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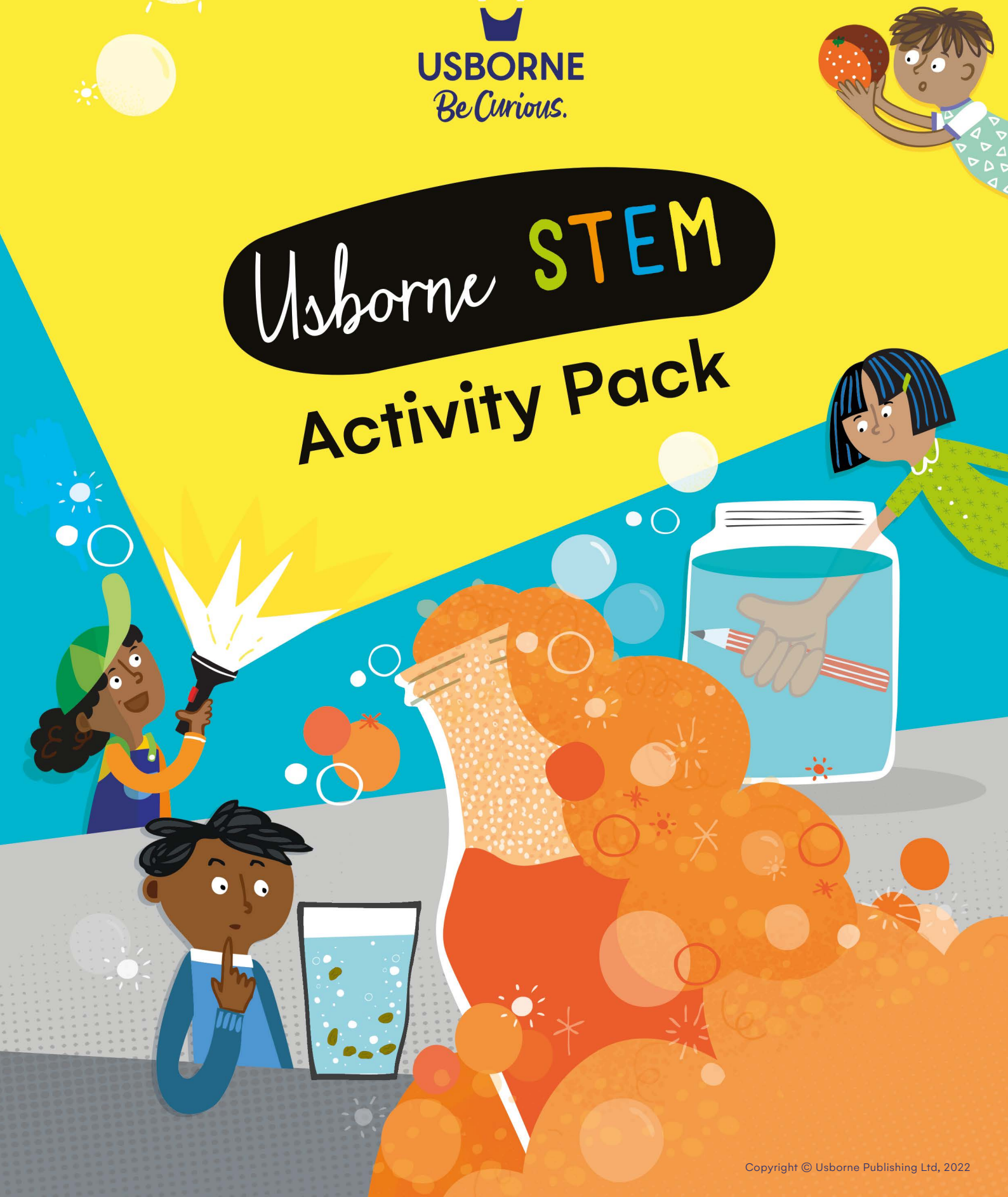
Be Curious.

Usborne STEM Activity Pack



The egg that floats and sinks

How can an egg sink and float in the same jar of water? This experiment will show you the answer.

1 Place a fresh egg into a big jar of water.

2 Carefully take out the egg. Then stir in five spoons of salt

3 Place the egg back in the jar. What does it do this time?

What does DENSER mean?

Everything is made up of tiny PARTICLES. The closer together those particles are, the denser something is.

Pick up a piece of dried pasta, and then a coin, to compare how dense they each feel.

Next steps

Repeat the experiment with flour instead of salt. Does it mix well? Does it make the egg float?

Then use a pebble instead of an egg. Does the pebble float if you add some salt?

Write down what you find out.

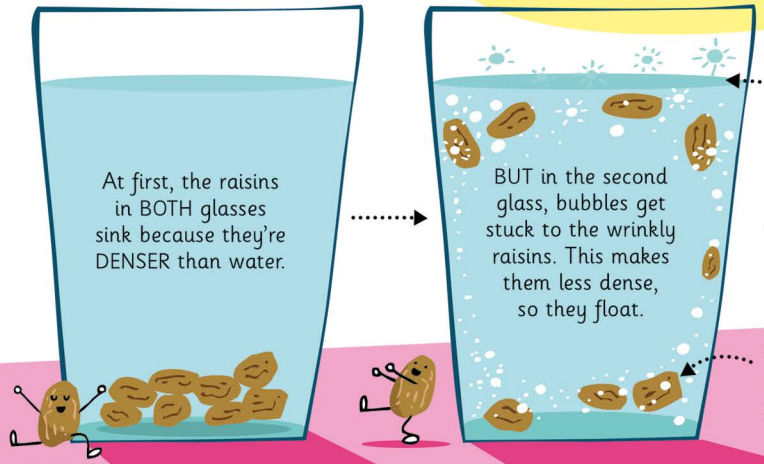
Dancing raisins

What do raisins do if you add them to two glasses of water – one still and one fizzy?

1 Fill the first glass with tap water. Use a new bottle of sparkling water to fill the second.

2 Drop about eight raisins into each glass. Then watch...

Sparkling water contains carbon dioxide. This gas causes lots of bubbles to form. Because gas is less dense than water, the bubbles rise.

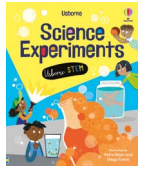


Expand the experiment

Do the raisins stop dancing after a while? Why do you think this happens?

Taste the water in the second glass at the start and end. How does it change?

Add smooth things, such as lentils, to a new glass of sparkling water. Do they start dancing?



Usborne Activities

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Forcing things to move

All objects stay still unless a big enough FORCE makes them move. Their resistance to start moving is called INERTIA. In these experiments, watch how forces overcome inertia.

Flick a coin

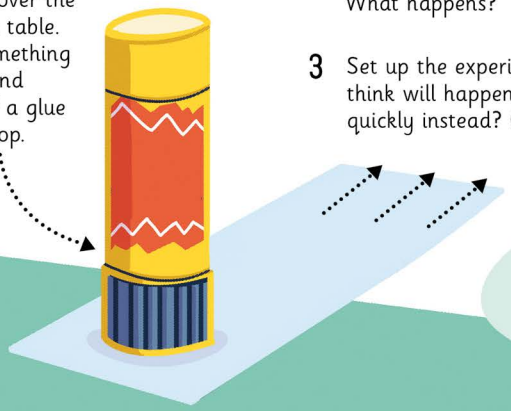
1 Stack at least five coins on top of one another.

2 Use the finger next to your thumb to flick another coin as hard as you can towards the base of the stack.

Does the stack fall over? Repeat this several times to confirm the result. Describe what you see and try to explain what you think is happening.

On the edge

1 Balance a strip of paper over the edge of a table. Stand something the size and weight of a glue stick on top.



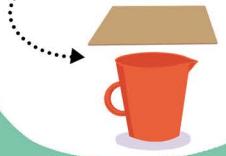
2 Slowly tug the strip away from the table. What happens?

3 Set up the experiment again. What do you think will happen if you tug the paper very quickly instead? Give this a try...

Does the tugging force have more of an effect when it's fast or slow?

Tumbling tower

1 Place a piece of card over the top of a wide jug.



2 Stand a cardboard tube on the card. Then balance a lemon on top.

3 Now, quickly hit the card sideways with the back of your hand.

What do you think will happen to the lemon and the tube?

Next steps...

Hold the tube and lemon – how heavy do they feel? Does their weight seem to affect which way they fall?

Then use a light ball of scrunched up paper instead of the lemon.

Does it fall in a different way?

THINK LIKE A SCIENTIST

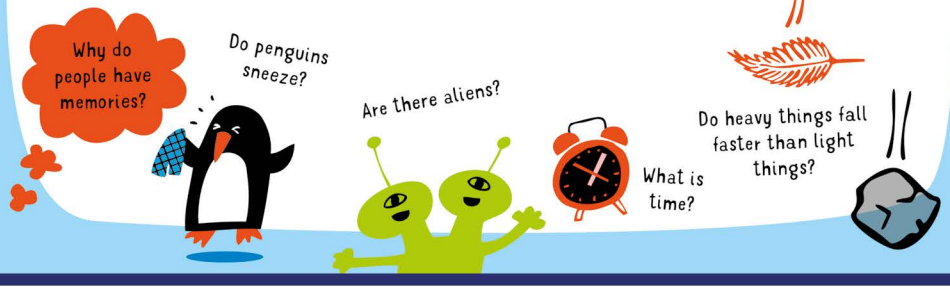
Scientists usually start by asking a QUESTION about the world around them.

Use this space to jot down any scientific questions you can think of about how or why something happens.

WHAT?

HOW?

WHY?



After asking a question, scientists design an EXPERIMENT to TEST their ideas. Pick one of your questions, and scribble down ways you could test it, using the ideas on the right as inspiration.

QUESTION:

WAYS TO TEST IT:

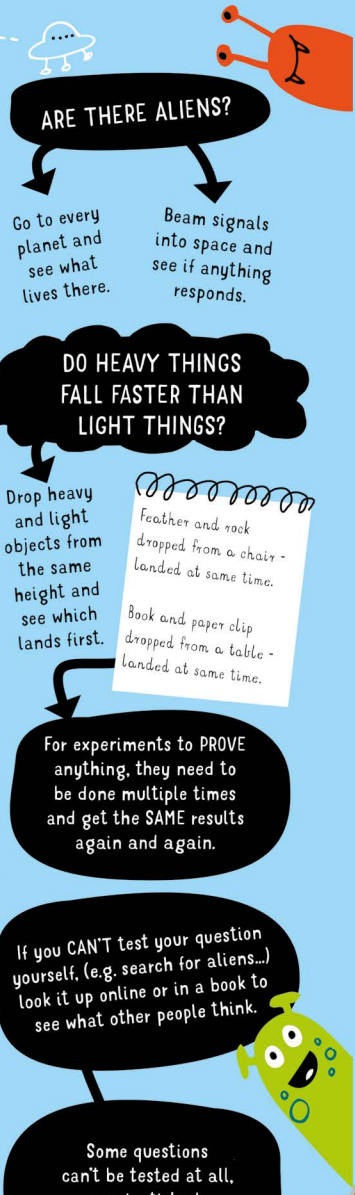
Scientists call this the METHOD.

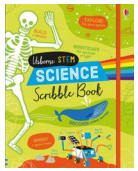
Then, if you can, try testing your question. Write down any notes and results here.

RESULTS:

CONCLUSION:

Do your results tell you anything?



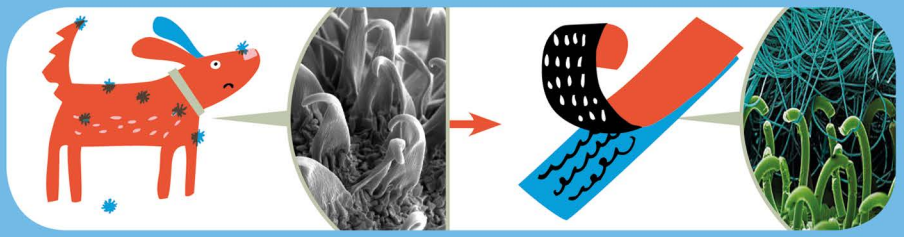


INSPIRED BY NATURE

Sometimes, when engineers are trying to find a creative new way to solve a problem, they take inspiration from the world of nature.

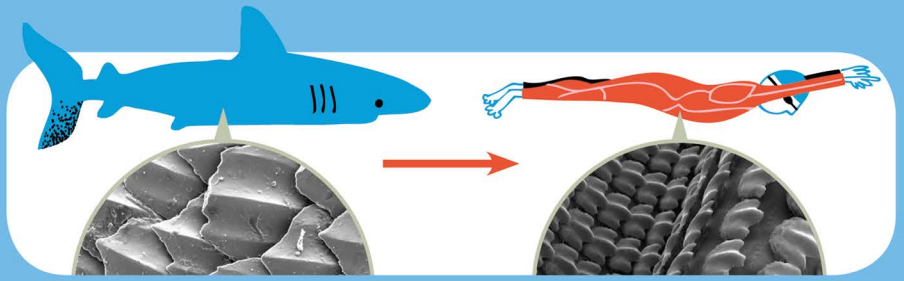
NATURE

INVENTION



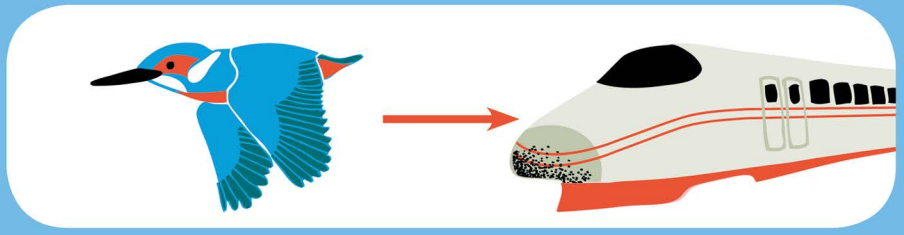
Burdock seeds use tiny hooks to attach to the fur of passing animals.

This was the inspiration for Velcro®.



Shark skin has lots of tiny scales which cut through the water

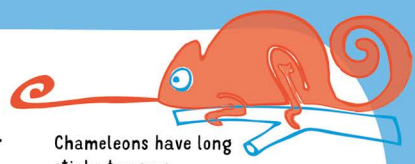
These scales inspired a scaled swimsuit so good it was banned from the Olympics.



The shape of a kingfisher's beak helps the bird fly more smoothly.

Japanese engineers copied the shape for the front of a high-speed 'bullet' train.

Taking inspiration from the natural world, can you invent a device to tidy your bedroom? There are some ideas below to get you started.

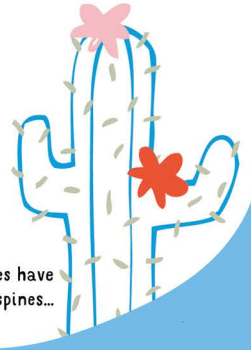


Chameleons have long sticky tongues...

...could you use something like that to pick up mess?

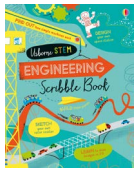
Bats make clicking sounds to help find things in the dark...

...could you use something like it to find lost things around your room?



Cactuses have sharp spines...

...could you use something like them on a device to collect stray socks?



THINK LIKE AN INVENTOR

Inventors have to start by thinking hard about what people DON'T HAVE, but MIGHT NEED. What hasn't been invented yet, and how could it make life better? Then inventors bring their idea to LIFE.

Fill in these boxes to follow the journey of an idea. Use one of these ideas, or come up with your own.

A gadget that can work out what is making someone ill.

A machine that can wash a person and their clothes at the same time.

A container that stops food from going bad.

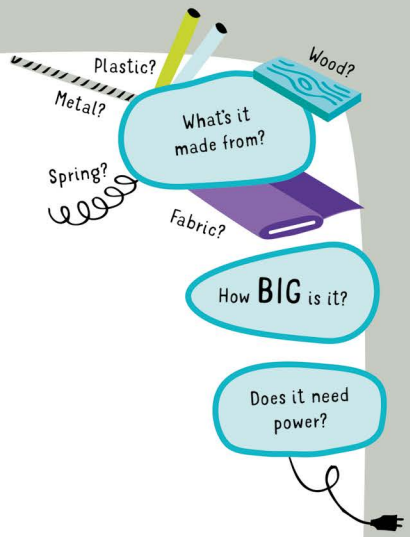
You could keep an inventor's notebook to jot down thoughts and ideas.

RESEARCH IT

Have a look online, or in books. Is your idea new, or are there similar inventions out there? How would you make yours different?

DEVELOP IT

Think through your idea. Draw diagrams and make notes.



DRAW IT OUT

Draw a final version of your invention here, based on all your notes and diagrams above.

The next stage for an inventor is to **BUILD** a model. Turn to page 48 to try it out.

ROOM FOR IMPROVEMENT

Technology isn't always about coming up with a brand new idea. Often, it's to do with DEVELOPING and IMPROVING things that already exist or COMBINING technologies to make something better. Here are some examples of technology that could be improved...

Pick one of the examples above, or think of your own. Follow this development process to try to improve it.

WHAT'S BEEN TRIED BEFORE?

Think about improvements that have already been made to try and solve the problem.

ANALYZE IT

Scribble down the STRENGTHS and WEAKNESSES of the existing technology, and try to think of IMPROVEMENTS.

For example:
REUSABLE CUP

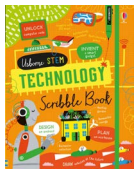
STRENGTHS
Reduces waste

WEAKNESSES
Have to remember to bring it

IMPROVEMENT
Reusable cup that people can wear when not in use

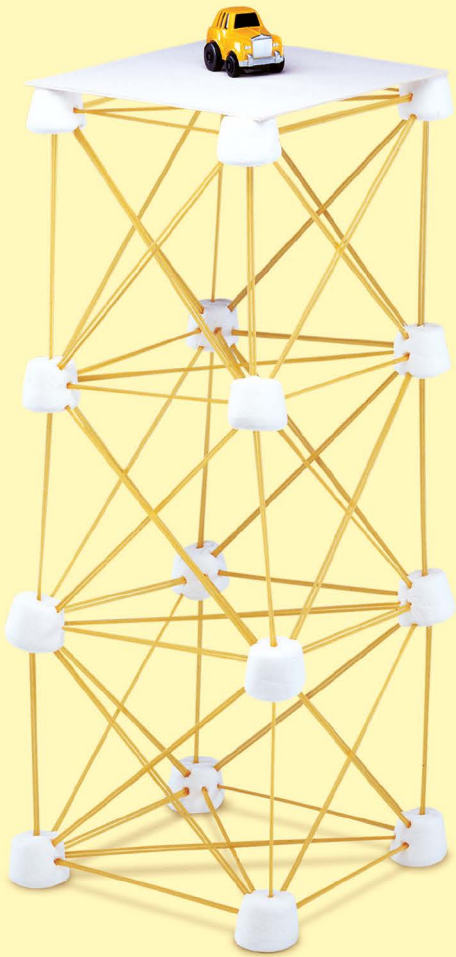
DESIGN IT

Design your improved piece of technology below.



Stable structures

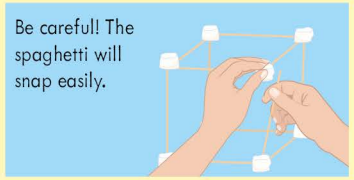
Find out which shapes make the strongest structures.



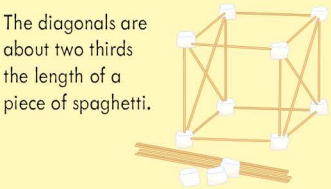
You will need:

- marshmallows
- spaghetti
- card

Tower challenge

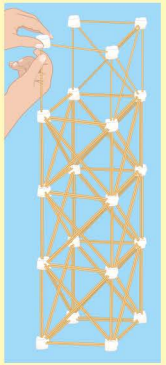


1. Use marshmallows and half lengths of uncooked spaghetti to build a cube like this. Does it feel stable?

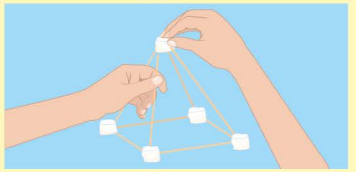


2. Snap other pieces of spaghetti to make diagonals across each side of the cube. Does it feel more stable now?

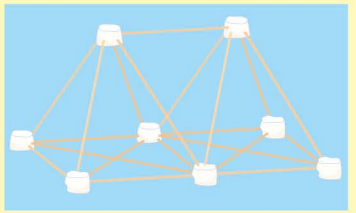
3. Build the tallest tower you can from marshmallows and spaghetti. Put some card on top and see what weight it will support.



Make a pyramid



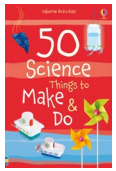
1. Make a square using half lengths of spaghetti and marshmallows. Add four half lengths to make a pyramid.



2. Add more spaghetti to extend your pyramid building like this. How stable does this shape feel?

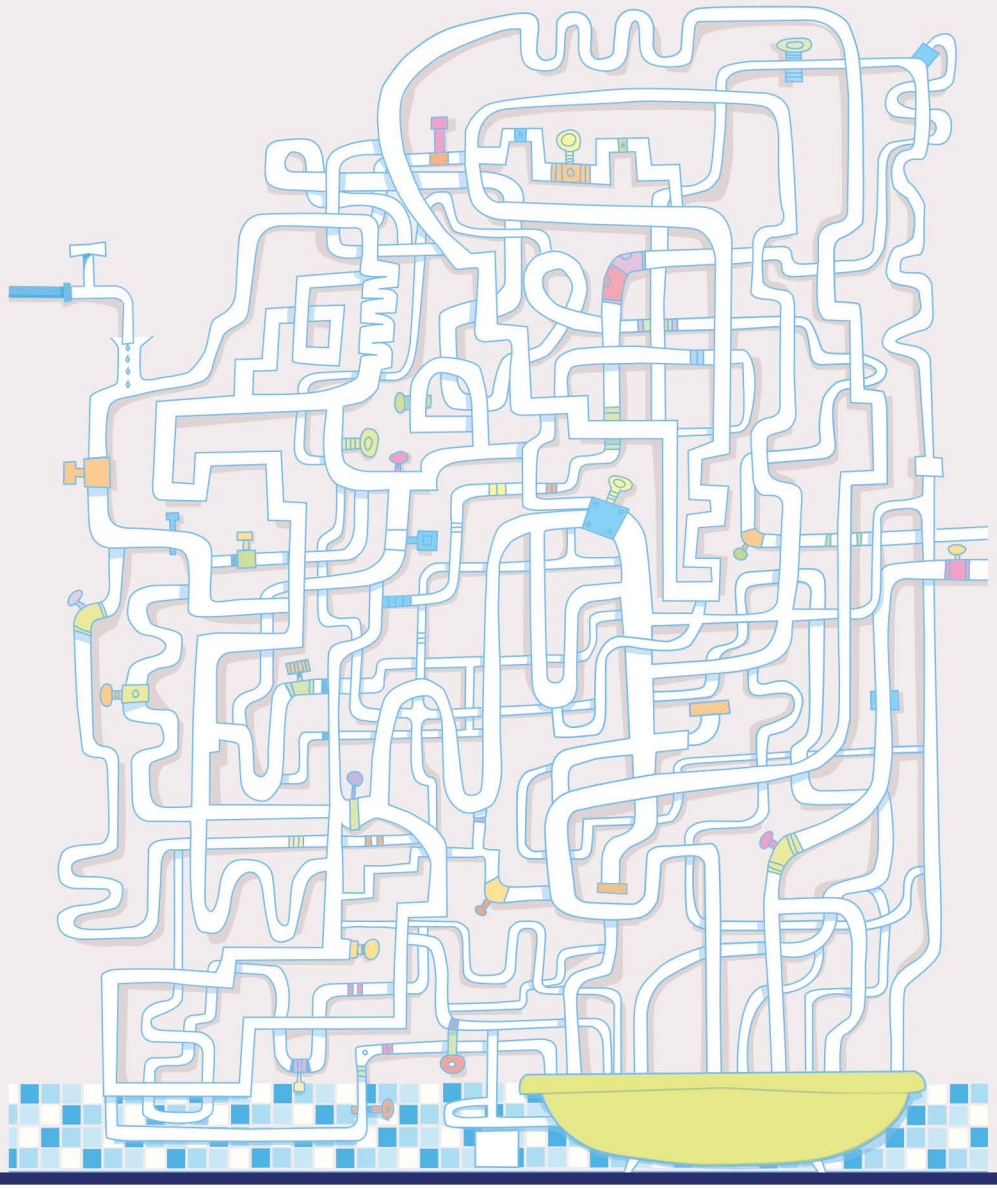
What's going on?

Cubes and pyramids make stable structures. Cubes make strong building blocks if they have reinforced diagonals. Pyramids make good structures because they contain triangles, which are one of the strongest shapes.



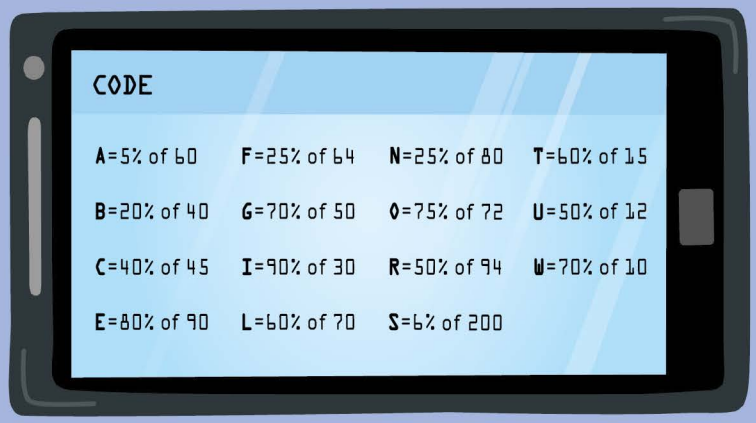
Plumbing puzzle

Which pipe will carry water uninterrupted to the bathtub?
(The water can flow in any direction as long as its path is not blocked.)



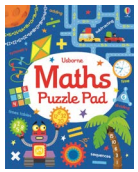
Secret cipher

Agent 003.6 is trying to decode a top secret message from his spymaster. Can you use the **percentages** on the screen below to write the correct letter under each number and help him find out what it says?



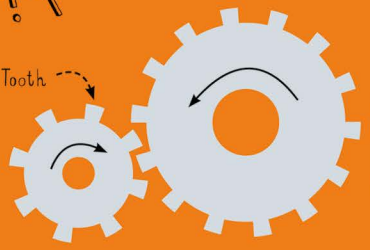
MESSAGE:

3	42	42			
3	35	72	20	9	12
47	72	9	6	47	20
9	54				
8	3	12	72		
16	54	47			
20	72	7			
27	20	12	9	47	6
18	9	27	54	20	12



Cogs in the machine

Cogs are wheels with TEETH around the edge. When these teeth mesh together, cogs can turn each other. Engineers connect parts of machines with them.

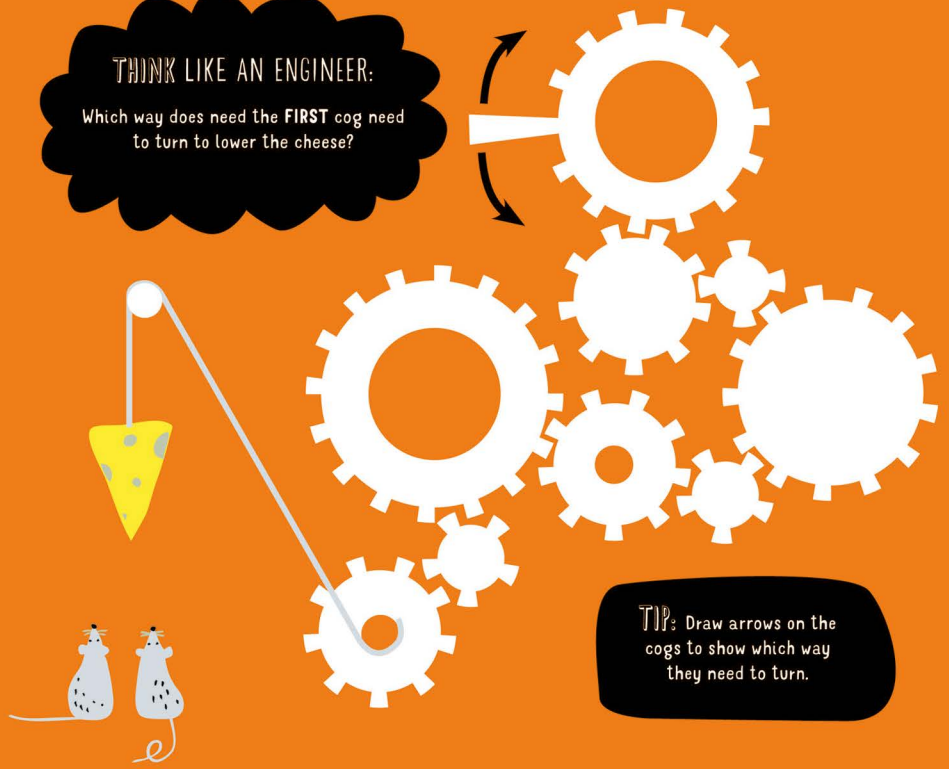


Meshed cogs turn in opposite directions.

The larger the cog, the more teeth it has and the faster a smaller cog will turn to KEEP UP.

THINK LIKE AN ENGINEER:

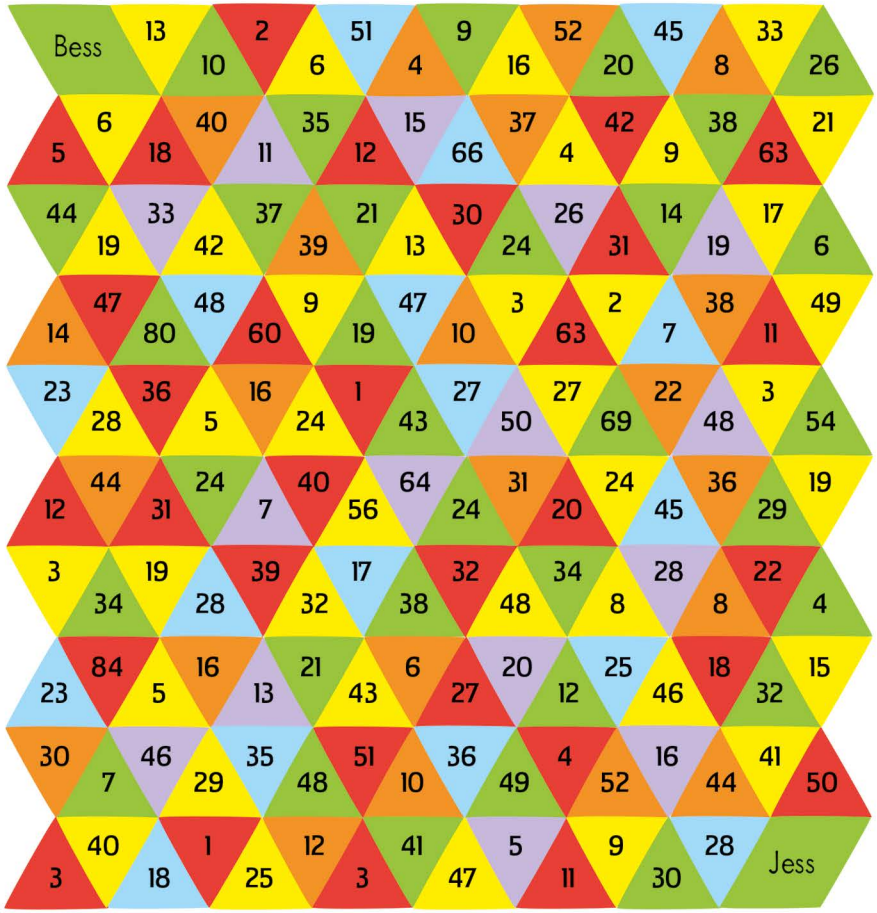
Which way does need the **FIRST** cog need to turn to lower the cheese?



TIP: Draw arrows on the cogs to show which way they need to turn.

Tile-hop

Bess can only step on tiles with numbers that divide by 3. Jess can only step on tiles with numbers that divide by 4. They can move to a tile that touches theirs along one side, but not one that just touches at a corner. Who will cross the floor using the fewest number of tiles?



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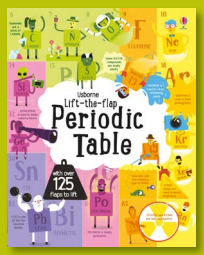
Prepare to be amazed by Usborne's out-of-this-world STEM books on Science, Technology, Engineering and Maths.



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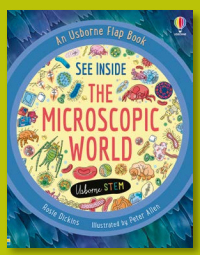

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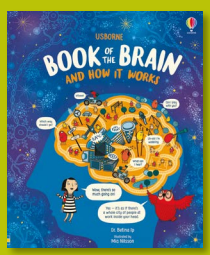

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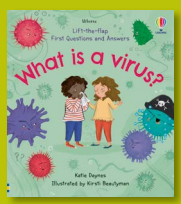

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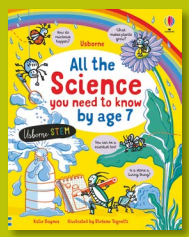

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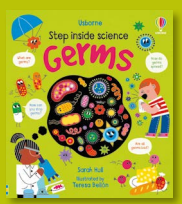

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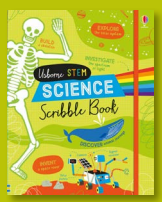

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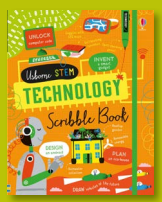

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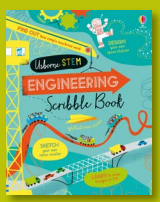

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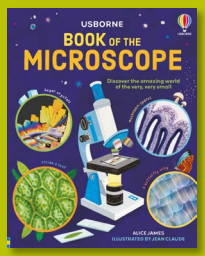

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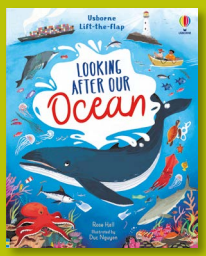

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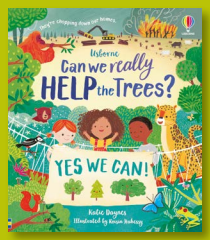

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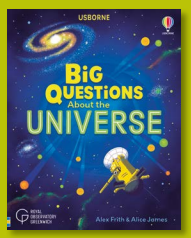

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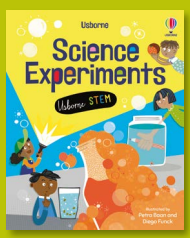

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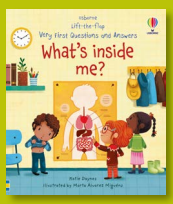

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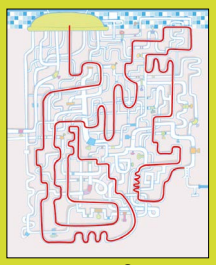
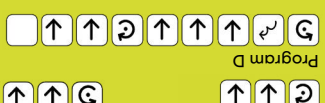
Answers:



Plumbing:



Program D

Program B

Program C

Making a move:
Tile hop: Bess 24 tiles, Jess 22 tiles, Jess won
Cogs in the machine: clockwise
Secret cipher: All agents return to base for new instructions
Train like an astronaut: astronaut, Soyuz, planet
Circuit route: must pass through purple batteries