Look at the Science and Engineering cards.

How many of these Challenges can you complete?

Tweet or Upload to Teams and let us know how you got on.

Good Luck!

CHALLENGE CARDS

40 engineering and science challenges from the engineers at Dyson.

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Please note that the activities contained here in are intended for children ages seven and above. Adult supervision is recommended for all projects.

SCIENCE CHALLENGE 01

CHANGING STATES

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SCIENCE CHALLENGE 01

CHANGING STATES

Designed by Charles,
Design engineer at Dyson

The brief

Make an egg fit into a bottle without breaking it.

The method

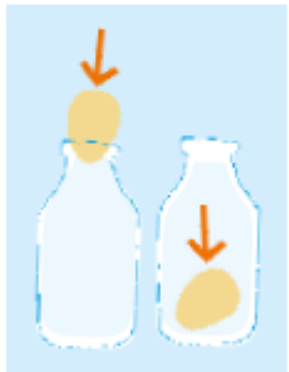
1. Submerge the egg in a glass of vinegar for two days: the shell will become rubbery.
2. Heat the bottle in hot water – remember to use gloves or a tea towel when handling it.
3. Rest the egg on the neck of the bottle.
4. As the air inside the bottle cools down, it will contract and suck the egg down.

Top tip

Try lubricating the egg with cooking oil or washing up liquid.

Materials

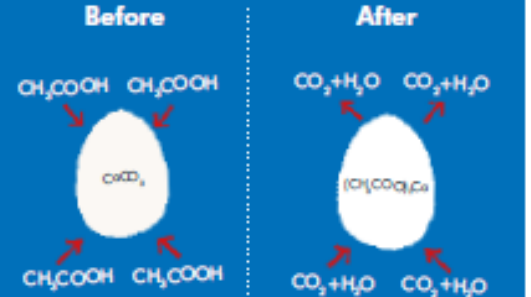
- An uncooked egg
- A pan of boiling water (with adult supervision)
- A glass of vinegar
- A wide-mouthed glass bottle



How does it work?

Eggs are rich in protein. When heat is applied, chemical bonds within the protein molecules are broken, and new bonds are formed between adjacent molecules. This creates a network of inter-connected proteins which causes the egg to go hard.

Vinegar contains acetic acid (CH_3COOH) that dissolves the calcium carbonate ($CaCO_3$) shell but leaves behind the egg's springy membrane.



SCIENCE CHALLENGE 02

UNDERWATER VOLCANO

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SCIENCE CHALLENGE 02

UNDERWATER VOLCANO

Designed by Ian,
Design engineer at Dyson

The brief

Create a colourful underwater volcano.

The method

1. Cut a two foot length of string with a pair of scissors. Tie a knot around the neck of a salt shaker with one end of the string. Double-knot it to ensure the knot is secure. Repeat this process with the other end of the string, resulting in a handle to lower your shaker.
2. Empty and clean a large jar. Fill the clean jar about three quarters full with cold water.
3. Fill the salt shaker with hot water (with adult supervision) – as hot as you can get from your tap – to just below the neck. Add three to four drops of red food colouring.
4. Hold your salt shaker over the mouth of the jar by the string handle. Slowly lower the salt shaker into the jar until the shaker is completely submerged and resting upright on the bottom of the jar. Observe how the coloured water erupts from the shaker into the cold water.

Materials

- String
- Scissors (with adult supervision)
- An empty salt shaker
- A large jar
- Food colouring

How does it work?

This shows how convection currents work. A convection current is the way that heat rises and falls in liquids and gases.

Design icons

Hot air balloons use convection currents. As hot air rises, so too does the balloon.

ENGINEERING CHALLENGE 01

GEODESIC DOMES

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ENGINEERING CHALLENGE 01

GEODESIC DOMES

Designed by Hannah, Design engineer at Dyson

The brief

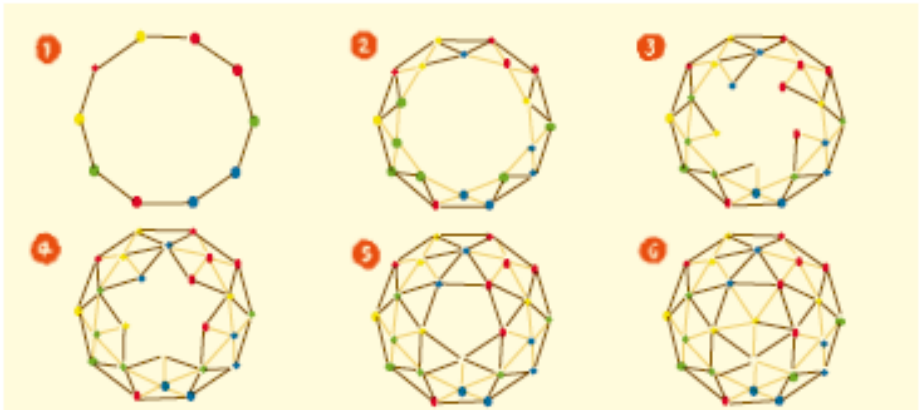
Using jelly sweets and cocktail sticks, make your own geodesic dome.

The method

Follow steps 1 – 6 in the diagram below.
Key for cocktail sticks: —— 60mm —— 54mm

Materials

- Cocktail sticks: 35 at 60mm long and 30 cut down to 54mm long
- Jelly sweets
- Scissors (with adult supervision)



How does it work?

Geodesic domes are extremely rigid. Multiple interlocking triangles form incredibly strong structures.

To deform or buckle a triangle you have to compress or stretch the lengths of the sides, which is hard to do as they support each other.

Design icons

Richard Buckminster Fuller, inventor of the geodesic dome. He was inspired by beehives, fishing nets and other 'networks'.

Today there are more than 300,000 geodesic domes around the world.

ENGINEERING CHALLENGE 02

MARBLE RUN

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ENGINEERING CHALLENGE 02

MARBLE RUN

Designed by Coco,
Design engineer at Dyson

The brief

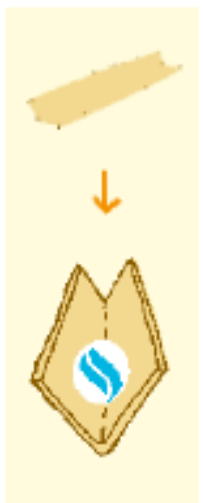
Use a cardboard box and cardboard struts to create a marble run. The marble must run for 60 seconds.

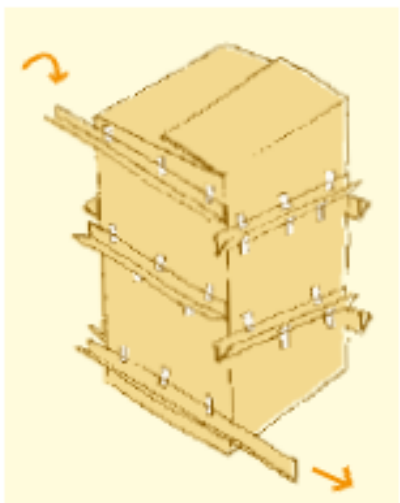
The method

1. Use sticky tape to attach the cardboard struts to the cardboard box, creating a run for the marble.
2. Place the marble at the top of the run and time how long it takes for it to reach the bottom.
3. Keep improving your design until the marble takes exactly 60 seconds to reach the bottom.

Top tip

If you can't find cardboard struts, make your own by folding four inch wide strips of cardboard in half to create a V shape.





Materials

- Large cardboard box
- Cardboard struts
- Sticky tape
- Marbles
- Scissors (with adult supervision)

How does it work?

To help you to control the time your marble takes to run its course you'll need to consider a few factors:

Potential energy = mass x gravity x height

The heavier your marble and higher your slope, the more energy your marble will have.

Friction

The rougher or stickier the surface, the slower your marble will travel.

Angle of the slope

The less steep the angle of the slope, the longer the marble will take to reach the bottom.