

INTRODUCTION TO PLASTIC WASTE

This lesson introduces students to the plastic waste problem, its environmental impact and the many ways different people are working on this problem. Including how the students can help.

LESSON OBJECTIVES

Students will be able to:

- Understand plastic as a material.
- Understand the effect of plastic on the environment.
- Understand the role of recycling and plastic alternatives.

STUDENT OUTCOMES

Students will:

- Discuss the properties and applications of plastic as a material.
- Learn about plastic pollution in the environment.
- Evaluate ways to reduce plastic waste such as the role of recycling and using plastic alternatives.

SUMMARY OF TASKS

Before undertaking this lesson, it would help students if they have been introduced to the circular economy. This could be through the 'Introduction to the Circular Economy' lesson plan.

PART 1 - INTRODUCTION

- Begin by splitting the students into groups of 3-5. Together they will brainstorm ideas for 5 minutes to answer the questions: What are the properties of plastic and what is plastic used for?
- Reconvene and share ideas with the class. Some example ideas relating to its properties include strong, light weight and cheap. Some example ideas relating to its use include bottles, film, car parts, clothes, in buildings. Finish the segment by summarising these ideas using the 'Introduction to Plastic Waste' fact sheet. The take home message is that plastic is a versatile and valuable material, used in a range of industries.
- For younger students, a matching activity could be used instead of the brainstorming. Have a list of opposing properties on the board and ask the students which property matches plastic, for example, strong or weak, cheap or expensive, heavy or light. Then place pictures of different plastic products and get the students to match the pictures to the correct industry, for example, a polyester jumper to textiles or a plastic hard hat to construction.

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Age range: 13 – 16 years

PART 2 – DISCUSSION

- Using the fact sheet explain the negative impact plastic waste is having on the environment. Two main ideas are crude oil causing climate change and environmental pollution.
- Ask the students to go back to their groups. Give them 5 minutes to discuss ways plastic waste can be reduced.
- Reconvene and share ideas with the class. It is important they understand that plastic is too important that we can not ban its use, instead other solutions are needed. Two main ideas to emphasise are the role of recycling and using plastic alternatives where plastic is not essential. These ideas will be reinforced with the activity sheets.

PART 3 – APPLICATION

- Ask the students to complete the 'Plastic Recycling' and 'Plastic Alternatives' activity sheet in pairs.
- The homework/extra activities suggested offer independent work if that is more appropriate.

RESOURCES/ EQUIPMENT

- 'Introduction to Plastic Waste' Fact Sheet
- 'Plastic Recycling' Activity sheet
- 'Plastic Alternatives' Activity sheet
- 'Plastic Household Use' Homework sheet

HOMEWORK/ EXTRA ACTIVITIES

These tasks may be appropriate for different age groups.

- Ask students to evaluate their household plastic use using the homework sheet.
- Ask students to write one paragraph why you think plastic is important for society and what they think should be done to help reduce the plastic waste problem.

FACTSHEET: INTRODUCTION TO PLASTIC WASTE

FACT SHEETS HAVE BEEN DESIGNED FOR TEACHER USE TO AID CREATING OF TEACHING RESOURCES, OR THEY ARE FREE TO BE REPURPOSED FOR STUDENT USE.

PART 1 – INTRODUCTION TO PLASTIC

Properties

Plastic has become a valuable and versatile material for a wide range of industrial applications. Plastics are polymers derived from monomers; the monomeric subunits originate from petrochemicals.¹ Plastic properties include cheap, readily available, light weight, durable and strong.² This material is very durable, it is this property that leads to difficulties at end of life.

Applications

Plastic plays a critical role in many industries, such as renewable energy and the healthcare system. Specific examples of these products include wind turbine blades, solar cells, blood bags and personal protective equipment (PPE). Some of the key applications used in everyday life that use plastic are plastic bottles, clothing/textiles, food packaging, part for construction and some car parts.

PART 2 – IMPACT OF PLASTIC WASTE ON THE ENVIRONMENT

Climate change

Plastic is derived from crude oil, which is a fossil fuel found deep underground.³ This is a finite resource. As it is derived from a fossil fuel plastic's combustion contributes to polluting emissions, specifically carbon dioxide and greenhouse gases. It is these emissions that contribute to climate change.

Environmental pollution

A large amount of plastic waste is usually found in nature; in soil, wastewater and the oceans.⁴ David Attenborough has raised awareness of plastic ocean pollution, 1.1 – 8.8 MT of plastic enters the ocean annually.⁵ Plastics take thousands of years to degrade, this extensive lifetime only increases the ecological impact of their environmental pollution.

¹ R. Geyer, J. R. Jambeck and K. L. Law, *Law Sci. Adv.*, 2017, **3**, 7.

² A. A. Shah, F. Hasan, A. Hameed and S. Ahmed, *Biotechnol. Adv.*, 2008, **26**, 246–265.

³ Fossil Energy Study Guide

https://www.energy.gov/sites/prod/files/2013/04/f0/HS_Oil_Studyguide_draft2.pdf (Accessed 21/04/2021)

⁴ M. Ghosh and S. P. Singh, *As. J. Energy Env*, 2005, **6**, 214–231.

⁵ J. R. Jambeck, R. Geyer, C. Wilcox, T. R. Siegler, M. Perryman, A. Andrady, R. Narayan and K. L. Law, *Science.*, 2015, **347**, 768–771

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PART 3 – WAYS TO HELP REDUCE THE PLASTIC WASTE PROBLEM

Mechanical recycling

Recycling is really important as plastic is too valuable a material to be banned, so instead recycling can help reduce plastic waste. When the council empties recycling bins, the contents are taken to a waste management facility that sorts and reprocesses the recycling waste. Recycling is aimed at recovering finite resources, reducing greenhouse gases and reducing landfill waste. The mechanical recycling process involves collection, sorting, granulating, washing and drying the plastic, resulting in plastic flakes and pellets. These flakes and pellets can be made into park benches, new packaging, car parts and carpets.

There are some difficulties during the recycling process, such as caps less than 5 mm are lost during the process. Sorting the waste is also a big problem but a new labelling method using a digital watermark on all products should improve this process. It is also hard to achieve recycled plastic material that is of food grade quality as this has to be a very high standard. However, polyethylene terephthalate (PET) and high-density polyethylene (HDPE) food grade recycled material has been achieved.

In order to incentivise businesses to recycle plastic the UK government are introducing the UK Plastics Tax; it will apply to plastic packaging with less than 30% recycled plastic. This should encourage businesses to design more recyclable packaging and use more recycled material in their packaging.

Plastic alternatives

Although plastic can not be banned, recycling alone will not solve the plastic waste problem. Due to plastic's popularity, it has been overused and this is an area that can be targeted to reduce plastic waste. There are many plastic products in people's everyday lives which can be swapped for plastic free or reusable items. These swaps will reduce their individual plastic waste contribution. Many people are trying to live more sustainably, which has led to new products and buying habits.

Some examples of plastic free or reusable swaps are detailed below.

- Filling a reusable water bottle instead of buying a plastic bottle of water.
- Using a bamboo toothbrush instead of a plastic toothbrush.
- Using a paper/metal straw instead of a plastic straw.
- Using a shampoo bar instead of shampoo in a plastic bottle.
- Buying fruit and vegetables loose instead of inside plastic packaging.
- Get milk delivered in glass bottles instead of buying milk in plastic bottles.

There are many more sustainable swaps that people are making, and more information can be found online.

ACTIVITY: PLASTIC RECYCLING

Instructions

Please see the web page for more information about plastic waste.

This activity is intended to introduce the method for mechanically recycling plastic.

This activity is intended to be used alongside the 'Introduction to Plastic Waste' lesson plan. The students should be shown the fact sheet within this lesson plan to help them complete the activity..

Task

If you are based in a classroom or at home:

Ask the students to fill in the gaps using the words provided. Each word can only be used once.

Students copy:

- Most recycling bins are
- Recycling is aimed at recovering, reducing and reducing
- Caps should be left on, anything less than is lost during the recycling process.
- Recycled plastic can be made into,, and
- PET and HDPE recycled material has been achieved.
- The new labelling method to improve the sorting process is called
- The UK Plastics Tax will apply to plastic packaging with less than recycled plastic.

food grade

finite resources

greenhouse gases

blue

car parts

new packaging

a digital watermark

park benches

5 mm

landfill waste

30%

carpets

Completed copy:

- Most recycling bins are **blue**.
- Recycling is aimed at recovering **finite resources**, reducing **greenhouse gases** and reducing **landfill waste**.
- Caps should be left on, anything less than **5 mm** is lost during the recycling process.
- Recycled plastic can be made into **park benches, new packaging, car parts and carpets**.
- PET and HDPE **food grade** recycled material has been achieved.
- The new labelling method to improve the sorting process is called **a digital watermark**.
- The UK Plastics Tax will apply to plastic packaging with less than **30%** recycled plastic.

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FRUIT AND VEG PLASTIC PACKAGING	LOOSE VEGETABLES IN REUSABLE BAGS	PLASTIC STEMMED COTTON BUDS	PAPER STEMMED COTTON BUDS
PLASTIC WATER BOTTLE	REUSABLE WATER BOTTLE	PLASTIC WRAPPED TOILET ROLLS	PAPER WRAPPED TOILET ROLLS
PLASTIC STRAWS	METAL/PAPER STRAWS	PLASTIC LAUNDRY BOTTLES	LAUNDRY POWDER IN CARDBOARD BOX
PLASTIC MILK BOTTLES	GLASS MILK BOTTLES	PLASTIC MEASURING BEAKER	GLASS MEASURING BEAKER
PLASTIC SPARKLING WATER BOTTLE	SODA STREAM	PLASTIC SANITARY PRODUCTS	REUSABLE SANITARY PRODUCTS
PLASTIC CUTLERY	WOODEN/BAMBOO /METAL CUTLERY	LIQUID SOAP BOTTLE	SOAP BAR

HOMEWORK: PLASTIC HOUSEHOLD USE

Instructions

Please see the web page for more information about plastic waste.

This activity is intended to help the student understand what can be recycled, in general and within their local area, and evaluate their household plastic waste impact.

It will highlight the key role of recycling and potentially items that could be swapped for a reusable or plastic free option.

Task

This activity can be used in the classroom but is potentially more beneficial to be set as homework so the student can explore around their house.

Ask students to complete the table below.

- They need to find plastic household items and evaluate if they are recyclable, circling yes or no in the table.
This can be completed using the online resources or the symbols on the packaging.
There may be different answers to this for the same item between students because recycling can differ between local areas.
- They also need to identify any reusable or plastic free alternative items that could be used instead and list them in the table, there may be more than one answer.
This can be completed using prior knowledge, asking their family using the online resources or searching online.

After the students have completed the table, ask them to answer the two questions under the table.

Useful online resources:

- <https://www.recyclenow.com/>
- <https://www.gov.uk/recycling-collections>
- <https://whatplastic.co.uk/blogs/blog/easy-plastic-free-alternatives>
- <https://www.businessinsider.com/household-plastic-alternatives-eco-friendly-2018-8?r=US&IR=T>

Fill in the table:

Household item	Does it recycle?		Name any reusable or plastic free alternatives?
Plastic water bottle	Yes	No	Reusable water bottle
	Yes	No	

Questions:

1. What was at least one item that you did not know could be recycled before completing this task?

2. What is at least one reusable or plastic free item that you would swap to in the future to reduce your plastic waste impact?