Plastic Pollution Assembly

These notes run alongside the PowerPoint presentation. They provide additional information (if required) and suggestions for interaction:

Slide 2: Has plastic always been around?
Ask the children to look around them and see if they can spot three things made of plastic. What are they? You might like to point out that a fleece jumper is also made partly from a kind of plastic (often recycled bottles!)

Where do the children think plastic comes from? Is it natural, or made by humans? How long do they think plastic has been around for?

Slide 3: When was plastic invented?
The word "plastic" comes from the Greek word "plastikos," which means "able to be moulded or shaped." Plastic is made from long chains of molecules called polymers, which can be manipulated and reshaped when they are heated or treated with certain chemicals.

In the late 19th century a man named John Wesley Hyatt was trying to create a substitute for ivory, which was a very expensive material used to make things like piano keys. Hyatt mixed together a number of different chemicals and came up with a substance that was moldable and could be made into all sorts of shapes and sizes. This new substance was called "plastic," and it quickly became very popular because it was cheap, lightweight, and strong.

The first fully synthetic plastic was called Bakelite, and it was developed by Leo Baekeland (pictured) in 1909. Bakelite was a thermosetting plastic, which means that it was able to be moulded when it was heated, but it retained its shape when it cooled. Bakelite was a very strong and heat-resistant material that was used in a wide variety of products, including electrical insulators, phone casings, and jewellery. It was the first plastic to be made entirely from synthetic materials, rather than being based on a natural polymer like cellulose. Bakelite was a major

breakthrough in the history of plastic, and it paved the way for the development of many other types of synthetic plastic.

Slide 4: Plastic became a material of choice for many products.
Today, plastic is commonly made from fossil fuel (oil, gas and coal) and it is used in all sorts of products, from toys and water bottles to cars and aeroplanes. As plastic became cheaper to produce, it also became very fashionable. In the 1960s, many people had clothes, shoes and furniture made from plastic. Schools still tended to have furniture made out of wood, like the chair pictured. Over the years, many schools replaced all of their wooden furniture with plastic alternatives. What are the chairs in your school made from?

Slide 5: Why is plastic an environmental problem?
Plastic has become an environmental problem because it doesn't break down and decompose naturally. This means that when we throw plastic away, it can stay in the environment for hundreds of years. Globally, we now produce about 242 million tonnes of plastic every year.

Even when plastic is sent to be recycled, it can only be re-used a certain number of times. Eventually, it has to be thrown away. Over time, plastic breaks down into smaller and smaller pieces, but it never completely disappears. These small pieces of plastic, called microplastics, can be harmful to plants and animals, especially when they get into the oceans.

Slide 6: Plastic waste gets piled in landfill
Researchers estimate that more than 8.3 billion tonnes of plastic have been produced since the early 1950s. More than half of it ended up either in landfills or in the natural environment. Most plastics are made from chemicals derived from oil, natural gas and coal, all of which are non-renewable resources.

Ask children how long they think it might take for plastic to decompose (break down into parts so small they are not detectable) - It takes anywhere from 10 to 1,000 years for a piece of plastic to decompose in a landfill.

When plastic ends up in a landfill, it also causes a number of problems. Firstly, landfills can be ugly and smelly. They take up space that could be used for other things. Landfills are areas where rubbish is collected and buried, and they are designed to keep the litter contained and prevent it from spreading into the environment. However, because plastic never

completely disappears, small pieces of plastic, called microplastics, remain in the soil. When rain passes through the landfill site, it can collect harmful chemicals released by the buried materials. The resulting polluted liquids are known as leachates. They can be very difficult to contain and treat.

Slide 7: Plastic waste in the sea
Studies have estimated that by 2050, the plastic in world's oceans will weigh more than the fish. At least 14 million tonnes of plastic end up in the sea every single year. That's around the same weight as 70, 000 blue whales. Plastic makes up 80% of all the waste that is found in the sea, from rubbish floating on the surface to the deepest sediments on the bottom of the ocean.

Slide 8: Marine life is harmed by plastic waste
Many species of sea life are harmed by all this plastic waste, which causes injury and death when creatures are tangled in it, or when they eat it by accident. To a sea turtle, a plastic bag looks a lot like a jellyfish - one of its favourite foods. At least 180 different species of marine life have been found to have eaten plastic, from huge whales all the way down to tiny plankton (which are then eaten by bigger creatures). Plastic waste kills up to a million seabirds a year.

Slide 9: Microfibres have been found in human blood
In recent years, plastic has even been found in human blood! A number of studies have detected various types of plastic and plastic-related chemicals in human blood, including microplastics, bisphenols, and phthalates. These chemicals can enter the human body through a variety of routes, including the air we breathe, the food we eat, and the water we drink. The presence of plastic and plastic-related chemicals in human blood has raised concerns about the potential health impacts of exposure to these substances. However, more research is needed to fully understand the potential health effects of plastic exposure, and to determine the best ways to reduce exposure to these chemicals.

Slide 10: Plastic production also contributes to climate change
The production and disposal of plastics also creates significant greenhouse gas emissions. Throughout their lifecycle, plastics add around 3.4% of global greenhouse gas emissions. In 2019 alone, the plastics industry pumped an enormous 850 million tonnes of greenhouse gases into the atmosphere.

According to research by the Centre for International Environmental Law, greenhouse gas emissions from plastic could reach over 56 gigatonnes by 2050 (in the context of the 1.5 degree goal of the United Nations Framework Convention on Climate Change Paris Agreement, this would be about 10-13% of our remaining carbon budget).

Slide 11: Where does most plastic waste come from?
Some of the worst plastic pollution comes from industries such as fishing, where the nets often break up in the water. When it comes to household waste, we know that plastic bags and plastic drink bottles are a serious problem, but there are lots of other things that we use only once that are made of plastic. These are known as 'single use plastics' - they are thrown away after just one use and then litter the earth for many years (sometimes hundreds). Single-use plastics have an average useful life of 12- 15 minutes and can take up to 500 years to disintegrate.

Ask children if they can think of some examples of single use plastics, such as:

Plastic drinks bottles
Food packaging
Wet wipes
Nappies
Crisp Packets
Drinks stirrers
Take away cutlery

Slide 12: Food packaging - a convenience and a problem
One of the issues that causes a lot of plastic waste is that it makes a convenient way to package food. Some foods benefit from being wrapped in plastic because it can increase the shelf life of the product. Other items don't really need to be wrapped in plastic at all, but it is seen to be more convenient for the customer. Some foods come in a plastic tray which is then wrapped in more plastic - all of which is going to be thrown away as soon as the food is eaten. Today, nearly two thirds of plastic waste comes from items designed to last under 5 years. 40% of global plastics production is for packaging and 95% of that packaging is single-use.

Slide 13: How can we help - reduce plastic usage
The best way to help with this huge plastic problem is to reduce the amount of plastic that you buy (and therefore throw away).

Avoid single-use plastics altogether, if possible. Buy things in bulk; disposable containers are hard to avoid (polystyrene trays, PET bottles, tetra paks, plastic containers, etc.) but more and more shops are offering the possibility to buy foods like cereals and rice in bulk, to cut down on the amount of packaging. There are even zero waste shops where you take your own packaging to the shop.

Rethink your food storage – instead of using plastic bags and plastic storage containers, try opting for a . Instead of using plastic zipper bags or wrapping things in clingfilm, use jars or glass containers.

Taking a cloth bag when you go shopping also reduces the need for a plastic bag.

Slide 14: How can we help - reuse plastic items
Whilst it's best to avoid buying unnecessary plastic in the first place, it's very difficult to avoid it altogether. Try to use any items made from plastic for as long as possible. You might find that you can buy things such as toys or clothes from second hand shops or car boot sales. You can also pass them on to other people when you have finished with them as well!

You might also be able to get more use out of plastic packaging that often gets thrown away. It's possible to make all kinds of things - from watering cans to bird feeders - out of old plastic milk bottles, for example.

Slide 15: How can we help - recycle plastic when possible
Unfortunately, as we have seen, recycling plastic is often not a long term solution. However, it is still far better to try to maximise the use of plastic, rather than sending it to landfill. Some councils burn plastic waste and, although it gives off harmful chemicals (and more greenhouse gases) it can sometimes be used as a fuel.

As well as recycling plastic packaging, you can also think carefully about other plastic products such as toys or household items. Maybe it's possible to buy some of these second hand, or to donate your own unwanted plastic items. Don't forget - this can mean clothes as well.

Slide 16: Try finding alternatives to single use plastics
Where possible, replace plastic items that you use with alternatives. Replace plastic Tupperware with glass or steel containers and single use plastic drinks bottles for metal or other refillable bottles.

Try natural beeswax coated cloth wraps instead of plastic cling film

You can also cut down on plastic packaging by using soap bars, instead of liquid soaps and by making your own cleaning products! Use a mixture of 1 part vinegar to 3 parts water with some lemon juice in it as an all-purpose spray cleaner (storing it in a reused spray bottle) to avoid buying lots of products in plastic bottles.

Slide 17: What is being done - the great ocean clean up
Individuals can only do so much to reduce their plastic use however, and there is still the issue of what to do about all the plastic that is already out in the environment.

The Ocean Clean-up is one example of action that is being taken to help. Inspired by the rubbish he saw in the sea on a scuba diving trip in Greece, Boyan Slat created a design to collect plastic waste from the 'Great Pacific Garbage Patch'. The system is made up of 600m-long floating structures intended to contain marine debris and designed to collect microplastics. It relies on wind and ocean currents to collect the plastic. Upon collection, the plastic waste is transported by a boat back to land, to be recycled if possible.

Slide 18: Future possibilities - using natural materials instead of plastic packaging.
As we have seen, one of the ways that plastic is commonly used is as a packaging material. What if we could use something different to pack all the products that people need?

One alternative might be to use mushrooms! It's possible to encourage mycelium, the roots of mushrooms, to grow into shaped moulds and to create packaging for products. The packaging you can see here has all been made from mushrooms. This is 100% plastic free and totally biodegradable.

Other experiments are being carried out doing similar things with types of seaweed and with hemp stalks. Perhaps there are future alternatives to plastic that are biodegradable and will break down naturally in the environment.

Slide 19: Future possibilities - turn plastic waste into roads
One possible partial solution to the problem of plastic pollution is to use plastic waste to make roads. A project called PlasticRoad created a bike

path in the Dutch city of Zwolle and a road in Overjissel in 2018 using 70% recycled plastic. The plan is to increase the amount of plastic used to 100%.

In the UK, a Scottish company called MacRebur has been developing a material that mixes waste carrier bags and other plastics with asphalt. Their technique uses 3 to 10 kilograms of waste plastic in each ton of asphalt. In 2020, MacRebur worked with Cumbria County Council to build the UK's first road made partially from waste plastic. More than 3,000 square metres of road was re-paved and around 240,000 single-use plastic bags were saved from landfill as a result.

Slide 20: Future Possibilities - turn plastic into fuels

An Australian company (Licella Holdings) has developed a new patented technology, known as a Catalytic Thermal Reactor(Cat-HTR), that can convert unrecyclable plastic into oil. It has been able to melt plastic and convert it into liquid fuel.

What makes this technology especially useful is that the Cat-HTR chemically recycles mixed plastics without the need to separate the different plastic types. This includes end-of-life plastic that would otherwise be burned, sent to landfills, or end up in the ocean. It means that plastic waste can be recycled again and again on a huge scale. The Cat-HCR could convert 20,000 tonnes of plastic waste annually. Unfortunately, the process does still produce emissions, so it may be something of an environmental trade-off, solving one problem, but adding to another.

Slide 21: Future possibilities - a microbe and a mushroom that digest plastic

One unusual and surprising scientific solution to plastic pollution that has been discovered is the plastic-eating enzyme. Enzymes are types of proteins that speed up chemical changes (such as the ones in our stomachs that help us digest our food and turn it into useable energy). In 2016, a scientist in Japan discovered a microbe that was able to break down the most commonly used type of plastic - Polyethylene terephthalate (PET). The bacteria, known as Ideonella Sakaiensis 201-F6, can digest plastic by secreting an enzyme called PETase, and ingesting the carbon in PET to be used as a food source. Though the 'digestion' process is currently slow, scientists have been working to speed it up.

Whilst studying different types of fungus, lead biotech engineer Samantha Jenkins discovered something surprising. A species of fungus, known as Aspergillus Tubingensis, was found to contain agents that can break down a type of plastic called polyurethane (PU). It had managed to 'eat' its way

through the plastic casing used to hold it! Jenkins is carrying out more tests on this fungus as it seems that the more plastic it consumes, the bigger it gets. This could mean that, one day, the fungus could break plastic down and could also be used itself, maybe as a food source for livestock, or as a packaging material.

Slide 22: For now we need lots of creative solutions to the problem of plastic pollution.
Helping solve a problem as big as the earth's plastic pollution issue is going to take a range of approaches and lots of new ideas. Scientists and engineers will be needed to come up with ways to develop better materials than plastic as well as to help devise ways to clean up the plastic that's already causing so much environmental harm. It will also take lots of people to spread the word about the dangers of plastic and to encourage everyone to be as thoughtful as possible about their plastic use. We can all play a part in helping to solve the problem of plastic.

Slide 23: Pause for thought

"It cannot be right to manufacture billions of objects that are used for a matter of minutes, and then are with us for centuries."
Roz Savage.

YPTE has also made a short video (just under ten minutes) about 'why plastic's not so fantastic' which you can find here:
https://ypte.org.uk/videos/why-plastic-s-not-so-fantastic