STEM in a Box

TEACHER GUIDE

Marvellous Materials

Delight

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Welcome!

We are so pleased that you and your class are joining us on this STEM adventure!

What is STEM in a Box?

A completely FREE, inclusive STEM learning resource created for primary aged children.

Greenergy, Europe's largest manufacturer of biodiesel from waste, asked Delight, a leading UK children's learning charity, to use their experience to develop a STEM-themed education resource.

Delight worked with teachers and partnered with a STEM Primary Education Consultant to develop the scientific content.

Lesson Resources

STEM-in-a-Box is a multi-year programme designed to align with the Science topic 'Materials'.

As children move through primary education they repeatedly experience the excitement of STEM-in-a-Box hands-on learning and engagement with real-world connections.

Senior Infants Marvellous Materials

4th Class Sludge to Salt

Resources

Shared Resources

The children's 'Lab Station' boxes are used by multiple year groups. Scientific equipment used by multiple year groups should remain in these boxes.

Year Specific Resource Boxes

Specific year group resources are stored in the year group plastic boxes.

Re-Storage After Lesson Delivery

Resources should be stored correctly ready for re-use. (Resource preparation and storage instructions – see QR code or Members Area).

Resource Care

These resources will be used year on year by multiple classes. Please ask the children to look after them.

Photos © Alex Brenner (pages 5, 10 and 15)

LESSONS OVERVIEW

Can be completed as 3 individual lessons across a half term or broken into smaller sessions as preferred.

Activity timings are approximated on each lesson page.

1. FINDING OUT ABOUT SCIENCE
2. INVESTIGATING MATERIALS
3. EXPERIMENTING WITH MATERIALS

1 FINDING OUT ABOUT SCIENCE

What's in Lesson 1?

What is a Scientist?

Meet the Scientists

Exploring Scientific Equipment

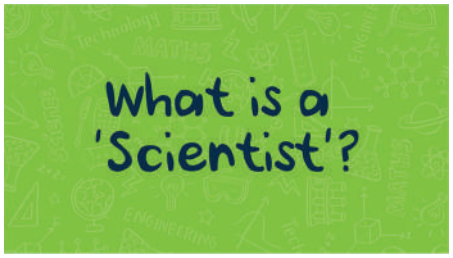
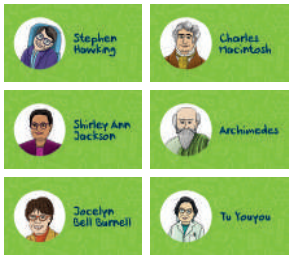
Using Scientific Equipment

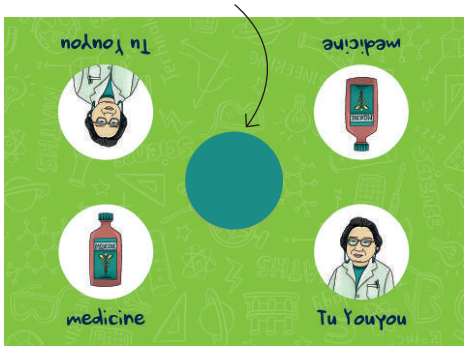
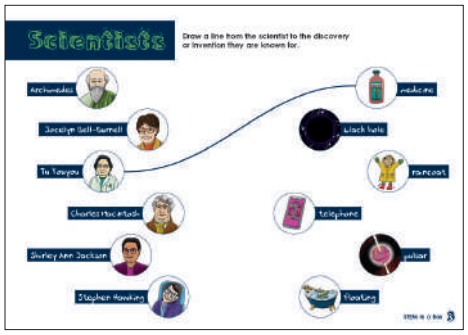
NB Remember to get the children into their science teams (wearing their goggles and team badges) at the start of each lesson, so that they always feel like 'real' scientists.



1 FINDING OUT ABOUT SCIENCE

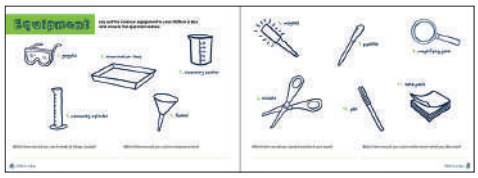
WHAT IS A SCIENTIST?

WHAT	ACTIVITY TIMING	RESOURCES
We are going to learn about scientists **Film** Watch 'What is a scientist?' with the children. **Whiteboard PDF** After the film, ask: **1.** What questions do scientists ask? **2.** What do scientists do? **3.** What do 'observe', 'experiment', and 'record' mean? **We are going to become 'real' scentists, working in a science team.** **Lab Stations** Children should work at six 'Lab Stations' in teams of five. Place one 'Lab Station' box on each 'Lab Station'. They are now part of the science team working with the real scientist on their badge (e.g. one team is in the Stephen Hawking team, another is in the Marie Curie team). • Place the goggles and scientist badges on top of each 'Lab Station' box. • Ask the children to put them on. They are now part of the science team working with the real scientist on their badge (e.g. one team is in the Stephen Hawking team, another is in the Jocelyn Bell Burnell team).	10-15 minutes (film 1 minute)	**Whiteboard** Film   **Lab Stations** Goggles & Badges  

MEET THE SCIENTISTS	WHAT	ACTIVITY TIMING	RESOURCES
	We are going to learn about scientists	10-15 minutes (film 1 minute)	**Lab Stations** Scientist boards and buttons, workbook (page 3) and colouring pens. colour-coordinated button   
	Lab Stations Place one scientist board (with the corresponding coloured button) on the 'Lab Station' of the team with the corresponding Team Badge scientist (e.g. the Tu Youyou board with the Tu Youyou team). **NB** Instruct the children not to press the button yet.		
	Workbook Hand out one workbook per 'Lab Station' and get them to open it to page 3. Each scientist board reveals facts about the scientist (see pages 22 & 23). Each child connects one scientist to one object in the workbook.		
	Suggested delivery methods **1.** Teams move from table to table with their workbook and colouring pens, press the button, listen and complete the workbook at each scientist board. **2.** Teams stay seated at their 'Lab Stations'. Each team presses their button one at a time. The children work in their teams to complete the workbook after each button. At the end, review and recap the answers with the class. Did they answer correctly?		

1 FINDING OUT ABOUT SCIENCE

EXPLORING SCIENTIFIC EQUIPMENT

WHAT	ACTIVITY TIMING	RESOURCES
We are going to learn about science equipment	15-30 minutes	**Lab Stations** Workbooks (pages 4 & 5), colouring pens & science equipment from 'Lab Station' box. 
Lab Stations Ask the children to lay out all of the equipment in their boxes neatly on their 'Lab Stations' and have a close look at them.		
Workbook Ask the children to open their workbooks to pages 4 & 5.		
Whiteboard Read out the questions in the workbook one by one.		**Whiteboard PDF** Workbook (pages 4 & 5)  
Suggested delivery methods **1.** Teams discuss which piece of scientific equipment might be the answer to the question and write the number or name of the object in the workbook. Each team tells the class what they have written. Were they correct? If not, allow them time to correct their answer. **2.** Whole class answers each question together before completing the workbook.		

USING SCIENTIFIC EQUIPMENT

WHAT	ACTIVITY TIMING	RESOURCES
We are going to use science equipment **Lab Stations** • On each 'Lab Station', help the children to set up the beakers and measuring cylinder in the large and small trays (the trays will catch any spilled water) as in the photo. • Place the funnel and the pipettes on the desk. • Fill the 250ml beaker in the small tray with water. **Children's challenge** Model the challenge to the children. The challenge is to move the water from the first large (250ml) beaker in the small tray, across all the beakers and the measuring cylinder in the line until all the water is in the last large (250ml) beaker in the large tray. The children should use all of the scientific equipment (e.g. they can transfer the water by pouring it from one beaker to another and using the funnel and pipettes). If this is too challenging for some children, simply let them 'water play'.	10-20 minutes	**Lab Stations** Science equipment from their 'Lab Station' box. Fill to 250ml with water 

2 INVESTIGATING MATERIALS

What's in Lesson 2?

Magnified Materials

Floating Ice Roses

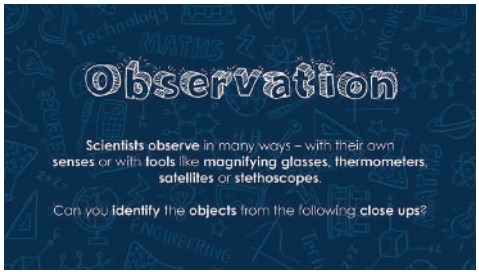
What's in the Bag?

Everyday Materials

NB Remember to get the children into their science teams (wearing their goggles and team badges) at the start of each lesson, so that they always feel like 'real' scientists.



MAGNIFIED MATERIALS

WHAT	ACTIVITY TIMING	RESOURCES
We are going to look closely at objects that are magnified (made bigger). **Whiteboard** Navigate through the presentation one page at a time. The magnified obejcts are made from the materials explored in the lessons: metal, glass, wood, stone and plastic. • Show the image of one magnified material. • Ask the children to guess what object it might be. Then reveal the answer on the next page. • Were they correct? • Continue until all five magnified objects have been identified.	5-10 minutes	**Whiteboard PDF** Magnified Materials  

FLOATING ICE ROSES

WHAT	ACTIVITY TIMING	RESOURCES
Preparation Before class, freeze six blue rose ice cubes. **We are going to investigate what happens to ice in water** **Lab Stations** • Ask the children to place one large 250ml beaker on their 'Lab Stations'. • Fill each beaker half full with warm water. • Place one frozen blue rose in each beaker. • Explain that we will return later to find out what has happened to the floating roses. **Later...** Return to the beakers when the roses have melted. **Discuss** • What has happened to the water? (It's blue). • Do they think that water and ice are the same thing? • Can they think of any other ice that turns to water? (Maybe in the winter, when a frozen puddle melts when the weather gets warmer). • Why did the water make the ice melt? (The water was warmer than the frozen ice).	5-10 minutes	**Teacher Prep** Rose ice cube tray and food colouring.  **Lab Stations** 1 x 250ml beaker  **Whiteboard PDF** 

WHAT'S IN THE BAG? GAME

WHAT	ACTIVITY TIMING	RESOURCES
We are going to explore the properties of everyday objects **Lab Stations** • Place one 'What's in the Bag?' and one 'Materials Sorting Board' on each 'Lab Station'. Each bag should contain ten mini objects (2 of each material: metal, wood, plastic, glass, stone). • Ask one child from one team to put their hand in the bag and describe one object to the class. What do they think that object might be? • They then remove the object and decide where to place it on the 'Materials Sorting Board'. • Once one child from each team has placed an item, the children continue the game themselves in their teams until each child has had two turns. **Discuss** When all the objects have been placed, ask each team to tell you where they have placed each item. **Whiteboard** Show them the correct answers on the pdf. • Do they all agree? What makes them think that an object is made from a particular material? Can they think of any other everyday objects that are made from metal, wood, plastic, glass, or stone? **Re-pack** Ensure the children re-pack all the objects back into the bag for re-use.	20-30 minutes	**Lab Stations** What's in the Bag? and Materials Sorting Board   **Whiteboard PDF** Completed Materials Sorting Board  

2 INVESTIGATING MATERIALS

EVERYDAY MATERIALS

WHAT	ACTIVITY TIMING	RESOURCES
We are going to observe everyday materials **Lab Stations** Place one 'Everyday Materials' bag on each 'Lab Station'. Each bag should contain five objects – metal disc, glass disk, filter paper, plastic swatch, stone. **Workbook** Ask the children to closely observe each material and record their findings in the workbook. **Whiteboard** Model on the whiteboard how to record their findings in the workbook. **Explore & Draw Challenge** • Ask each child to take a note pack and pen from their 'Lab Station' box. • Assign each child a material (e.g. child 1 metal, child 2 paper, etc). • Challenge the children to explore their environment to find an everyday object that they think is made of their assigned material and to draw it on their note pack. • Show and tell what the children have drawn. **Whiteboard** • Model on the whiteboard how to stick their drawings into the workbook and write the name of the everyday object next to it.	20-30 minutes	**Lab Stations** Filled 'Everyday Materials' bags, colouring pens, magnifying glass, note packs (one for each child) and workbook (pages 6 & 7).  **Whiteboard PDF** Workbook (page 6 & 7) 

3 EXPERIMENTING WITH MATERIALS

What's in Lesson 3?

Magnetic Astronaut

Absorbent Everyday Materials

Experimenting with Everyday Materials

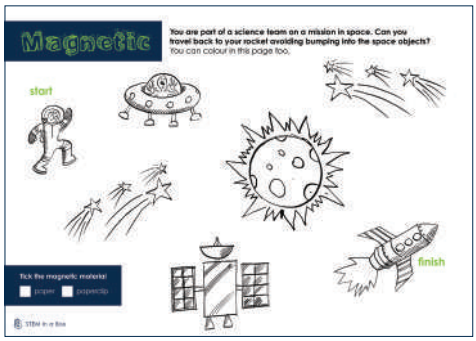
Materials Card Game

NB Remember to get the children into their science teams (wearing their goggles and team badges) at the start of each lesson, so that they always feel like 'real' scientists.

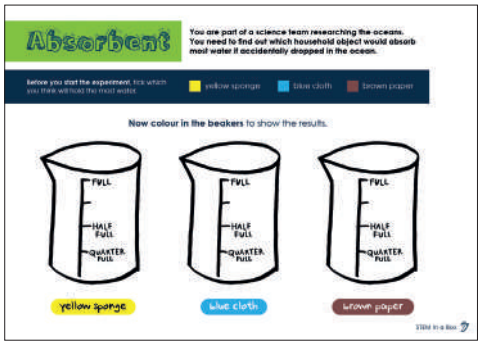


3 EXPERIMENTING WITH MATERIALS

MAGNETIC ASTRONAUT

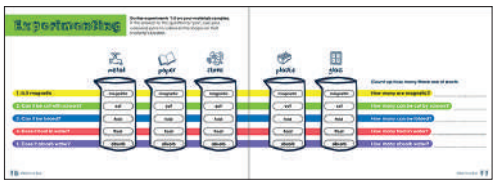
WHAT	ACTIVITY TIMING	RESOURCES
We are going to experiment with a magnetic astronaut **Whiteboard** • Display workbook page 8 on the whiteboard and read out the challenge. **Lab Stations** • Hand out a paper astronaut on a paperclip to each 'Lab Station' team. **Workbook** • Model how to hold the workbook. Place the astronaut on the 'start' position and the magnet on the back of the workbook. Then move the magnet to navigate the astronaut to the spaceship. • Model how to hold the workbook with one hand and place the astronaut on the 'start' position on the page and place the magnet on the back of the workbook and use it to to navigate the astronaut to their spacecraft. • Let each child have a turn. **Discuss** Ask the children which is the magnetic material – the astronaut or the paperclip – and then to tick the answer in their workbook.	10 minutes	**Lab Stations** Astronauts on paperclips, magnet, workbook (page 8) & colouring pens.   **Whiteboard PDF** Workbook (page 8)

ABSORBENT EVERYDAY MATERIALS

WHAT	ACTIVITY TIMING	RESOURCES
We are going to experiment with absorbent materials	30 minutes	**Lab Stations** 'Absorbent' bags, 3 x 250ml measuring beakers, large and small examination tray, pens & workbook (page 9).   **Whiteboard PDF** Workbook (page 9)
Lab Stations • Place one 'Absorbent' pack on each 'Lab Station' and ask the children to get out the three material swatches within. • Ask the children to get out the three largest (250ml) beakers (each has a different coloured elastic band attached which corresponds to the colours of the materials swatches – yellow/ blue/brown) and both examination trays. • Ask them to place the three beakers in the largest examination tray. • Fill the small examination tray with water.		
Workbook Before the children begin the experiment, get them to look closely at the materials and tick which one they think will absorb the most water.		
Lab Stations • Model how they should submerge the first 'Yellow' swatch of material into the water and squeeze it out into the beaker with the yellow elastic band. • Get each chid in each team to do this with the 'Yellow' swatch, so it has been submerged and squeezed five times. • Repeat the process until all three swatches have been submerged and squeezed out into their colour-coordinated beaker 5 times.		
Workbook Model on the whiteboard how the children should record the water levels for each beaker in their workbook (page 9).		
Discuss Which material was most absorbent? Were their predictions correct?		

3 EXPERIMENTING WITH MATERIALS

EXPERIMENTING WITH EVERYDAY MATERIALS

WHAT	ACTIVITY TIMING	RESOURCES
We are going to experiment with everyday materials **Lab Stations** • Place one 'Everyday Materials' bag on each 'Lab Station'. • Ask the children to get out their large examination tray. • Fill the large examination tray with water. • Model how to complete each experiment (e.g. use the magnet on the materials, cut the materials with the scissors, etc) and how to record their findings in the workbook (page 10 & 11) using the whiteboard PDF. • Assign one child from each team to be responsible for doing one of the experiments on each of the materials (e.g. child 1 answers question 1 – Is the metal/stone/plastic/etc magnetic?). **Workbook** • Model on the whiteboard how the children should colour in the corresponding beaker, etc in the workbook. • Ask the children to count up the number of coloured shapes in each row and write down the number in the workbook.	30 minutes	**Lab Stations** Filled 'Everyday Materials' bags, magnet, scissors, colouring pens, large examination tray and workbook (page 10 & 11).   **Whiteboard PDF** Workbook (page 10 & 11)

MATERIALS CARD GAME

WHAT	ACTIVITY TIMING	RESOURCES
We are exploring what material is suitable to make a specific object.	10-20 minutes	**One 'Lab Station'** 'Materials' and 'Objects' Card Packs
Lab Stations • Gather the children round in a circle and explain that they are going to play a game that lets them imagine what the world would be like if a particular object was made from a specific material. • Place the 'Objects' pack of ten cards and the 'Materials' pack of ten cards in the centre side-by-side face down (as you would with the game 'Snap'). • Ask one child to turn over an 'Objects' card and another child to turn over a 'Materials' card.		
Discuss • Is that a good material to make that object from? If not, why not? If yes, why yes? **NB** Some of the cards may make a good match (e.g. metal and car), others are more fun (e.g. bicycle wheel and chocolate). • Repeat until all cards have been turned. • Shuffle and play again as many times as you wish.		

SCIENCE WORDS

WHAT	ACTIVITY TIMING	RESOURCES
We are going to find out what science vocabulary you have learnt.	10-20 minutes	**Whiteboard PDF** Science Words PDF
Discuss Use the whiteboard PDF to test the children to see what vocabulary they can recall from the lessons.		

RESOURCES

Children's Resources (per 'Lab Station' box)

- 5 x goggles
- 5 x team badges (of the same scientist)
- 1 x large examination tray
- 1 x small examination tray
- 1 x 25ml measuring beaker
- 1 x 50ml measuring beaker
- 3 x 250ml measuring beaker (with a different coloured elastic band around each – yellow, blue, brown)
- 1 x measuring cylinder
- 1 x funnel
- 1 x magnet wand
- 1 x magnifying glass
- 5 x post it note packs (different colours)
- 5 x pipettes (all different colours)
- 1 x pair of scissors
- 5 x pens (all different colours)
- 1 x workbook per 'Lab Station' team.

Replacement Resources

Workbooks, filter paper, plastic swatches and 'Absorbent' bags are provided each year. Paper astronauts can be printed from the Members Area if required.

Teacher's Resources

Digital resources

- Teacher Guide
- Whiteboard PDFs
- Workbook
- 'Magnified Materials' PowerPoint
- Animated Video: 'What is a scientist?'
- Sheet of astronauts

Physical resources

- 6 x 'scientist' boards (one for each 'Lab Station')
- 6 x scientist information buttons (for 'scientist' boards)
- 6 x 'What's in the Bag?' (one for each 'Lab Station') including:
  - 1 x material sorting board
  - 1 x bag containing 2 x mini objects of each material: metal, wood, plastic, glass, stone
- 1 x bag 'Magnetic' astronauts on paperclips (one astronaut per 'Lab Station').
- 6 x bags 'Absorbent' materials (one for each 'Lab Station', containing yellow sponge, blue cloth, brown paper).
- 1 x rose ice tray
- 1 x food colouring bottle
- 6 x 'Everyday Materials' bag (one for each 'Lab Station') including:
  - 1 x disk (metal)
  - 1 x filter paper (paper)
  - 1 x swatches (plastic)
  - 1 x disk (glass)
  - 1 x pebble (rock)

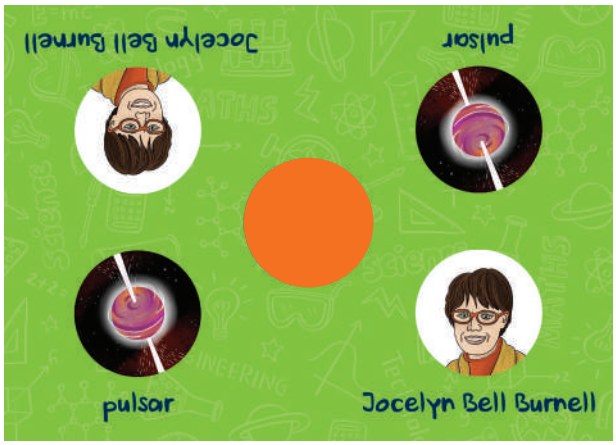
Questionnaires

- 1 x teacher questionnaire
- 30 x child questionnaires
- 1 x stamped-addressed envelope for the return of the questionnaires

MEET THE SCIENTISTS

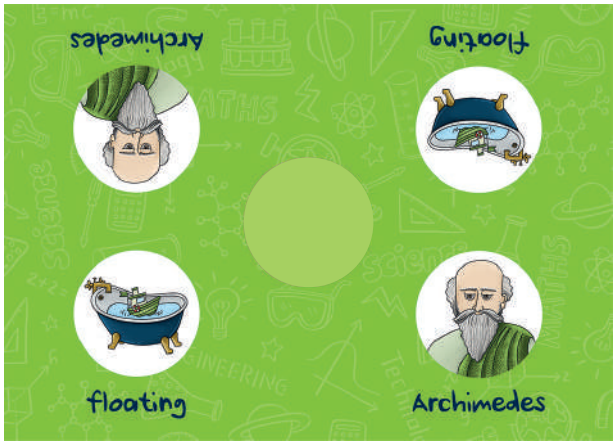
Appendix

What the scientist board buttons say about the scientists.



Jocelyn Bell Burnell

"Jocelyn Bell Burnell is a space scientist from Ireland. She used a radio telescope which makes far away sounds much louder. One day she was listening to space when she heard a beep… beep… beep. It wasn't aliens though, it was pulsars, tiny stars that spin really fast."



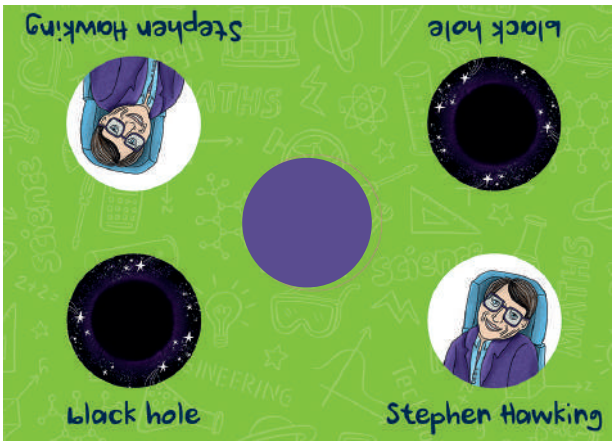
Archimedes

"Archimedes lived more than 2,000 years ago. He loved science and maths and used them to answer very difficult questions such as: what makes an object float in water?"



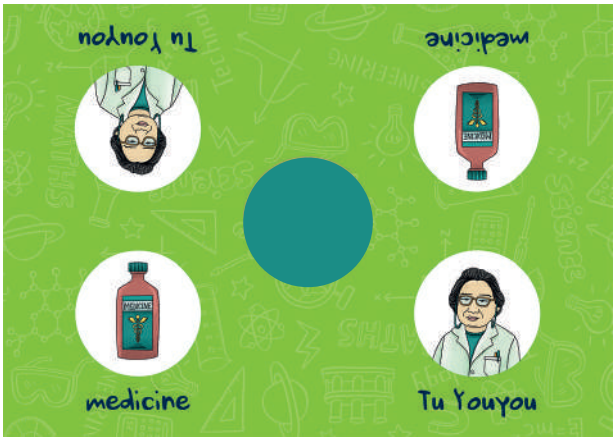
Shirley Ann Jackson

"Shirley Ann Jackson works as a scientist and teacher in America. When she was a girl she loved learning and was one of the best pupils in her school. After school, she carried out research that helped make telephones easier to use."



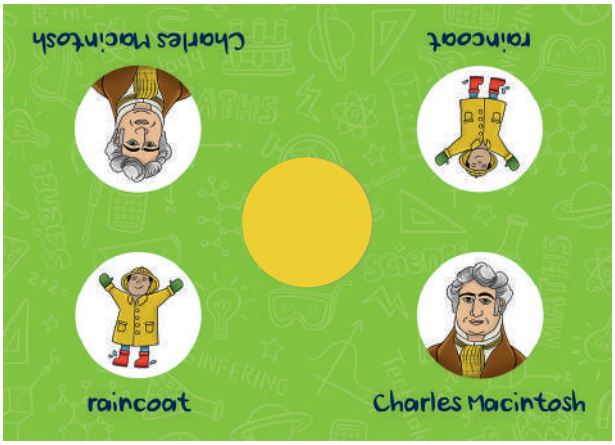
Stephen Hawking

"Stephen Hawking lived until recently. He loved outer space and became famous when he discovered important things about a black hole – that's an area in space so powerful that even light cannot escape from it."



Tu Youyou

"Tu Youyou is an award-winning scientist working today. She was ill when she was young and this inspired her to make a very special medicine that has helped millions of people get better from an illness called Malaria."



Charles Macintosh

"Charles Macintosh was born more than 200 years ago. He added a layer of rubber (that's like a balloon) to a piece of cloth, which made it waterproof. He then made a raincoat from it called a Mackintosh."



Delight

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