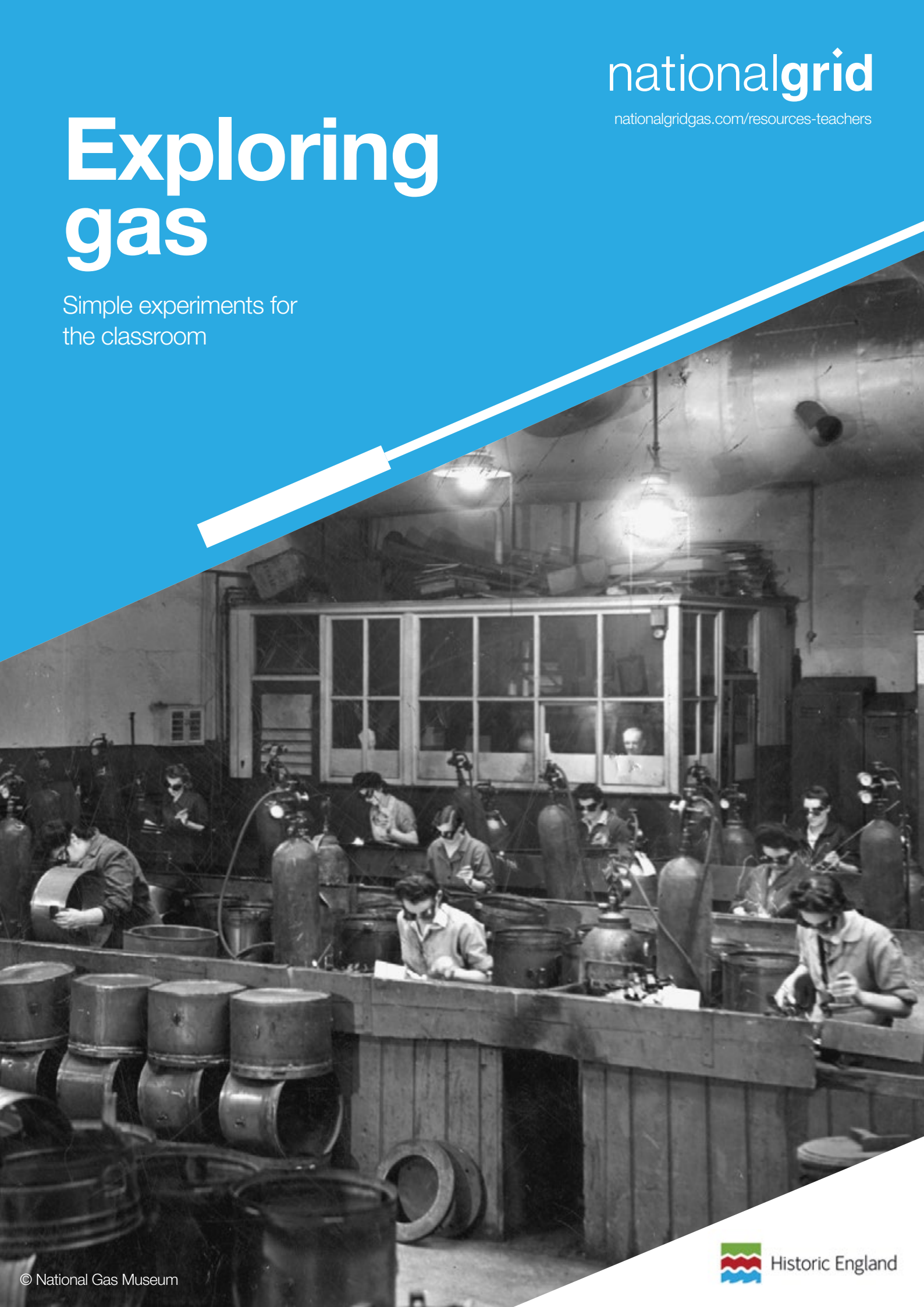
nationalgrid

nationalgridgas.com/resources-teachers

Exploring gas

Simple experiments for the classroom



Historic England

nationalgrid

Using the resource

National Grid owns, manages and operates the national gas transmission network in Great Britain, making gas available when and where it's needed all over the country. This resource is part of our series for schools, highlighting and celebrating how gas has lit our homes and streets and kept us warm for over 200 years.

This resource supports Science at Key Stages 1 and 2 and the development of children's investigation and critical thinking skills. The experiments can be undertaken in small groups or as a whole class, with volunteers demonstrating different elements.

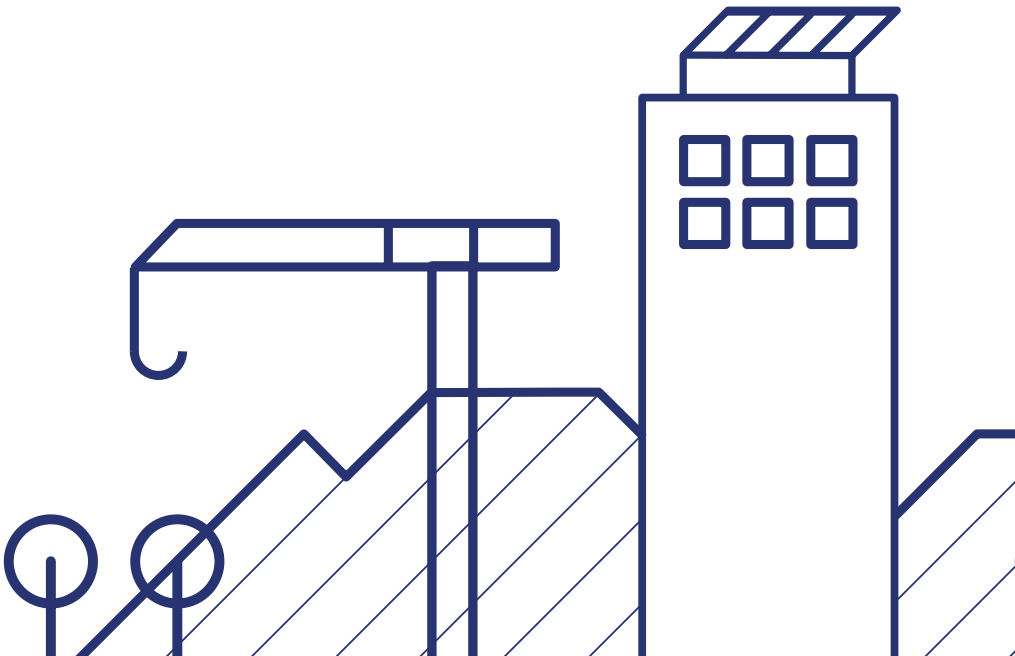
It can be combined with other resources in the series to explore wider topics such as:

- **Energy**
- **Homes**
- **Victorians**
- **Jobs and work**
- **The industrial revolution**
- **Technology**

And used to support cross-curricular work in English, Technology, Science and History.

Further resources in the series

- Gas lighting
- Heating and cooking with gas
- Gas gadgets
- Gas – how was it made?
- The changing role of women
- Transport and vehicles
- Classroom activities
- Your gas heritage: local study



1 Three states of matter

The **'Exploring gas'** Powerpoint can be used to introduce children to the three states of matter (solids, liquids and gases) ending with **slide 16.**

Use the experiments below to explore gas further.

Continue the **Powerpoint** to find out more about gas in our homes and where it comes from.

i. Gas all around us

Resources and equipment

- **Balloons and balloon pump**
- **Bubble mixture and wand**

Get the children to blow bubbles and to use the pump to blow up some balloons.

Tip: pump up and deflate balloons before the session to stretch them and make them easier for the children to inflate.

- **Where is the gas?**
- **What kind of gas is it?**

Our breath – which is mainly a gas called Carbon Dioxide – in the bubbles.

Air – in the balloons – which is mainly made up of gases called Nitrogen and Oxygen.

Talk about how the gas is spreading out but being contained by the bubble or the balloon. Where does the gas go when the bubble pops..?

ii. Fizzy balloons

Resources and equipment

- **2 litre bottle of coke (or fizzy drink)**
- **Balloons and balloon pump**

Show the children a large (2 litre) bottle of coke (or any other fizzy drink).

Ask them which bit is the…

- **Solid** *(The plastic bottle, cap and the paper label are all solids)*
- **Liquid** *(The coke)*
- **Gas** *(The fizzy bubbles – they are bubbles of a gas called Carbon Dioxide)*

Open the top of the coke bottle and attach a deflated balloon to it. Tell the children to keep an eye on it as you carry on with other experiments or activities – the balloon should inflate as the gas escapes from the coke. Keep an eye on the balloon's progress and choose a good point to go back to it – once it has inflated as much as possible. Talk about what's happening.

Tip: prepare the balloon by blowing it up and deflating it before the session so that it has had a chance to stretch and will inflate more easily.

2 How can we make gas?

i. The ghost hand

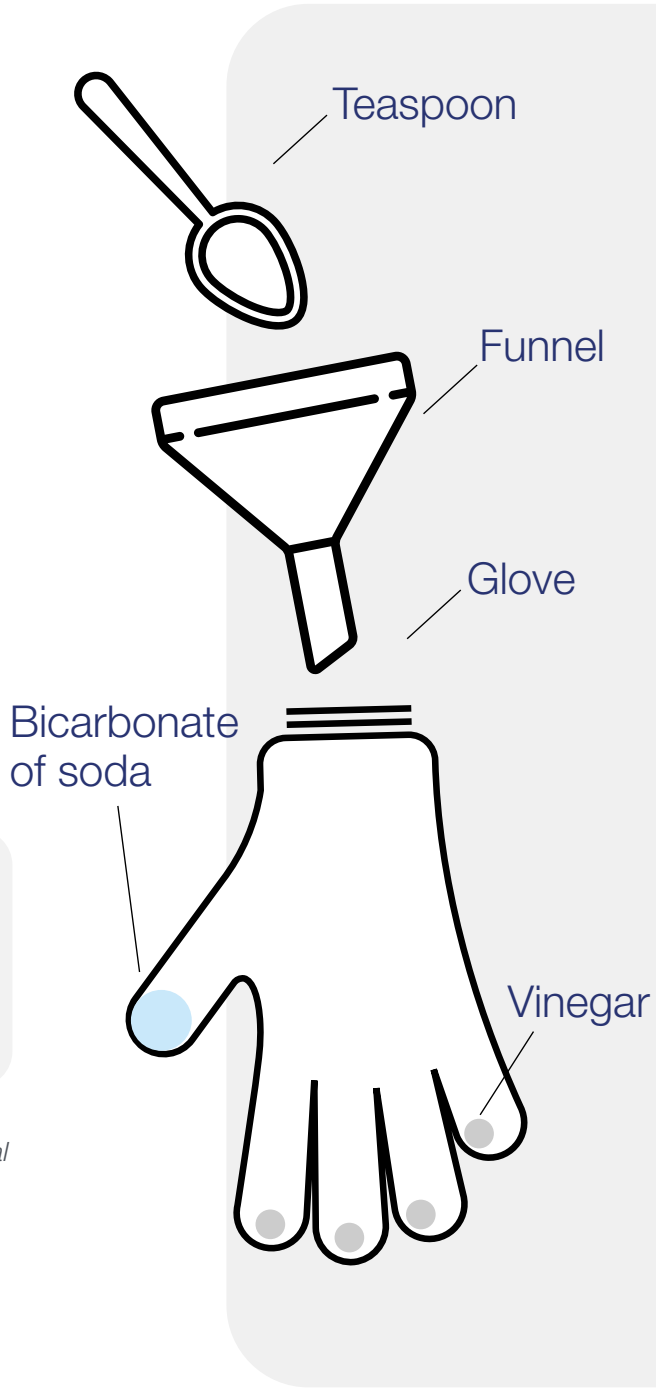
Resources and equipment

- **Disposable, stretchy latex gloves (the type used by doctors rather than for washing up)**
- **Elastic bands**
- **Bicarbonate of soda**
- **Funnel**
- **Vinegar**

Place around two teaspoons of bicarbonate of soda in the thumb of the glove.

Place about half a tablespoon of vinegar in each finger using the funnel.

Close the end of the glove with a couple of elastic bands.



What do the children think will happen when they shake the glove?

Then ask the children to give their glove a good shake. The glove will start to inflate.

What do they think is happening?

When bicarbonate of soda mixes with the vinegar, it makes a chemical reaction which produces a gas called Carbon Dioxide. The gas then spreads out as far as it can go and inflates the glove.

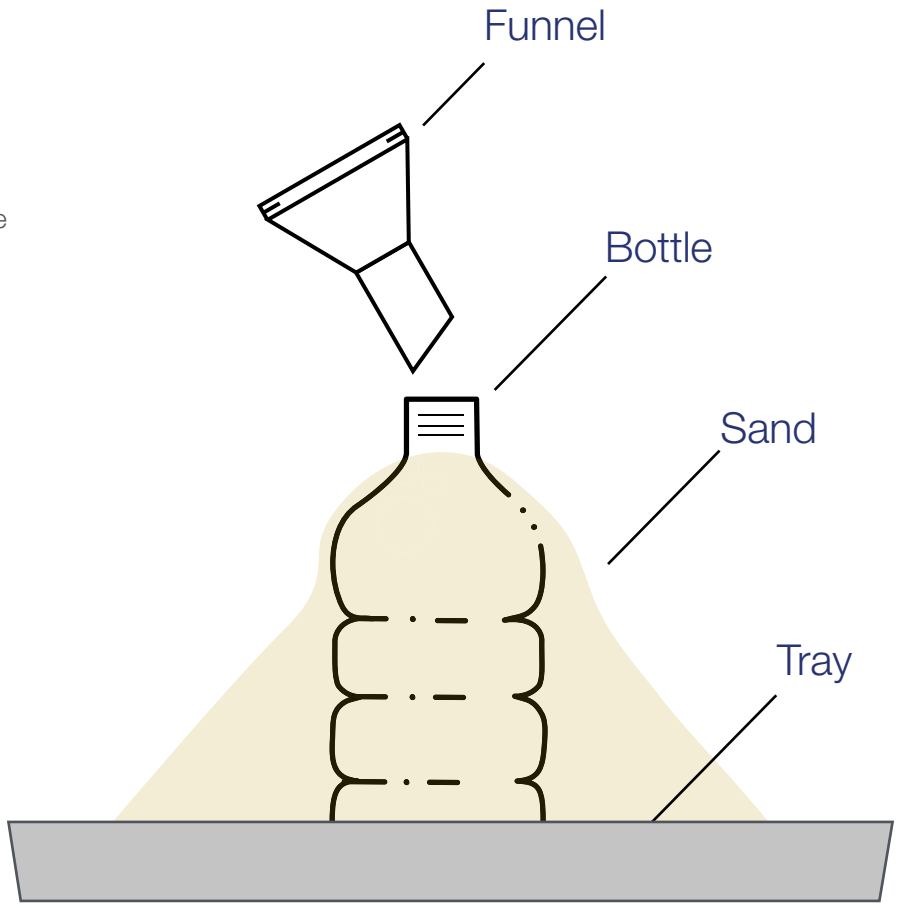
Tip: experiment with the amounts of bicarbonate of soda and vinegar to produce just the right amount of gas to fill the glove.

ii. Volcanoes

Resources and equipment

- **A small, empty plastic drink bottle**
- **1 tablespoon bicarbonate of soda**
- **1 tablespoon washing-up liquid**
- **2 tablespoons water**
- **½ cup (about 8 tablespoons) of vinegar**
- **1 tablespoon red food colouring or washable paint**
- **Funnel**
- **A washing-up bowl (or similar)**
- **Sand or earth**

Place the empty drink bottle in the middle of the tray and surround it with the sand or earth to make a volcano shape. Place some sand/earth around the edges to catch the 'lava' that will be generated in the experiment. Add some red food colouring to the vinegar.



Put the baking powder, soap and water into the top of the volcano (using the funnel).

Ask the children what they think will happen when they pour in the vinegar.

Ask them to explain why they think this will happen – what will be going on inside the volcano (they should be able to use their learning from the 'ghost hand' experiment if they have already done this).

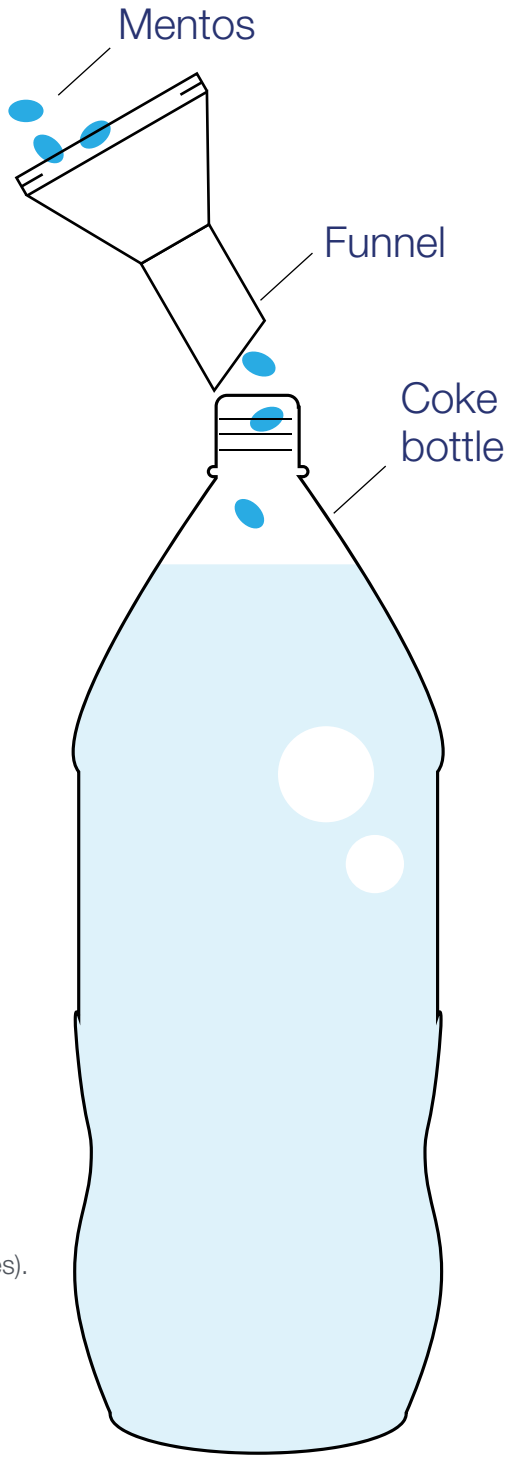
The vinegar will react with the bicarbonate of soda and produce Carbon Dioxide gas. The gas will form bubbles in the mixture – which will be especially big because of the washing-up liquid. Because the whole thing is in a space which is too small for all that gas and mixture, it will escape by 'erupting' over the top of the volcano.

Now ask the children to pour in the vinegar…were they right?

iii. Diet Coke fountain

Resources and equipment

- **2 litre bottle of Diet Coke**
- **Half a packet of Mentos (sweets)**



This experiment is popular on YouTube and may be familiar to the children.

THIS EXPERIMENT MUST BE DONE OUTSIDE

Stand the children in a large circle with the bottle of Diet Coke in the middle – at least 2 metres away from the nearest child. Make sure the bottle is on a flat, steady surface.

Open the lid and place a funnel (this can simply be a carboard tube) in the top so you can drop all the Mentos into the bottle at once.

Drop about half of the packet of mentos into the bottle and **RUN LIKE MAD!**

A huge geyser of Diet Coke should spirt out of the bottle.

Getting the Best Eruption

- You can use any carbonated drink but Diet Coke works best – it's also less sticky than ordinary Coke to clean up!
- Let the bottle of Diet Coke warm up to room temperature.
- Don't open the bottle until the very last minute.
- Drop in all the Mentos at once - place a finger or card over the end of the funnel/tube to hold them in place. When you're ready, open the bottle and let the Mentos all fall at once.
- Use a fresh bottle of Diet Coke (avoid any that are close to their sell-by dates).

Try repeating the experiment with Mentos that have been cut into small pieces. Do the children think the fountain of Diet Coke will be bigger or smaller? *(It's much smaller)*.

What's happening?

There are a few theories about what's happening, but most scientists think it's because of the combination of Carbon Dioxide in the Diet Coke, the little dimples on the surface of the Mentos and the fact that they sink quickly through the liquid.

As we know, when you open a bottle of Coke (or other fizzy drink), the bubbles of gas (Carbon Dioxide) escape. Dropping the Mentos into the Diet Coke speeds up this process by breaking the surface tension of the liquid and allowing bubbles to form on the surface area of the Mentos. Mentos are covered in tiny dimples (like a golf ball), which increases the surface area and allows a huge number of bubbles to form.

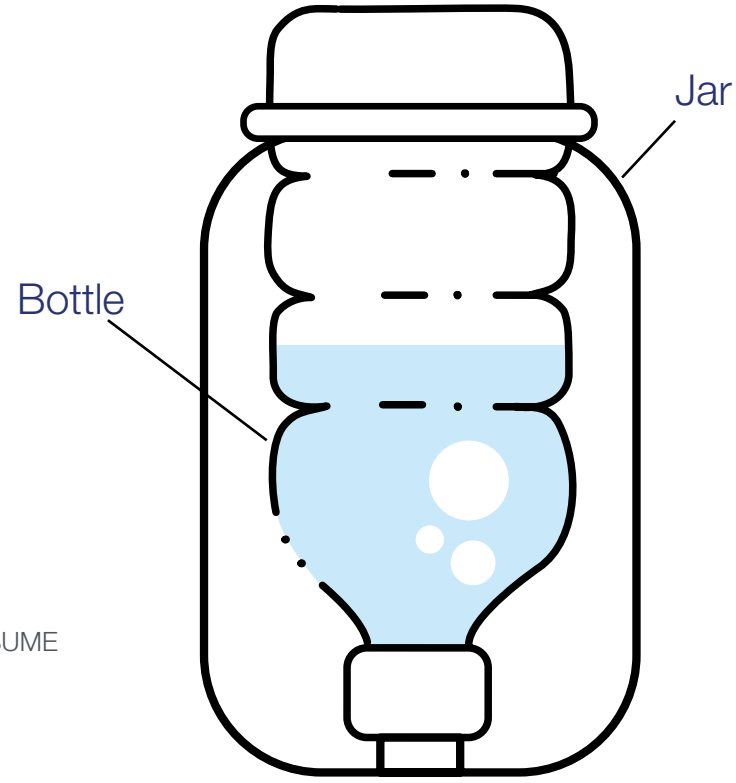
Mentos are quite dense, so they sink rapidly through the liquid, causing a fast, large eruption. The crushed Mentos are not as dense as the whole ones, so they sink more slowly, creating a smaller fountain of liquid.

3 How can we use gas as energy - to make things go?

i. Bottle rockets

Resources and equipment

- **Small drink bottle (500 ml or less) with a sports cap lid which pops open – such as a Fruit Shoots bottle**
- **Fizzy vitamin C tablets**
- **Cup or jar, with a wide enough opening to stand the bottle upside down in so that it touches the bottom**
- **Warm water**



THIS ACTIVITY MUST BE DONE OUTSIDE

REMIND THE CHILDREN THAT THEY MUST NOT CONSUME THE FIZZY VITMIN C TABLETS OR DRINK THE WATER

Half fill the drinks bottle with warm water.

Add two of the fizzy Vitamin C tablets to the bottle.

Make sure the lid is closed, screw it back on to the bottle and give the bottle a shake.

Quickly place the bottle upside down in the cup/jar (make sure the lid is touching the bottom) and stand well back.

The bottle should shoot into the air as the liquid becomes fizzy and is forced out.

IF NOTHING HAPPENS, ALLOW AT LEAST 3 MINUTES BEFORE CHECKING THE BOTTLE ROCKET

What's happening?

The fizzy vitamin C tablets contain bicarbonate of soda and citric acid. When the tablet is dropped in the water, the ingredients react and make the gas Carbon Dioxide (just like mixing the bicarbonate of soda and vinegar in the experiments above). The gas builds up inside the closed bottle as it tries to escape. When the pressure gets too much, it pops the lid, which pushes against the bottom of the cup or jar. The force of the fizzy liquid spurting out of the bottle pushes it upwards.

This is the same principle as a real rocket – gas is forced out of the bottom pushing it upwards.

ii. Gas-powered boats

Materials and resources

- **Small plastic drink bottle (500 ml)**
- **Drinking straw***
- **Large tub of water**
- **Vinegar**
- **Bicarbonate of soda**
- **Scissors**
- **Glue gun or water-proof tape**

*Eco-friendly alternatives to plastic, such as bamboo straws, can now easily be bought online. Paper or card will quickly become soggy and not work in this experiment!

DO NOT TRY THIS EXPERIMENT WITHOUT THE HOLE FOR THE STRAW – THE BOTTLE COULD EXPLODE.

Carefully cut a small hole in the bottom of the bottle, near to one side.

Poke the straw through the hole and seal it up with hot glue or water-proof tape. Make sure there are no leaks.

Hold the bottle as level as possible with the straw at the top. Pour in some vinegar.

Still holding the bottle level, spoon in some bicarbonate of soda, being careful not to let it drop into the vinegar.

Screw the bottle cap back on and tip the bottle to mix the vinegar and bicarbonate of soda.

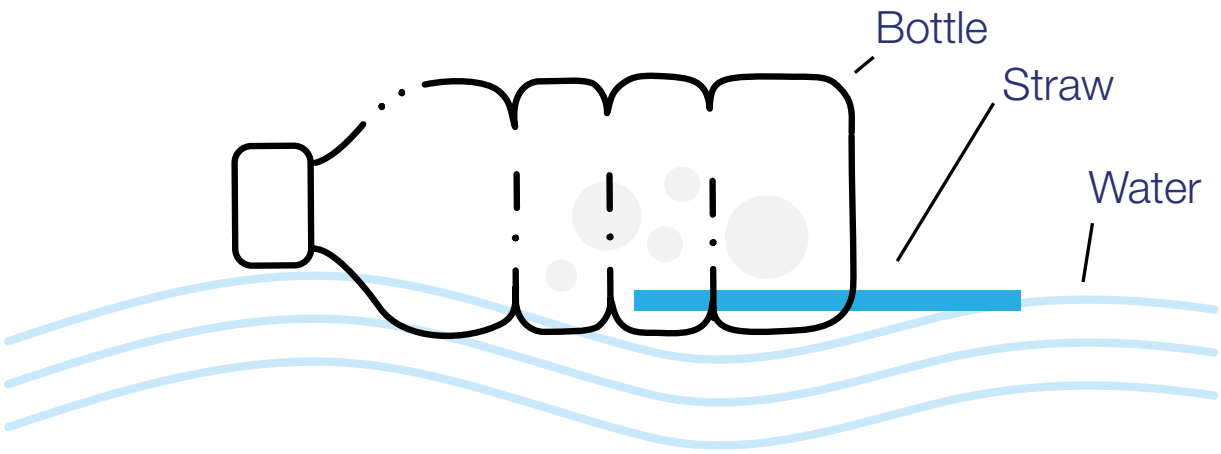
Quickly place it into the tub of water, with the straw under the water.

What happens to the water bottle boat?

What's happening?

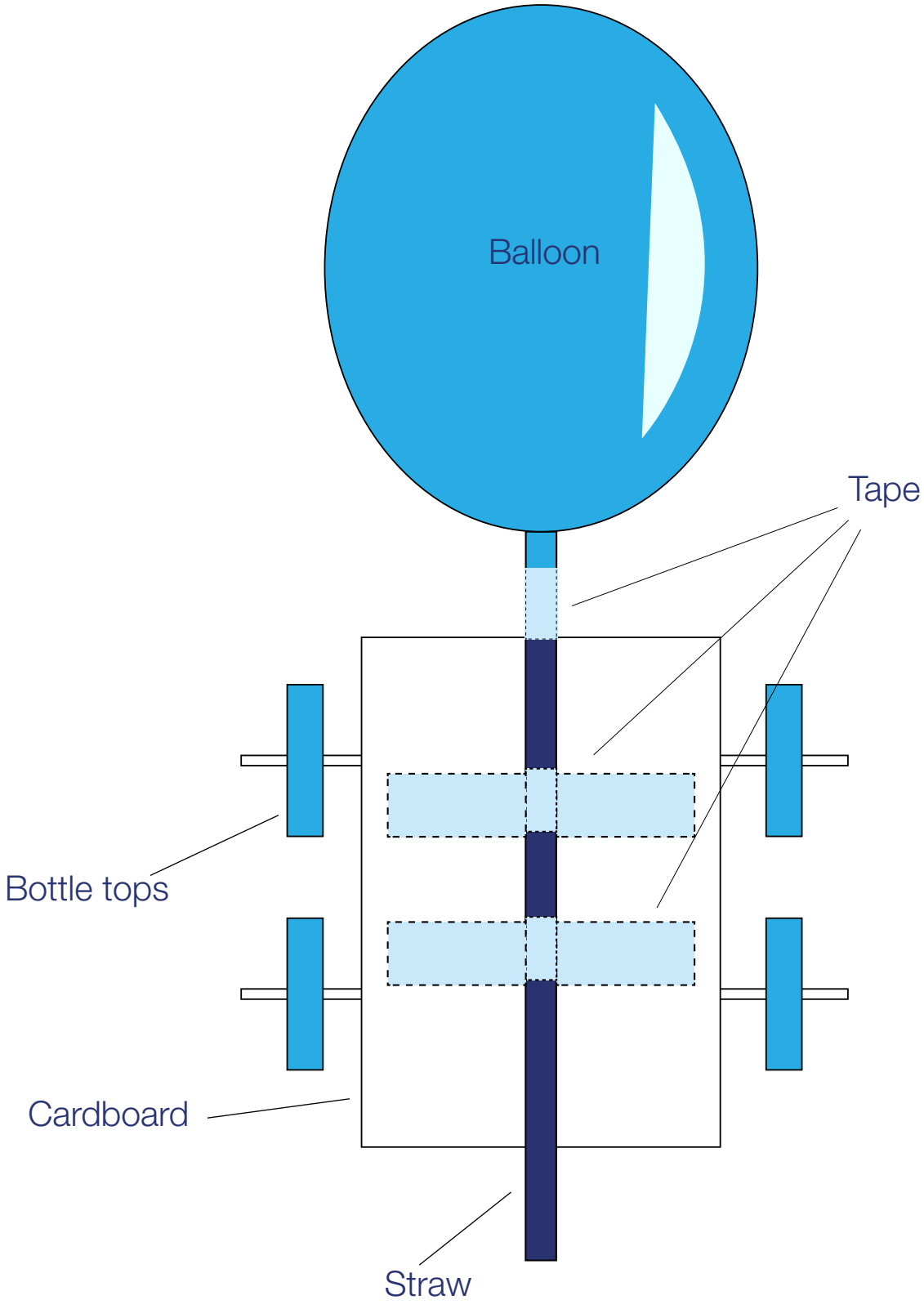
As with the Ghost hand and Volcano experiments, when the two ingredients mix together they make a gas called Carbon Dioxide. The gas builds up pressure inside the bottle as it tries to escape. The only way out is through the straw – because it's a small space, it comes out quickly. The force of the gas escaping propels the 'boat' forward.

This is the same principle used by airplanes. Hot gases are thrown backward out of the engine, propelling the airplane forward.



iii. Gas powered cars

Children can also try using recycled materials to make lightweight ‘cars’ with wheels that turn. Tape a balloon to the top of the ‘car’, blow it up through a straw and watch it go! Who can make their car go fastest/furthest?



iiii. Gas-powered hovercraft

Materials and resources

- **A CD or DVD (which is blank or no longer needed)**
- **A sports bottle top which can be opened and shut**
- **Glue gun or similar strong glue**
- **Balloon**

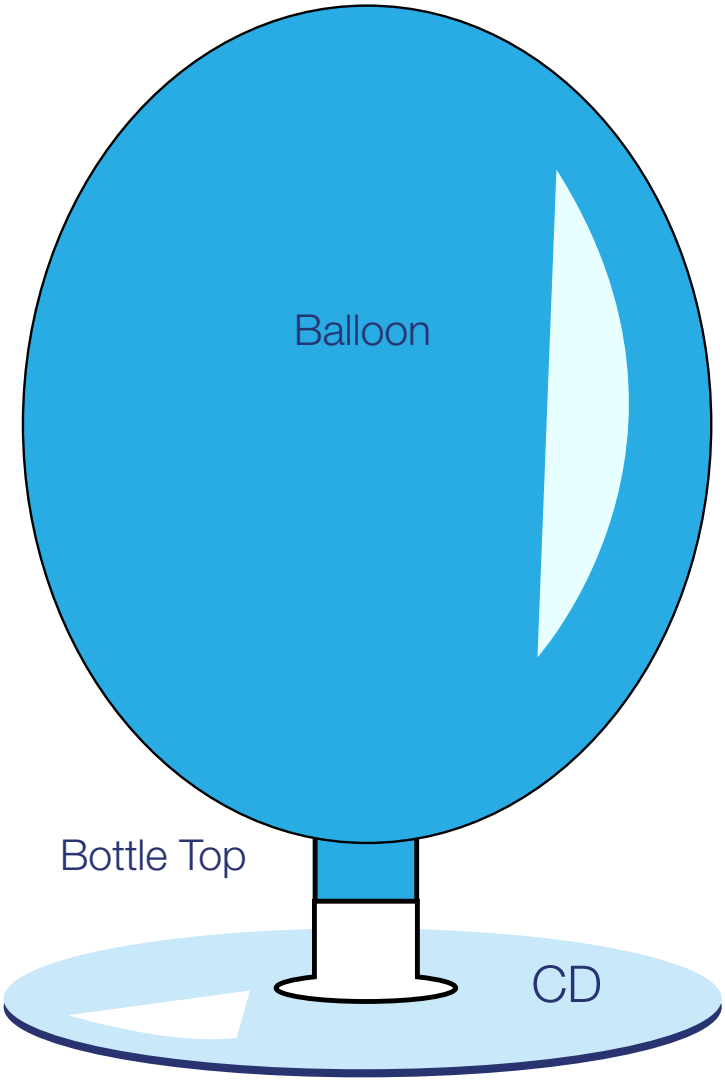
Make the hovercraft: open the bottle cap and glue the mouth of the cap onto the middle of the CD. Make sure there is glue all the way around the edge of the cap to avoid any leaks.

Inflate the balloon by blowing into it through the hole on the other side of the CD. Quickly close the nozzle once you have finished. Blowing up and deflating the balloon before you attach it will stretch the balloon and make it easier to inflate. If you still have trouble inflating the balloon, try taking it off, closing the cap, blowing up the balloon and stretching it over the cap without letting out the air.

Set the hovercraft down on a flat, smooth surface. Open the cap without removing the balloon. As air flows out of the balloon, it'll start to hover. Give it a push and watch it move around.

What's happening?

The gas (air) escapes from the balloon and creates a cushion of air between the CD and the surface, making it hover and reducing the friction so it can easily move around.



4 Gas then and now

Return to the Powerpoint and use the slides to:

- introduce how we use Gas today to cook with and heat our homes
- talk about where it comes from and where it came from in the past.

Find more information, images and ideas for activities at nationalgridgas.com/resources-teachers.