

Subject links:

Science, Citizenship, Maths, ICT

Ages 7-11

Curriculum key words:

Human impact, modern world, materials and properties, investigation, digital skills, statistics, environmental responsibility

Ocean Literacy Principles:

6. The ocean and humans are inextricably interconnected

Learning objectives:

- To categorise different materials according to their properties and characteristics
- To learn about what happens to materials after they have been used and explore degradation times
- To create a fair test, develop a hypothesis, observe changes, record data and draw conclusions

Resources provided:

- [Marine Litter Fact File](#)
- [Litter Timeline](#) (printed back-to-back)
- [Investigation worksheet](#)

Extra resources required

- One of each of the litter items from the timeline
- Litter items from home
- Hoops

The plastic problem

Sustainability Goals:



Step 1

Background

Litter reaches the ocean in several ways: it's washed in from our rivers, is left on our beaches, or is cast overboard from boats. It not only makes the marine environment look unpleasant, but it impacts the health of thousands of marine animals every year, usually by ingestion, entanglement or suffocation. Plastic is the most-commonly found marine litter material, and it does not biodegrade, but breaks up into smaller and smaller pieces which can be mistaken for plankton or other food sources. You can find more information in the [fact file](#).

In preparation for this lesson, ask your pupils to bring in three waste items from home. These could be items that would be put in the bin or recycled, but they must be clean! Explain that they will be examining the items as a class, so they should try to bring in things made from different materials.

Step 2

Set the Scene

10 minutes – What is marine litter?

Check pupils' knowledge of the subject of marine litter by creating a mind map of how litter reaches the ocean and how it impacts marine wildlife.

If you have completed the previous lessons in the series, use this time to reflect on the learning so far.

Step 3

Activities

Activity 1: 20 minutes – Grouping materials

Look at the used items brought in by pupils and use the hoops to group and classify the materials by different criteria.

Using the hoops for different materials (e.g. plastic, paper, metal), pupils should place their items into the correct hoops. Discuss the uses of the everyday items and share ideas about why they might be made from these materials. Identify the most common material (usually plastic) and discuss why they think it's used so often.

Repeat the grouping activity, but this time comparing and grouping the materials based on their properties, like hardness, solubility, transparency and conductivity.

Activity 2: 15 minutes – Litter timeline

In an open space, lay out the [litter timeline](#) cards in order, with all the used items in a pile in front.

Using the 'paper' card as an example, discuss its properties and encourage the group to think about what they already know about this material. Then, match paper to its degradation time from the timeline cards. Emphasise that these are scientists' best predictions, as materials like plastic haven't been around long enough to truly know their degradation times.

One child at a time should choose an item and guess how long it's estimated to take to break down. Remind each pupil to use the paper as a guide.

Repeat until all items have been matched with a time card. Then, starting with the shortest length of time, children should turn over the time cards to reveal the correct answers.

Was anyone surprised by the answers? Which items could be recycled or reused? Could any of the items be avoided and how? Why is avoiding items better than recycling them? How could this litter affect the marine environment?

Activity 3 (Part 1): 30-40 minutes – Degradation experiment

In small groups, pupils should discuss ideas for an experiment to test how long litter items might last in the ocean, and how the properties of these materials might change over time. Encourage the group to think about the conditions that might contribute to degradation, like salt water, wave action, and sunlight.

Pupils should consider how to make their experiment a fair test and what items could be used to compare decomposition rates (e.g. apple, paper bag, plastic bag, piece of wood). Discuss ideas as a group and create a class experiment. Ensure pupils make a hypothesis and record this in the [investigation worksheet](#).

As these items will decompose relatively slowly, you will need to run your experiment for at least four weeks. Students should take weekly observations and record their findings. Encourage the group to ask questions during this process to consolidate their understanding.

Step 4

Extend

1 hour – Presenting the results

At the end of the experiment, pupils should write up their methodology. They could then present their data through tables, graphs, charts or labelled diagrams. They could practise plotting data on a graph by hand and use computers to present their results. Support pupils to draw conclusions from their investigations and write a written explanation of their findings.

10 minutes – Reviewing evidence

Discuss with the group how the plastic item didn't change state throughout their experiment, and how this result provides evidence of the strength and durability of plastic as a material.

Refer back to the litter or throwaway items brought in from home used in Activity 1. Ask pupils if something that's only intended to be used a few times needs to be made from a material that can last in the environment for many years. From the experiment results, can pupils think of alternative materials that can be used for packaging that will have less of an environmental impact than plastic?

Step 5

Reflect

5 minutes

From the litter items brought in, what was the most common material? What are the properties and characteristics of this material? What damage could these items do in the environment? How could we reduce the risk of litter reaching the environment?

Step 6

Follow up

Our [Artivism](#) lesson is a great way of using the items brought in from home to raise awareness of the topic.

If you want to explore how you can reduce plastic waste at your school, check out the [Ocean-Friendly Schools Award](#).

Marine Litter Fact File



From source to sea

It is estimated that 11 million tonnes of plastic ends up in the sea worldwide each year (1), and that 80% of litter found in the sea is from inland sources (2).

Sources on land can include intentional and accidental littering, items flushed down toilets, sinks and drains, windblown litter from bins and landfills, and litter carried by rainwater into drains, rivers and eventually the sea. Litter is also a problem at sea, with sources like fishing, sailing, speed boats, commercial ships and container spills causing litter pollution.



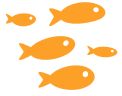
Litter timeline

Litter in the ocean takes longer to degrade than litter on land, but will eventually start to break up due to wave action, currents, saltwater and sunlight. Degradation time varies greatly depending on the properties of the litter.

Microplastics are a serious environmental issue. They are plastics that have broken up into pieces less than 5mm. However, some plastics enter the environment this size already - like microfibres and plastic nurdles. Nurdles are the small plastic pellets used in the production of plastic products.

1. Pew, 2020
2. Europa, 2016

Marine Litter Fact File



Marine life and litter

Litter items can cause harm to all sorts of marine life, from tiny plankton to huge whales.

Animals can become entangled in litter, causing injury, reduced mobility and even death. Ingestion of litter, particularly plastic, is very problematic for marine life as they are unable to digest it. Large amounts of plastic ingestion can lead to starvation, as there is no room left for food. One study found 100% of turtles sampled to have plastic in their stomach (3). In some areas, the extreme amount of plastic on the sea floor can suffocate the animals and plants living there.

Invasive species

Ocean currents can move plastics around the world. Small animals and plants can hitch a ride on the surface of plastic and travel with the currents, introducing non-native species to new areas. The introduction of non-native species could cause harm to the ecosystem.

Plastic chemicals

Several chemicals used in the production of plastic materials are carcinogenic. Toxic contaminants can also accumulate on the surface of plastic materials that have broken up and been underwater for a long time. When marine animals ingest plastic accidentally, these toxic contaminants enter their digestive systems and could build up in the food web over time.



Gannet carrying fishing rope
📷 JHS Archer-Thomson



Microplastic pieces within seaweed
📷 Natasha Ewins

Marine Litter Fact File



Litter surveys

Litter surveys are not only important for clearing rubbish, but also for gathering data on the types of litter polluting our environment. [Beachwatch](#) is our national beach clean and survey initiative, and has been running for nearly 30 years. Our brilliant volunteers head out to beaches across the UK to clean and survey our coastline, collecting and recording the rubbish they find within a 100m stretch of beach. This litter data helps inform our campaigns and lobby government, and has led to influential changes like the UK-wide carrier bag charge, microbead bans and changes to wet wipe packaging.

We also use the data to determine the sources of litter. For example, if a significant amount of sewage-related debris (SRD) is found in an area, we work with local sewage treatment companies to try to improve treatment plants, and with communities to raise awareness of what should and shouldn't be flushed down the toilet.



Reducing litter

We all need to do our bit to reduce litter in the environment. By rethinking how we shop and what we use in our daily lives, we can all make a difference. Refusing unnecessary plastic and other materials, reducing the amount of products we consume, and repairing rather than replacing are all important actions we can take. Through education, we can help raise awareness, encourage positive consumer behaviour, and campaign for change from businesses and the government.



© Natasha Ewins



© Aled Llywelyn

Marine Litter Fact File



Recycling

Even if we reduce the number of items we use, we will still need to throw some away. This is where efficient recycling is key. Download a guide from your local council to help students understand what can be recycled at home and at school. Many items can be recycled, but if your local council has limited recycling options check out [Terracycle's website](#) for local drop-off points.

Plastics can only be recycled at best 2-3 times before they lose their strength, so we still need to move away from plastics to materials that can be recycled time and time again. We need to change how products are recycled, and how we incentivise best practice to ensure materials and resources are valued. This could include redesigning products or calling for economic incentives like Deposit Return Schemes (DRS), where a small deposit is paid when consumers buy a single-use drinks container and is refunded when they return it to a store or dedicated recycling point.



Circular economy

We currently have an economy which is linear, which means we make, use and dispose of products using up finite resources. It's estimated that only 9% of all plastic ever made has been recycled (4), so we know that recycling alone isn't the solution. Instead we need to move towards a circular economy, where products are designed to be used time and again, repairable, or re-purposed as new products. The whole life cycle of the product has been considered, so very little ends up in landfill.



Litter collected at a beach clean
📷 Natasha Ewins



Single-use plastic straws
📷 Natasha Ewins

4. Geyer *et al.*, 2017

Paper





Weeks

Cardboard



The background of the image consists of a complex pattern of light blue and white wavy lines. These lines flow horizontally across the frame, creating a sense of movement and depth. The waves vary in amplitude and frequency, giving the overall appearance a fluid, organic quality.

Months

Balloons



4 years

Plastic carrier bag



The background of the image consists of a complex pattern of light blue and white wavy lines. These lines flow across the frame in a somewhat chaotic but rhythmic manner, creating a sense of movement and depth. The overall effect is reminiscent of a topographic map or a stylized water pattern.

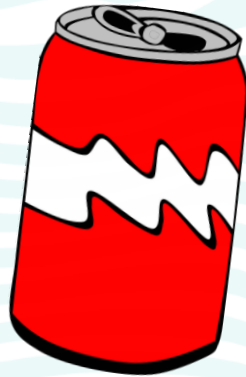
20 years

Crisp packet



75 years

Drinks can





200 years

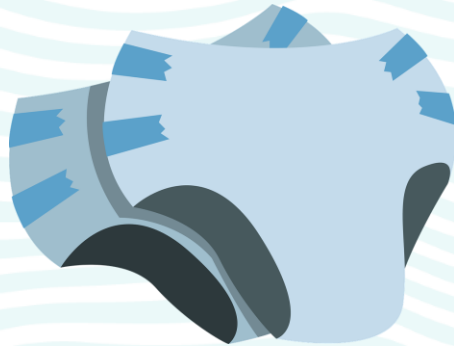
Plastic drinks bottle





450 years

Disposable nappy





500 years

Glass





Forever?

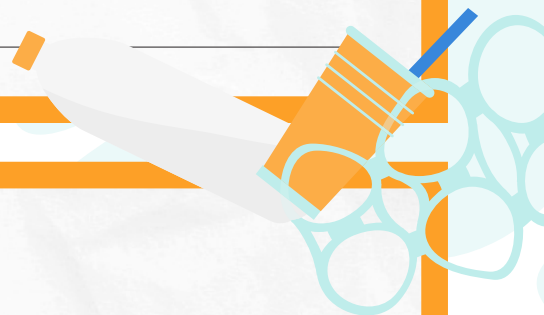
Our Investigation

Name:

We are finding out about....

This is what we will do....

This is a picture of what we will need

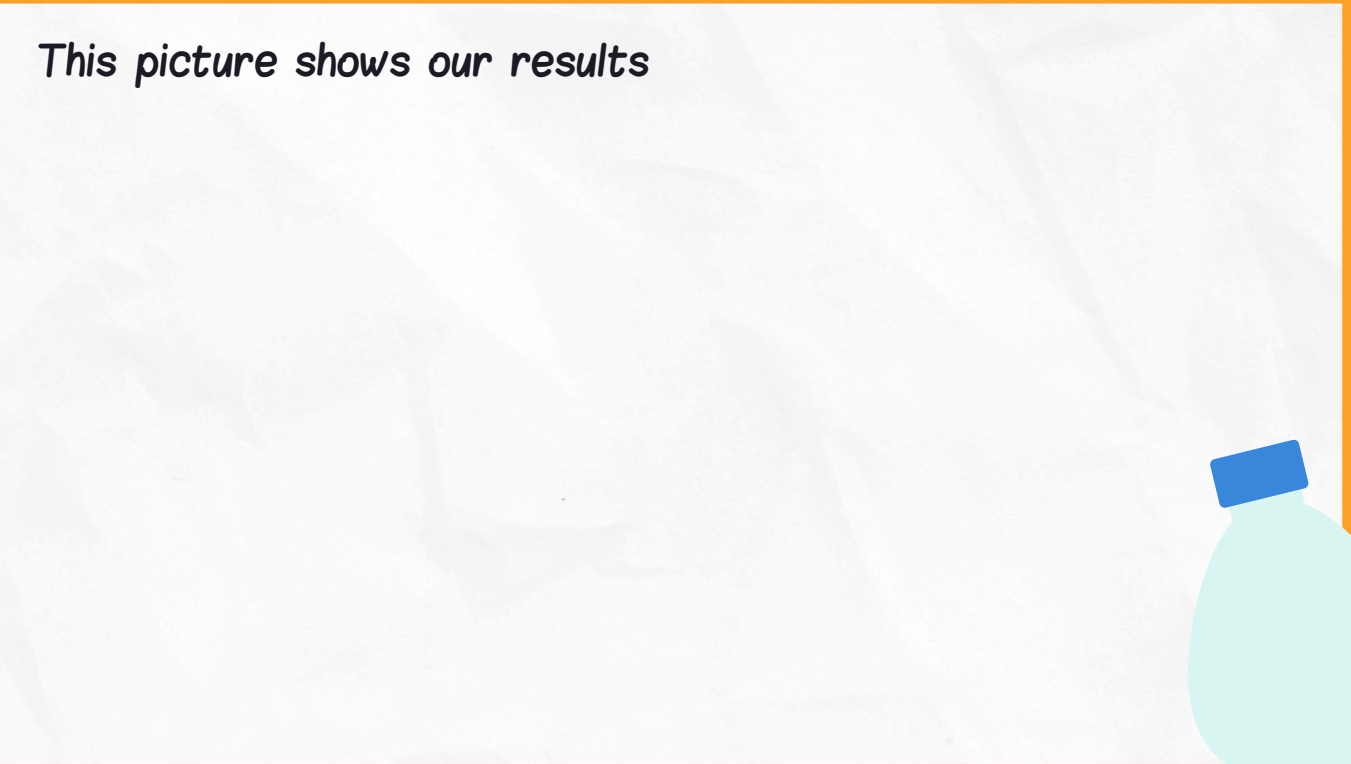




We will make it a fair test by...

What I think will happen...

This picture shows our results



We found out that...
