Superhero materials

1 Unit summary
The children first talk about superheroes, discussing how different superheroes are good at different things, before creating their own ‘material superheroes’ out of different materials. This unit then focuses on testing materials and looking at their properties through a selection of modelled experiments, contextualised age-appropriate activities and free-flow areas for the setting.

Science learning
Children develop their ability to work scientifically as they are supported to sort and group materials, carry out simple tests and talk about their findings. They begin to identify everyday materials and describe their physical properties. They start to distinguish between an object and the material from which it is made.

Science for practitioners
When testing the materials to see how effective they are at keeping things warm or cold, we are testing their levels of thermal insulation (an insulator slows down heat transfer between objects). A good insulator will keep hot things hot and cold things cold. Children will find this hard to understand at this stage, but plenty of experience now will prepare them in an understanding of the concept when they are older.

Specific areas

Literacy
With support, the children could collect adjectives to describe the different materials and superheroes. In subsequent phonics lessons, the different words could be sorted according to their onset phoneme. This could then be the basis for choosing some exciting superhero names (e.g. a bubble wrap character might become ‘Bubbles the Brave’ and a fur fabric character ‘Fantastic Fuzzy’). If you give the children more choice, the names chosen might not seem quite so appropriate. However, it is important the children take ownership of the project and become engaged in the science.

Mathematics
Presenting the experiments as a competition between the materials is an opportunity to apply ordinal numbers (first, second, third) to the results of each test. With support, children could also keep a tally of the scores of each test so they can see which materials are most versatile. For some of the tests there will be opportunities to use simple measuring equipment.

Understanding the world
With support, the children could use software to keep a record of the scores of the different materials and to make simple graphs (see Websites and books). They might be interested to learn about real-life superheroes: local newspapers often have stories of children and adults who have behaved exceptionally. This topic could also be linked to finding out about people who help us.

Expressive arts and design
Children could use the tested materials and other materials to make collages. This encourages them to talk about texture and other properties of a wide range of materials.

Prime areas

Personal, social and emotional development
As children begin to realise that there is no one ‘best’ material, they can be encouraged to realise this is the same with people and that they all have different skills. Because this unit is likely to take place over a period of time, with different tests carried out on different days, it gives children the opportunity to develop a sustained interest and to work more independently as they gain confidence and understanding.

Physical development
Some of the tests need well-developed fine motor skills (e.g. putting an elastic band around the top of a beaker can be difficult). Give the children access to elastic bands in the making area and demonstrate how to use them to help build this skill. The children will also need to be taught how to use simple scientific equipment such as pipettes and syringes.

Communication and language
Dedicate some time at the beginning of the unit to help the children learn the names of the materials and practise using the vocabulary they need to describe texture and appearance (see Key vocabulary on page 64). Display the key words around the classroom on the walls. Encourage the children to talk about their ideas and predictions as much as possible. If at first they find this difficult, it will help them to hear you talking about (and exaggerating) your own thought processes out loud.

2 Getting ready

Resources
A selection of approximately six different materials works well for this unit. Ensure you have enough of each type of material so all the children have the opportunity to handle them and to allow for the loss of some in the tests. Suitable materials include a range of fabrics, such as fake fur and cotton, papers, bubble wrap and tinfoil.

Websites and books
• A book about owls or other nocturnal animals links well to the section on testing materials.
• The Science Games for Kids web page has an interactive activity that gives children the opportunity to test a range of materials. (http://www.sciencekids.co.nz/gamesactivities/materialproperties.html)
• 2Count, produced by 2Simple (https://www.2simple.com), is a simple graphing tool aimed at the 3–5 age range.

Key vocabulary
• Working scientifically: think, describe, sort, plan, look, watch, measure, test, find out etc
• Materials: texture (hard, smooth etc), properties (waterproof, flexible, see through etc), names (tin foil, fur, fabric, bubble wrap etc)

Home science links
If the tests take place over several days, children could make a display outside their classroom, with support, of the test results for families to see. You could invite families to send materials into school so that the children can test them.

Health and safety
Testing materials for strength could lead to a heavy weight being dropped. If you decide to test the materials this way encourage the children to think about how they can make sure this can be done safely.
Although there are some ideas for tests in this section, once the children have grasped the idea they may be able to suggest some tests of their own. This would be even more valuable.

### Introductory activity

Introduce the children to this activity by showing them the materials to be tested. Give the children time to feel the materials. With support, ask them to use appropriate language to describe the textures and compare the materials with each other (think about suitable descriptive vocabulary before the lesson). Once the children can name and describe the materials, put one of the materials in a feely bag and ask a child to describe it to the rest of the group. The other children must guess which one it is. The children might find this easier if they all have access to the materials throughout this activity: this will help them to build a good understanding of the vocabulary.

### Setting the scene

For the rest of these activities, the children will test the materials to investigate how suitable they are for different purposes. Explain to the children that different materials are good for different purposes. They might find this easier to understand if you give them examples of unsuitable materials for different jobs, such as a jumper made of metal or a window made of wood. They may enjoy thinking of some silly examples of their own!

Ask the children to tell you what they know about superheroes. They may know that superheroes are good at different things and have different ‘super powers’. Introduce the idea of a ‘superhero material’. The children may like to spend some time making some material superheroes of their own (see the pictures on the website for some examples of how this could be done). Next, they will do some experiments to find out which material is best. For the first few experiments, they will probably need guidance from adults, but they should begin to generate their own ideas as they gain experience.

### Focused exploration

#### Activity 1: waterproof

A straightforward first experiment is testing how waterproof a material is. You could start the activity with a request from a teddy that keeps getting wet in the rain. Which superhero material will be able to help him out and become his hat?

Place a small plastic toy in a clear beaker and stretch a sample of the superhero material over the beaker, holding it in place with an elastic band. Dip water onto the material and see if the toy gets wet or not. Using a syringe or pipette to drop the water as possible) and introduce the word ‘absorbent’ to them. Discuss how they will test for this. Using syringes to make puddles that are the same size may make them feel more like ‘proper’ scientists. Discuss predictions with the children and allow them to record their results if they wish to.

#### Activity 2: insulator (heat)

When experimenting which superhero material is best at keeping things warm, a small baked potato is much safer than the cup of hot liquid that is often used. Wrap each potato in several layers of the superhero material and insert a thermometer so that the temperature can be read over a period of time. Although it makes the experiment less valid, occasionally unwrapping the potatoes so the children can feel the difference between the coldest and hottest will make this easier for the children to understand than expecting them to comprehend how a thermometer measures temperature.

#### Activity 3: insulator (cold)

A similar experiment to the one above is with a large block of ice, to find out which material is best at stopping it melting. Make sure all of the blocks of ice are the same size to begin with. Let the children unwrap the material from the ice and take photographs every so often, to see which is melting fastest. Encourage the children to predict which material will keep the ice coldest. If this is done after the ‘keeping-warm’ experiment, the children are likely to predict the material that kept the potato warm is the one that will melt the ice first. When they discover the same material that is good at keeping the potato warm is also the best for stopping the ice melting, they may find it hard to believe. Fortunately, they do not need to understand insulation until KS2, but experiences such as this will help them to do so when the time comes.

#### Activity 4: absorbency

Introduce this experiment with a letter from Cinderella. Ask the children to find out which superhero material is the best at mopping up puddles of water. Discuss what the material will need to do (e.g. soak up as much water as possible) and introduce the word ‘absorbent’ to the children and ask them what they think it means. Introduce this experiment with a letter from Cinderella. Ask the children to find out which superhero material is the best at mopping up puddles of water. Discuss what the material will need to do (e.g. soak up as much water as possible) and introduce the word ‘absorbent’

#### Activity 5: light blocking

Another experiment the children could perform is finding out how well the materials block light. Introduce them to a toy owl and talk about nocturnal animals and how they sleep during the day. Ask them to think about which of their materials would make the best curtains for blocking out the light so that the owl can sleep. Provide some torches so the children can experiment with which material is the most effective. Discuss predictions with the children and allow them to record their results if they wish.
Free flow exploration

**Activity 1**

Once the children are familiar with the idea of testing materials for different properties, make sure they have access to the equipment they need in the science-discovery area. You could arrange for your school administrator to visit your classroom at the start of a child-initiated session with a special delivery for the class scientists! Make sure ‘report forms’ are available so the children can choose to record their results if they wish to.

**Activity 2**

A selection of small pieces of fabric can be useful props in the small-world area, and larger pieces are a good open-ended resource for role play. Ensure you supply a variety that can be used for different purposes. Joining children in self-initiated activity is deceptively challenging to do well and practitioners often fall into the trap of asking too many questions. A simple way to join children’s play is to follow perhaps on a short washing line in the science-discovery area. You could arrange for your school administrator to visit your classroom at the start of a child-initiated session with a ‘special delivery’ for the class scientists! Make sure ‘report forms’ are available so the children can choose to record their results if they wish to.

**Activity 6: parachutes**

An experiment that fits particularly well with the superhero theme is seeing which material makes the best parachute. A polystyrene cup makes a good basket and is just the right size to hold a test pilot such as a small plastic figure. Attach string to the cup with sticky tape, and use paperclips or small pegs to attach the string to the materials. Although the children may like to try using stopwatches to time the fall they will not be able to do this accurately enough to test the parachutes. They will all need to be dropped at the same time so they can be compared and the slowest one declared the winner. This is even more exciting if the ‘passenger’ is an egg that you don’t want to crack!

**Activity 7: strongest**

The children will be keen to find out which is the strongest material. This can be a difficult test as more than one material may be strong enough to hold quite a lot of weight! Using thin strips of each material will mean they break sooner than larger pieces. The children could test the strips by hanging weights on them until they break or tear. However, because at this stage children are only making a comparison rather than a ‘fair test’, they do not need to be able to measure the exact breaking points of the different materials. A carefully supervised ‘tug of war’ may be another way of testing the materials.

Taking it further

If you and the children enjoy this activity, you are likely to return to it throughout the year as children think of new properties they want to test (e.g. after a windy day making and playing with kites, someone may wonder which of their superhero materials would fly the highest). For this reason, it is worth making sure you have plenty of your chosen materials to hand. Children should also be able to carry out familiar experiments on new materials with increasing independence, such as testing to see if they are waterproof.

4 Characteristics of effective learning

**Playing and exploring – engagement**

By providing children with a selection of materials in the small-world and role-play areas, they will have opportunity to think creatively about different ways to use and combine them. This activity will help them make more informed choices, especially if they are supported by adults to make these connections (e.g. ‘I bet you’ve chosen that piece of fabric to be your cloak because it swishes when you spin around.’ or ‘Wow! That shiny blue fabric makes a perfect river for the dinosaurs doesn’t it?’). Another strategy would be to ask for children’s help (e.g. ‘Please will you help me choose a good material to use for the dog’s bed? I want him to be warm and comfortable.’).

Providing props to continue this activity in the science-discovery area will help children to get in role as scientists as they rehearse the tests again. If they choose this independent repetition of the activity, it will not only reinforce their understanding of the science, but it will help them to see themselves as potential scientists.

**Active learning – motivation**

Because this activity is presented to the children in slightly different ways over a period of time, it gives them the opportunity to gain confidence and build their understanding of what testing the materials involves. Make sure there are plenty of resources available so all the children have hands-on experience, rather than having to watch others or take turns. This will mean a diffident child can watch a more confident peer carry out an activity while experiencing it alongside them. As they build confidence in this way, they are more likely to take a more active role and make comments of their own.

**Creating and thinking critically – thinking**

Encouraging the children to talk about their ideas and predictions before and after each experiment will help them to develop the cognitive skills they need to think creatively and critically. In a busy classroom it is difficult to find time to listen to all the children. However, some children almost never have the experience of someone really paying attention to, and respecting, what they say. So finding time to do this is a powerful way to help the children build their confidence and understanding. This will help them to have – and value – their own ideas and to make connections between different experiences.