design a user-centred recycling bin to promote recycling, create a sustainable fashion brand, build a modular phone, and pitch their own unique design solution to the ocean plastic problem.

**Where
Learning
Meets
The World**

www.encounteredu.com

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