

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.

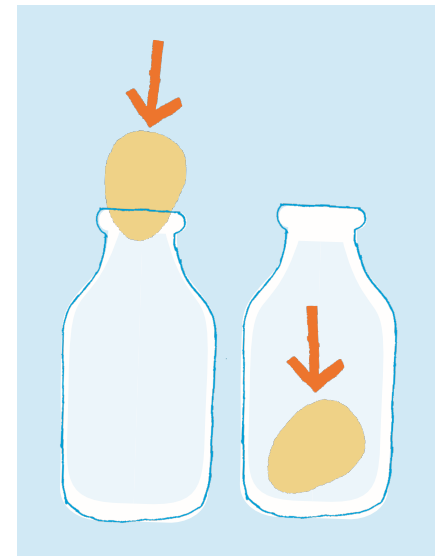
Materials

- An uncooked egg

- A pan of boiling water (with adult supervision)

- A glass of vinegar

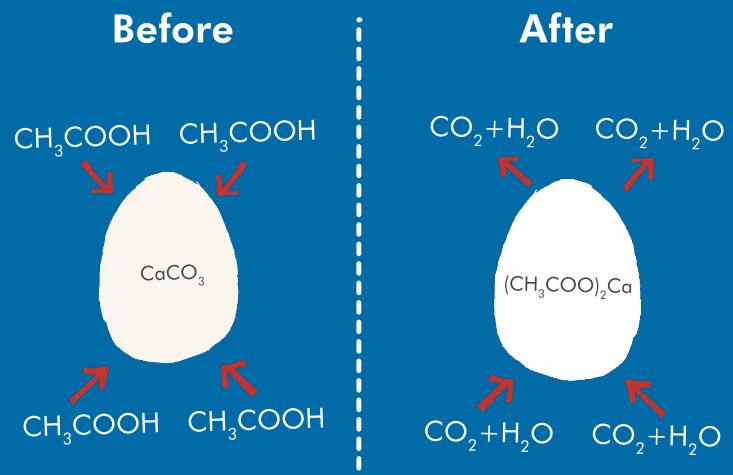
- A wide-mouthed glass bottle



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.



FLOATING PING-PONG BALLS

The brief

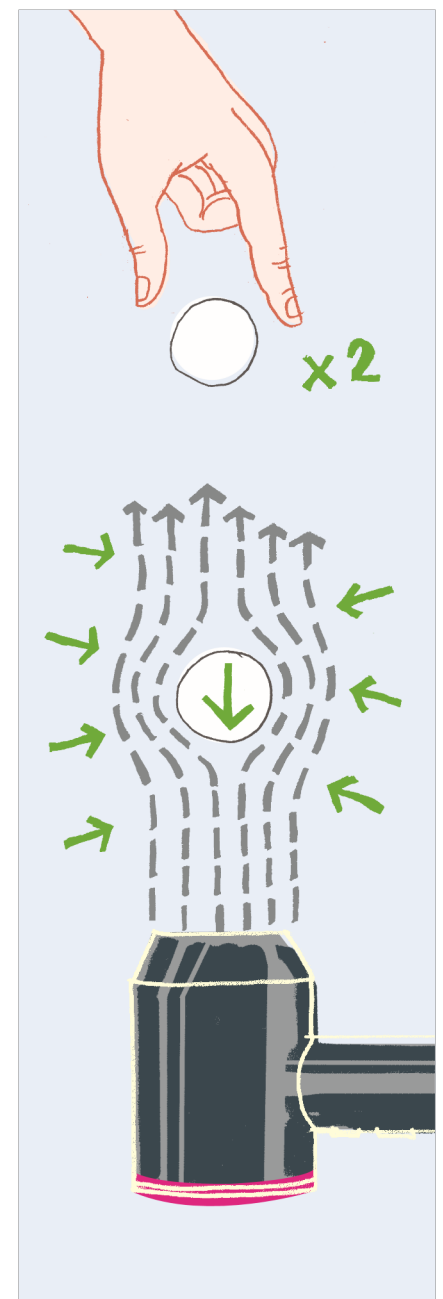
Make two ping-pong balls float in the air flow of a hair dryer at the same time, without hitting each other.

The method

1. Switch on your hairdryer, making sure it is on the cool setting.
2. Hold it with the nozzle pointing upwards.
3. Place one of the ping-pong balls into the stream of air.
4. Try and place another ball into the same stream of air – on top of the first ball.

Materials

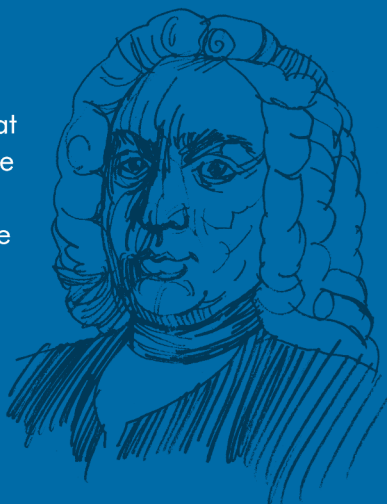
Two ping-pong balls
A hairdryer
(on cool setting)



How does it work?

The hair dryer produces a high velocity stream of air with low pressure. The surrounding air is at a higher pressure which keeps the ball inside the stream. When the upward force of the air equals the weight of the ping-pong ball the ball is said to be in 'equilibrium'.

The theory at work here is Bernoulli's principle. This is an equation linking air pressure, velocity and density with particle weight.



BALLOON KEBABS

SCIENCE
CHALLENGE

04

Designed by Phil,
Design engineer at Dyson

The brief

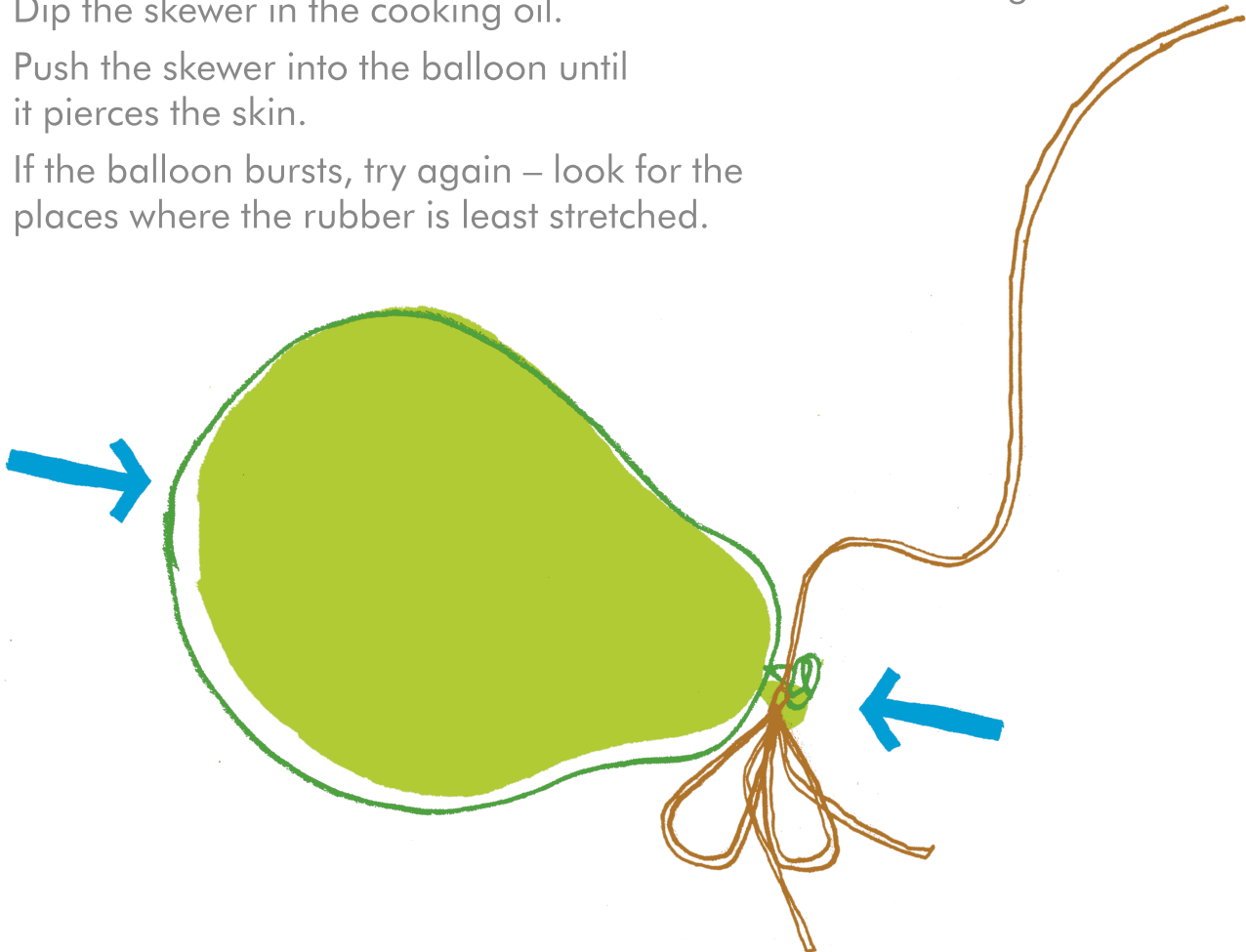
Push a wooden skewer through a balloon without popping it, creating a "balloon kebab".

The method

1. Dip the skewer in the cooking oil.
2. Push the skewer into the balloon until it pierces the skin.
3. If the balloon bursts, try again – look for the places where the rubber is least stretched.

Materials

.....
A balloon inflated
until $\frac{3}{4}$ full
.....
A wooden skewer
.....
Cooking oil



How does it work?

Most of the balloon is stretched evenly, but there are two points where the rubber is least stretched. The tied section and the darker patch at the opposite side of the balloon have the lowest surface tension. Most of the balloon is under high tension, so attempting to push the skewer through just makes the balloon pop. At the low tension sections it is possible to make a small hole without breaking the overall surface of the balloon.