

### 3. SUSTAINABLE MATERIALS: WHICH PLASTIC?

1–2 HOURS

Children discuss the properties of a range of everyday materials before focusing their attention on different types of plastic and their uses. They are challenged to identify and name unknown plastics by observing what happens when samples are placed in different liquids and when a force is applied. Children learn about the impact that plastics can have on the environment and why it is important to recycle plastic items. They consider how one company supports a recycling scheme to reduce the amount of a certain type of plastic that is usually used once and sent to landfill sites.

The original activity and comprehensive background information can be found on pages 3–6 of <http://www.ciec.org.uk/resources/plastics-playtime.html>.

#### TYPE OF ENQUIRY

Grouping and classifying things / Carrying out comparative and fair tests

#### OBJECTIVES

Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic (Year 5 Properties and changes of materials)

Use and develop classification keys and other information records to identify, classify and describe materials (UKS2 Working Scientifically)

#### SCIENCE VOCABULARY

plastic, properties, single-use, fossil fuels, non-renewable, landfill, recycling, non-degradable

#### RESOURCES

per group of 4, unless otherwise stated

- **ONE OF EACH FOR WHOLE CLASS:** example plastic objects, e.g. Christmas card packaging (PVC), milk carton (polythene), yoghurt pot/hot drinks cup lid (polystyrene), pizza base/insulated foam cup (expanded polystyrene)
- 1 x 1-litre measuring jug (or bowl of similar capacity)
- 1 teaspoon
- **Activity Sheet 5:** Identifying Plastics Key
- 1 small bowl of salt
- Plastics pieces – 1 sample of PVC, polythene, polystyrene and expanded polystyrene cut to approximately 8cm x 1cm. The strips are then numbered 1 to 4 with a permanent marker.
- 4 safety glasses and 4 pairs of disposable non-latex gloves
- Industry sustainability story: **Presentation**

**Important note:** As it is not certain that an object is made from a specific plastic it is imperative that the **teacher checks the identity and tests** selected items before presenting the activity to the children. Often, the recycling number or code is printed on everyday plastic objects. Teachers are looking for: 2 (HDPE) or 4 (LDPE) for polystyrene, 3 (PVC or V) for PVC and 6 (PS) for each type of polystyrene, however expanded polystyrene will be the foam version. Do not share this information with children until the end of the activity.

## PRIOR KNOWLEDGE / EXPERIENCE

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Children will have compared and grouped materials, focusing on similarities and differences.

## ACTIVITY NOTES

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**Introduction:** A game of 'Jeopardy,' where the answer is provided and children work in small groups to suggest what the question might be, would be a fun starter activity to recap what they already know about a range of everyday materials. For example, the teacher says, 'The answer is wood,' and the children must phrase their response in the form of a relevant question, such as 'Which material comes from trees?' or 'What can a pencil, desk and drum sticks be made from?' Finish the game with the answer of 'plastic' and discuss the various questions suggested by the class.

Discuss how there are many different types of plastic and that each one is useful for different things. Ask the children to name as many different types of plastic as they can and collect responses. Refer to Lesson 1: 'which metal?' and consider how we know of metals in everyday use but often struggle to identify different types of plastic. Children may be familiar with names of plastics in specific contexts such as shopping with polythene bags or sitting on bean-bags filled with polystyrene beads.

Discuss how many types of plastic begin with the prefix 'poly' and can have very tricky long names so are often abbreviated. Give the examples of polythene (or polyethylene) (PE), polystyrene (PS), polypropylene (PP), polyethylene terephthalate (PET) or polyvinyl chloride (PVC).

Ask children if they think plastics are sustainable materials. Discuss how plastics are made from materials found in fossil fuels which are non-renewable and so will eventually run out. Children might also talk about how plastic is often thrown away after one use and can end up in landfill sites or as litter pollution. Focus the discussion on how important it is for us to consider the sustainability of the products we use and how plastics can be reused and recycled. It is important that we can sort plastic items by type and ensure that they are not just used once and then thrown away.

Show four everyday plastic objects (see Resource list for suggestions) and explain that each object is made from a different type of plastic, with different properties. Challenge children to suggest how we can identify each type of plastic in order to help us make decisions about plastic recycling.

Children could attempt to name the examples provided because of the colour or texture and similarity to objects that they already know. They should begin to realise the difficulty in identifying plastics simply by appearance, and the idea of investigating different properties can be introduced.

## MAIN ACTIVITY 1: SINK FLOAT TEST

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Children work in small groups and are given four samples of plastic (numbered 1-4) to represent each of the example objects. Explain to children that they should half fill a jug with water and place each sample piece under the water before letting it go. They should observe and record which samples of plastic float and why they think this might be (the pieces of polythene and expanded polystyrene will float).

Children should then add salt to the water, a teaspoon at a time, stirring after each addition, then observe and record which plastic sample begins to rise and which sample stays at the bottom of the jug and why they think this has happened. (The piece of polystyrene will begin to rise and will float after 2-3 teaspoons of salt have been added. The piece of PVC will stay at the bottom.)

Explain to children that by observing what a plastic sample does when placed in various liquids, different types of plastic can be identified, and this technique can be used to sort plastics during the recycling process.

## MAIN ACTIVITY 2: CREASE TEST

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Using the same samples (removed from the water), children should attempt to fold a crease in each of the four plastic pieces. They should observe and record whether each sample either snaps, creases or shows signs of stress whitening (the plastic becomes white along the line of stress where the material structure is altered).

For reference only, the results are usually:

- Snaps – thick PVC, expanded polystyrene
- Crease – polythene
- Creases with stress whitening – polystyrene, thin PVC and some polythene

Using their own results, groups should have enough information to use the classification key provided on Activity Sheet 5 to identify and name each of the unknown plastics. They should then relate this information to which type of plastic each of the example objects are made from so that they can be appropriately recycled.








## EXTENSION OR HOME-BASED ACTIVITIES

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Discuss with children that, in order to identify the type of plastic that an object is made from, it would be impractical to see whether it floats or sinks or can be creased! Ask if anyone knows of another way to help us to identify which plastic an object is made from. Explain that many plastic items that can be recycled have a symbol like the one shown here.



Show lots of examples of plastic items (or children could be challenged to find these in the home) and allow time for children to locate this information and work out what the abbreviations or numbers might mean. They should then use what they have found out to sort and group a range of different plastic items according to plastic type. It would be interesting for children to find out which materials and types of plastics can be recycled near to where they live.

	polyethylene terephthalate	Water bottles, soft and fizzy drink bottles, pots, tubs, oven ready trays.
	high-density polyethylene	Toys, picnic ware, household and kitchenware, cable insulation, carrier bags, food wrapping material.
	polyvinyl chloride	Window frames, drainage pipes, medical devices, blood storage bags, flooring, vehicle interiors and seat coverings, fashion and footwear, packaging, cling film, credit cards.
	low density polyethylene	Squeeze bottles, toys, carrier bags, insulation, tank linings, heavy duty sacks, general packaging, gas and water pipes.
	polypropylene	Bottle caps, cereal liners, lunch boxes, ketchup bottles, packing tape, straws.
	polystyrene	Toys and novelties, rigid packaging, refrigerator trays and boxes, cosmetic packs, CD cases.
	other types of plastics	Baby bottles, water cooler bottles, car parts.

Source: [https://www.bpf.co.uk/sustainability/plastics\\_recycling.aspx](https://www.bpf.co.uk/sustainability/plastics_recycling.aspx)

## QUESTIONS FOR THINKING

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- How can you tell plastics from other materials?
- Are all plastics the same? What similarities and differences have you noticed?
- Do you know the names of any plastics?
- Can you find out why many names of plastics begin with 'poly'?
- Why do you think so many things are made from plastic?
- Why is it important to recycle items made from plastic?

## SAFETY GUIDANCE

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Safety glasses should be worn during the 'crease test', as small pieces may splinter off the plastics when under stress. The option of wearing gloves would prevent cuts from sharp edges. Dispose of the pieces of plastic by recycling them if possible – do not pour down the sink.

## INDUSTRY LINKS AND AMBASSADORS

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Ambassadors visiting the classroom could bring samples of plastics and plastic equipment to show the children and talk about how plastics are used on site or for important industrial processes. It is interesting to discuss the sustainability of plastics in terms of how plastics are made, used, reused or recycled in industry, and to think about alternative materials to plastics.

To enable children to explore one company's solution to the problem of many plastic items ending up in landfill and the uncertainty of recycling plastics, such as PVC, teachers and children should follow the slides on the presentation Sustainable materials: which plastic? and engage in discussion points and activities to develop a further understanding of industrial contexts.

## CROSS CURRICULAR LINKS

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**Mathematics:** complete, read and interpret information in tables and graphs. Develop keys and other information records to identify, classify and describe.

**PSHE:** to research, discuss and debate topical issues, problems and events that are of concern to them and offer their recommendations to appropriate people; to learn that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment across the world.