2. SUSTAINABLE MATERIALS: WHICH SOAP?

1.5–2 HOURS

PLUS 4 WEEKS OF OBSERVATION

Children carry out a sequence of three investigations to investigate the environmental benefits of using a solid, as opposed to a liquid cleaning product, while developing their science and maths understanding through practical activities. After an initial class input of about 30 minutes the first two activities will be ongoing over a period of four weeks and will take up to an hour over that period in 5–10 minute slots once or twice a week. The final activity will take about 30 minutes.

TYPE OF ENQUIRY

Carrying out comparative and fair tests

Observation over time

OBJECTIVES

Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary (UKS2 working scientifically)

Estimate volume – for example, using 1cm^3 blocks to build cuboids including cubes and capacity using water (Y5 measurement)

Convert between different units of metric measure – for example, gram and kilogram, litre and millilitre (Y5 measurement)

SCIENCE VOCABULARY

Mass, volume, liquid, solid, shampoo

RESOURCES

per group of 4, unless otherwise stated

Activity 1:

- Unused 100g bar of soap
- Unused 500 ml bottle of hand wash
- Record of the price of both items (if not at hand this could be checked online)

Optional

- 100g play dough
- 10 x small beakers that will hold at least 50ml liquid

Activity 2:

- 5 slices of fresh white bread
- 5 new sealable bags
- Access to hand washing facilities and both soap and hand wash
- Access to hand sanitiser

Activity 3:

- playground chalk
- trundle wheel or large measuring tape

SAFETY GUIDANCE

Mould can produce many microscopic spores which are breathed in and can exacerbate conditions such as asthma. The bags of mouldy bread should remain sealed at all times and be placed together within another bag for disposal.

PRIOR KNOWLEDGE / EXPERIENCE

Children will have compared and grouped materials together, according to whether they are solids, liquids or gases.

They will have set up simple practical enquiries, comparative and fair tests.

ACTIVITY NOTES

Introduction: Show children the image on **presentation slide 2** and ask children to identify which is the odd one out and, most importantly, ***why***. An important aspect of an activity like this is that there are very few possible wrong answers but a large number of possible correct answers. There are some suggestions included in the presentation notes and children may come up with more once they realise that you are genuinely interested in all of their responses and are not just looking for a single 'correct' answer.

Ask: Can they think of other products that come in different forms? For example, they might suggest clothes washing products which are typically either liquid or powder (although in the past this too was a solid bar), shampoo which is starting to be sold as a solid bar as well as a liquid, and bubble bath which is sometimes sold in solid bars as well as liquid in bottles.

MAIN ACTIVITY 1: HOW LONG DOES SOAP LAST?

This activity will take at least 4 weeks, including observations over time. It is carried out concurrently with activity 2. Show children a bottle of hand wash and a bar of soap. Ask them to talk about the similarities and differences between the two products and possible advantages and disadvantages. Ask them to weigh the bar of soap and to make a note of the volume of handwash contained in the bottle. Ask children to work out how much of each product there would be if it were to be divided into 10 equal portions. Children who need more support may find it helpful to pour 500 mls of water into 10 containers and to divide 100g of (play)dough into 10 equal portions so that they can see that one tenth is 50ml and 10g respectively. If you have a record of the price of each item, children could also be supported to calculate the price of a tenth of each product.

Leave the handwash in a location where it will be regularly used for a set period of time (at least a fortnight, or until it is used up if that is sooner). Swap it for the bar of soap and leave it for the same period of time. Alternatively, if there are two wash basins which get an equal amount of use the two products can be used concurrently.

At the end of the period, weigh and measure the remaining amount of each product to calculate how much has been used. Remind children that each 50 ml of liquid equates to one tenth of the total quantity. Whereas for the solid one tenth equals 10g. Children can use this information to work out how long each product would last if the usage remains constant and how much each would cost per week. They could use a calculator to do this.

Discuss which product is cheaper to use and which one lasts longer. Children should be able to tell you that the bar of soap is longer lasting and more economical than the handwash.

MAIN ACTIVITY 2: DOES A BAR OF SOAP CLEAN YOUR HANDS AS WELL AS LIQUID HAND WASH?

This activity will take at least 4 weeks, including observations over time. It is carried out concurrently with activity 1.

The activity is best done after a playtime, before children have washed their hands. To prevent contamination it is vital that the slices of bread is only touched by one person until it is sealed in the bag. The bags should not be opened again at any point.

Remind children of good hand washing technique. The four children in each group handles and seals a slice of bread in an appropriately labelled transparent bag after doing one of the following:

- Child 1 cleans their hands using a bar of soap.
- Child 2 cleans their hands with hand wash.
- Child 3 cleans their hands with hand sanitiser
- Child 4 does not clean their hands.

The last slice of bread is sealed in a bag without anyone handling it.

All five bags are left for up to a month in a warm, dark place. Ensure that the bread does not get so hot that it dries out otherwise mould will not grow at all.

One would expect to see very little, if any, mould growing on the untouched bread, minimal growth on the two slices handled by children who have washed their hands and a significant amount of mould on the slice handled by the child who had not washed their hands. Children may be surprised to see that although hand sanitiser reduces the amount of mould on the bread, there is still more than on the bread handled by children who washed their hands. As well as helping children to understand the importance of regular hand washing, this activity should show that solid and liquid forms of soap are equally effective.

However, as with all science experiments, there may be anomalies. In this case, for example, if a child sneezed while handling the bread, or if their sleeves came in contact with it there might be more mould than expected on one of the 'clean' slices. Because the activity has been carried out by more than one group there is a good chance that the collated class results will show what you are expecting. This provides a good opportunity to compare results, for finding and considering the reasons for anomalies, and emphasising the reasons why experiments are repeated many times, i.e. it is not unusual for these kinds of unexpected results to occur.

MAIN ACTIVITY 3: WHY USE SOLID PRODUCTS?

Explain to children that the transport of products such as medicine, food and personal care products including soap and shampoo has a major impact on the environment. ***In the UK in 2019***, domestic transport was responsible for emitting the equivalent of 122 metric tonnes of carbon dioxide. Transport is the largest emitting sector of greenhouse gas emissions and produced over a quarter of the UK's total emissions that year. Anything that manufacturers can do to reduce the amount of transport can help to reduce these emissions.

Remind children of the data collected during Activity 1 and remind them that the solid soap lasted much longer than the liquid soap because one of the major ingredients in liquid soap is water. When we use a solid product we add the water at the point of use, thus saving the use of fossil fuels to transport the water in liquid soap (hand wash).

Show children **presentation slide 3** and explain that this shows how much more space is needed to transport liquid rather than solid soap.

FACT CHECK

The difference in the amount of transport required is even more than this once the two products are packaged. This is because liquids need more substantial packaging than solids. We will address this issue in a later activity.

Tell children that the average size of an HGV lorry is 25 metres by 3 metres. Challenge children to draw at least one rectangle of this size on the playground. If space allows, ask them to draw 6.5 such rectangles to help them visualise the difference in the amount of transport needed depending upon whether the product is in solid or liquid form.

Finish by explaining to them that scientists, such as the ones working at Innospec, continue to work on ways to address environmental problems and one way that they are doing this is to find ways of making solid instead of liquid products. For example, until recently shampoo was only available as a liquid product. However, in recent years scientists have been developing ways to make a solid shampoo which is as effective as a liquid one.

BACKGROUND INFORMATION

Research shows that on average people use about 2.3g of liquid soap every time they wash their hands and about 0.35 g if they are using a solid product. Solid soap has also been shown to be as effective as liquid soap at removing microbes from the skin. However, solid soap needs more hot water to create a lather and also needs more raw material such as vegetable oil than liquid soap. Nevertheless, by the time transport costs, packaging and increased usage is taken into account it is estimated that the carbon footprint of liquid handwash is approximately 25% greater than solid soap.

EXTENSION OR HOME-BASED ACTIVITIES

Children could be challenged to look at liquid personal care products in their own homes and when out shopping. Ask them to see if the manufacturers make any claim about the 'eco-friendliness' of their products. Do the children always agree with the claims made?

QUESTIONS FOR THINKING

- Are solid products such as soap and shampoo as effective as liquid products?
- What are the benefits of liquid products?
- What are the benefits of solid products?
- Why is it important to reduce the amount of fossil fuels that we use for transportation?
- How does the manufacturer persuade one to buy a particular product?
- In what ways do they claim that it is beneficial to the environment?
- Is there any information that is missing that the children think should be included?

INDUSTRY LINKS AND AMBASSADORS

Scientists in industry, such as those employed at Innospec, are constantly working to produce better personal hygiene products. This is why we so often see words such as 'new' and 'improved' emblazoned on familiar items. Some of the changes made are to improve the customer experience or to make a product more effective. For example, a new toothpaste formulation (recipe) may claim to make your teeth whiter or reduce plaque more effectively than a previous formulation.

Scientists also take the environmental impact of a product into consideration alongside customer experience. For example, early formulations of shampoo bars were bought by people keen to reduce packaging and transport costs and for convenience when travelling. However, because they were not as effective or pleasant to use as liquid shampoo people rarely bought a second bar. Since then, scientists have experimented with different ingredients and processes to produce a solid bar which is as good as liquid shampoo.

The next job of the industry will be to persuade consumers to trust these new products, and that will be a job for their marketing teams.

If you find an ambassador with relevant expertise, ask them to talk to the children about any innovations their company has carried out. For example, what has the impact of the innovations been on the products' efficacy and/or the environment? Encourage ambassadors to bring samples for children to handle and see for themselves how the product is different to the previous versions.

CROSS CURRICULAR LINKS

English: Children draft, edit and produce scripts and poster advertisements for solid formulations of soap and shampoo, explaining their benefits. This creative thinking has excellent links with the genre of persuasive writing in the English curriculum.

Mathematics: Children solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts. They can solve problems involving the calculations of percentages [for example, of measure e.g. 15% of 360].

Design and Technology: Children design new packaging for soap and shampoo bars, selecting from and using a wide range of materials as well as evaluating their functional properties and aesthetic qualities.

PSHE: Children learn what improves and harms their local, natural and built environments and develop strategies and skills needed to care for these (including conserving energy).