

## 4. SUSTAINABLE FUEL LUMPY CHALLENGE

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1 HOUR

Children explore different types of sugar dissolving in water, to discover the relationship between surface area of the sugar and speed of dissolving.

### TYPE OF ENQUIRY

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Comparative/fair tests

Problem solving

### OBJECTIVES

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Know that some materials will dissolve in water to form a solution. (Y5 materials)

Compare and group together everyday materials based on their properties. (Y5 materials)

Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate. (UKS2 Working Scientifically)

### SCIENCE VOCABULARY

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liquid, dissolve, solution

### RESOURCES

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per group of 4, unless otherwise stated

- **Activity Sheet 4**
- 3 transparent cups or similar containers
- Water
- Measuring jug or cylinder (at least 100ml)
- 30-50g granulated sugar
- 30-50g caster sugar
- A few sugar cubes
- Teaspoon
- Stopwatch

### TOP TIPS

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Children should be given access to a small amount of the different sugars and a teaspoon to enable them to practice measuring their own amounts precisely. They should also be given free access to water, to select the quantities they use.

Each group can use different sized cups/containers, as long as those used within a group are the same.

## PRIOR KNOWLEDGE/EXPERIENCE

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Children should have had some experience of setting up simple practical enquiries and comparative tests.

If children have misconceptions about the difference between melting and dissolving, try the activity ***In the Melting Pot*** from the CIEC A Pinch of Salt publication to enable children to investigate and find the difference for themselves.

## ACTIVITY NOTES

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Revisit the letter (**Activity Sheet 4**) to present the 'lumpy challenge'.

Tell the children that you are providing different types of sugar to help them plan and carry out this investigation. Ask them to explain the differences between the sugars and plan an investigation to find out the differences in the time taken for each type to dissolve.

Provide support, as appropriate for each group, to ensure they work in a systematic way, keeping variables the same, other than the type of sugar. Wherever possible, give children autonomy and time to make mistakes, leading to deeper learning.

During a plenary discussion discuss how they might improve their investigations if there was time to do so. Point out that this is true for professional scientists too, who refine their investigations in the light of experience. Encourage children to notice a pattern in the relationship between the size of the grain and the speed with which it dissolves.

Ask children to think about how they will share their results with Emily in clear and concise manner. For example, scientists often replace lengthy prose with photographs, diagrams, tables, chart and graphs.

## BACKGROUND INFORMATION

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This information is for teacher use only. It is not intended to be used in the classroom.

Companies like Johnson Matthey make ingredients called catalysts to add to the layers of fuel cells, to speed up the hydrogen production in the fuel cell. When the catalyst has been made, it is filtered from water, resulting in a 'cake' that is then dried to remove the last of the water. This leaves large lumps of catalyst.

These catalyst lumps need to be ground, or milled, into a very fine powder. This fine powder is made into a 'suspension' in a liquid, which is spread thinly onto fuel cell membranes. The fine powder has a high surface area to speed up the production of hydrogen, in the same way that finer sugar dissolves more quickly or effectively.

## EXTENSION OR HOME-BASED ACTIVITIES

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Ask children if they have any experiences with other materials that dissolve, such as salt.

You could ask children to be on the lookout for any other examples of dissolving they come across and report back to the class, perhaps collecting examples on a display or a page in a floor book.

Encourage children to plan and carry out their own dissolving activity at home, perhaps testing out granulated sugar in different liquids like vinegar or sparkling water. An adult could supervise a safe investigation into whether the temperature of a liquid affects how quickly sugar cubes dissolve. Water below 50°C is safe for children to handle.

## QUESTIONS FOR THINKING

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- Where has the sugar gone?
- How could we get the sugar back?
- What are the benefits of a smaller surface area?
- Does the size of the grains affect the total surface area?

## INDUSTRY LINKS AND AMBASSADORS

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An ambassador from a local company could initiate the activity, by introducing the challenge to the children and showing them a sample of an unground ingredient of any kind that they would go on to mill into a finer powder (e.g. pigments used in paints). The ambassador could outline their job and explain the skills required to carry out their role, explaining that scientists and engineers in industry often need to find solutions to problems such as this. Finally, the ambassador could discuss the children's results and ask for their recommendations.

## INDUSTRY LINKS AND AMBASSADORS

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**Hellen is a senior scientist** who works for Johnson Matthey. She uses special computer programs and powerful computers to make models, learn about how ingredients called catalysts work, and how to make better ones. These important ingredients are used to make lots of our everyday products, including fuel cells.

You can learn more about Hellen and STEM careers linked to sustainable fuel in **Activity 6**.