

HOW DO YOU USE ENGINEERING TO MAKE STUFF?



Engineering is the use of science and maths to design, plan and build things. A car, a house, a computer – they're all the result of engineering. Circus performers use engineering a lot. They might use it to create an act or make a prop.

The engineering process has several steps:

First **ASK A QUESTION**.

A circus science question might be – How do we make poi (a sort of juggling) buckets hung on string that hold water even when swung upside down?

Next do your **RESEARCH**. Look for information to help answer your question. For the poi act, the answer is that to keep the water in the buckets you have to make them properly and use **CENTRIPETAL FORCE** – a force that seeks the centre. You must swing the bucket fast enough to create the centripetal force to stop the water from escaping.

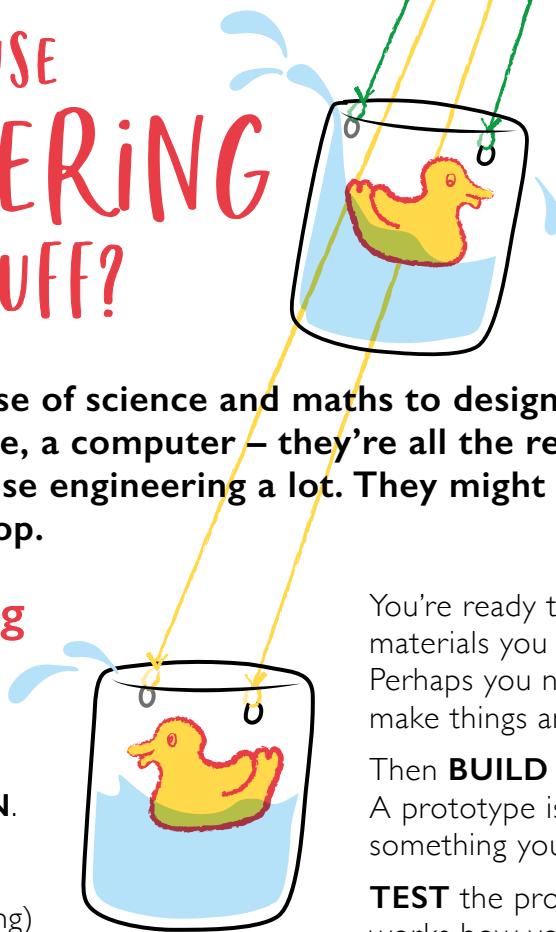
Now comes an important bit – the **DESIGN**. Brainstorm ideas and think about what your prop might look like. Imagine what could go wrong to avoid problems in the future. For example, what would happen if the buckets hit the ground? We need to make sure that doesn't happen. How can we do that?

You're ready to **PLAN**. Work out what materials you need so they're at hand. Perhaps you need people to help you make things and a place to make them?

Then **BUILD** your **PROTOTYPE**.

A prototype is the first version of something you make.

TEST the prototype to make sure it works how you want it to. Don't worry if it needs more tweaks and changes.



Did you know?

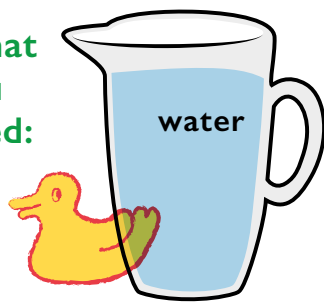
Poi is bit like juggling by swinging heavy weights on strings to make patterns. Poi began with the Maori people in New Zealand who still practise today.

Did you know?

The opposite to **centripetal force** is **centrifugal force**. Centrifugal force pulls away from the centre, while a centripetal force pulls towards it.

HOW TO BUILD YOUR PROTOTYPE POI BUCKET

**What
you
need:**



scissors
or something pointy,
like a screw



**plastic
container**
a large yoghurt
pot will do



string



somewhere it doesn't matter you splash water

- 1 First measure the length of your string. Remember, your container mustn't hit the floor. Put the container on the floor and hold the string in your hand with your arm down by your side. The string should be a bit shorter than twice the length from the top of the container to your hand. You can ask someone else to help measure.
- 2 Make two holes in the container on opposite sides of the top rim. You might want to ask someone to help you with a pair of scissors.
- 3 Thread the string through one hole from the outside in and tie a knot on the inside to stop it coming out. Then do the same with the other end of the string. Now you have a big string handle on your bucket that doesn't quite reach the floor when you hold it in your hand by your side.
- 4 Put some water in your container – around a third full works well.
- 5 Now swing the bucket around and around like a wheel with your arm stretched out. Is the water falling out or staying in? Is the centripetal force at work?

Be careful: If the container swings fast it can knock your head.

Tip: The bottom half of a juice bottle makes a good container, and you're reusing too.

We're not quite finished with engineering!

The next step is to **IMPROVE** what you've done. Maybe you need a longer string? Or a stronger container? Then you go back to the **DESIGN** step and add your improvements.

You can **IMPROVE** your poi buckets with stickers and coloured tape.



Now you have engineered your poi buckets.

HAVE FUN!

KEEP GOING!

You can always go back a stage and make changes and improvements.

You don't have to get it right first time! Trying things out is good.

