ROALD DAHL'S

GEORGE'S MARVELLOUS EXPERIMENTS

SUPER SCIENCE YOU CAN DO AT HOME!

AKE YOUR OWN
OLCANIC
ERUPTION

orge hates Grandma so much that he wants to do something out her. Something **whopping**, a sort of **explosion** . . . and here's how you can make your own **giant eruption**!

WHAT YOU'LL NEED:

- A small plastic bottle
- Brown modelling clay
- A mixing bowl
- White vinegar
- Red food colouring
- Washing-up liquid
- Bicarbonate of soda
- Kitchen roll or toilet tissue
- Elastic bands

This one can get **very messy very quickly**, so either do it **outside** or build your volcano on a baking tray or large dish.

WHAT TO DO:

1

Take the lid off an **empty plastic bottle** and stand it on a flat, **level surface**. Use the **modelling clay** to **cover the bottle**. Try to make it look volcano-shaped, and don't forget to leave an **opening at the top** so the lava can erupt out of it.

2

In a bowl, **mix together** half a bottle of **vinegar** with some **red food colouring**. Add a squirt of **washing-up liquid** and stir.

3

Carefully pour the vinegar mixture into the bottle through the hole at the top of the volcano.

4

Wrap two or three heaped tablespoons of bicarbonate of soda in a sheet of **kitchen roll** or tissue.

Tie the package together with **elastic bands** so the powder can't leak out.

5

Drop the package into the volcano – then **stand back**. Marvel at the **spluttering**, **fizzing** 'lava' as it fizzes and splutters through the hole at the top, just like **a real volcano** (only not as hot).

WHAT IF?

Try cutting the top off the bottle to make a **wider hole**. **How does this affect the eruption?**

What happens if you **leave out** the washing-up liquid?

WHAT'S HAPPENING HERE:

Bicarbonate of soda is another name for the chemical sodium bicarbonate. This is an **alkaline** that, when mixed with the **acetic acid** in the vinegar, creates carbon dioxide gas – just like in our **Foaming Fizzy Potion** experiment (see pages 6–7). Although it's a 'greenhouse gas', carbon dioxide is otherwise completely harmless and is used to put the fizz in soft drinks.

MAKE YOUR OWN PUTTY FARM

WHAT YOU'LL NEED:

- A mixing bowl
- Flour
- Five eggs
- White craft glue
- Water (cold is fine)
- Your choice of food colouring

There are lots of methods for making **squidgy silly putty** that you can shape and mould, but most involve **weird chemicals** that are better used for **unblocking drains** or feeding to **miserable old grandmas** (but not your grandma!). This version is completely cleaning-product free and you can make your putty farm animals as **GIANT** or tiny as you want, just like George did.

WHAT TO DO:

1

Put **two cups** of **flour** in a big mixing bowl.

2

Crack in the eggs and **mix them** all together. Try not to think about cakes. Once the mixture is **smooth**, **stir** in **three quarters of a cup** of the glue, a little bit at a time.

3

Mix, mix, mix. Mix a bit more, **slowly** adding a few tablespoons of water until the mixture turns **putty-like**.

4

Add some **drops** of your chosen **food colouring** and mix it in. Use your hands to really **squish** the colour in there.

WHAT'S HAPPENING HERE:

With the **flour**, **eggs** and **water**, you're actually making a basic **dough**. The **glue** acts as a **binding agent**, which holds the mixture together, creating a malleable putty that can be **stretched**, **shaped**, **squashed** and **bounced**.

WHAT IF?

What happens if you use **half** as much **glue**?

What if you use **twice as much**?

FOAMING FIZZY POTION

When George made his marvellous medicine, it **frothed** and **fizzed** and **foamed** as if it were alive! Now you can re-create that same effect for yourself and concoct something that looks like a **weird magic potion**.

WHAT YOU'LL NEED:

- Bicarbonate of soda
- A plastic cup or mug
- Washing-up liquid
- Food colouring (optional)
- Lemon juice

WHAT TO DO:

1

Put a **teaspoon** of the **bicarbonate of soda** into the cup. Any cup will do, but tall, narrow ones work best.

2

Add a **squirt** of washing-up liquid.

3

Stir to mix together. If it's tricky to stir with a spoon, try using a long drinking straw.

If you want your magic potion to be **colourful** (and who wouldn't?), add some **food colouring**. Not too much – a couple of drops will do.

4

Squeeze or **pour** in a small amount of **lemon juice**. **Continue stirring while you pour.** As you stir, **bubbles** will form and start to fill the cup!

5

Add more **lemon juice** and **bicarbonate of soda** until the **frothy mixture** bubbles up over the top!

WHAT IF?

Try using another citrus fruit juice like **lime** or **orange**. Do they have the same effect?

What happens if you use a **large bowl** instead of a cup?

WHAT'S HAPPENING HERE:

The **bicarbonate of soda**, when mixed with the **lemon juice**, is forming **carbon dioxide gas**. As this fizzes up in the washing-up liquid, it creates lots of soapy bubbles – see, **science IS magic**!

OOEY, GUNGY LOOP

WHAT YOU'LL NEED:

- Boiling water (get a grown-up to help with this!)
- A large mug
- Gelatin
- Green food colouring
- Corn syrup (or golden syrup)

Grandma is a real **old hag**. She's **filthy** and **disgusting**! Now you can make something really unpleasant, just like her!

WHAT TO DO:

1

Very carefully, pour **boiling water** into the mug until it is about **half full**.

Add **three teaspoons** of **gelatin** to the mug.

2

Wait **twenty** to **thirty seconds**. Perhaps use this time to fondly remember the **biggest bit of gungy gloop** you've ever seen.

3

Using a **fork**, give the mixture a **stir**. Add one or two drops of the **food colouring**.

4

Add **syrup** until the mug is roughly **two thirds full**, then give it another **stir**.

5

Slowly add cold water until you achieve that **perfect gooey consistency**.

WHAT IF?

What if you use **powdered jelly mixture** instead of gelatin?

How about if you **replace the syrup** with some **sugar** in boiling water?

WHAT'S HAPPENING HERE:

The snot produced inside your head is a mixture of **protein** and **sugar**, which is more or less what you've just mixed in your mug. The long, **stringy bits** are **protein strands**, and they're what give both the real and fake stuff its **amazing stretchiness**!

OOGIE LOOP

na's voice isn't soft and lovely – **hrill** and **shouty**! Here's how can make your own **glorious op** and see **invisible sound s** in action. It's **messy**, it's **fun s two experiments in one**!

HAT YOU'LL NEED:

- A mixing bowl
- Cornflour
- Water
- A subwoofer music speaker
- A thin metal baking tray
- Food colouring (optional)

WHAT TO DO:

1

Mix two cups of cornflour with **half a cup** of water. Add more water until your gloop is thick and . . . well, **gloopy**. Add some spots of **food colouring** if you like.

2

Lay the music speaker on its back and place the metal tray **over the part where the sound comes out**.

3

Pour your gloop on to the tray.

4

Press lightly on one corner of the tray to hold it steady.

Play music through the speaker – **the louder, the better.**

5

Your gloop should start to **jiggle** and **dance** on the tray. If it doesn't, try a different song, change the volume or adjust the pressure you're putting on the tray.

WHAT IF?

What makes the gloop dance more – **low frequencies** or **high frequencies**?

Try changing the mixture. Does **thicker gloop** dance better than **thinner**?

WHAT'S HAPPENING HERE:

When at rest, the cornflour and water mixture is mostly liquid. **When agitated**, though, it becomes more firm and almost solid. As the sound waves pass through the gloop, the **vibrations alter the consistency**, turning it from **solid to liquid** and back again, and making it jiggle and wiggle around on the tray.

UICKER THAN UICKSAND

WHAT YOU'LL NEED:
- Cornflour
- Water
- A plastic tub or jar

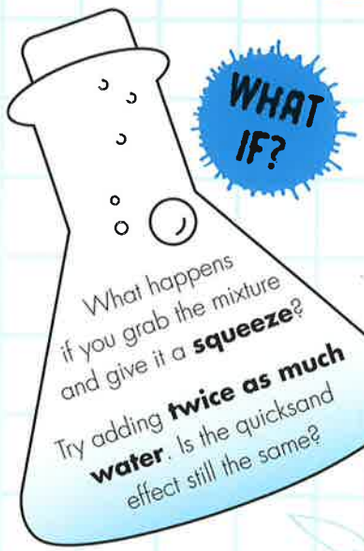
When Grandma drinks her **marvellous medicine**, she grows quicker than you'd ever believe – one te she's in her chair, the next she's **through the roof**! Quicksand an be pretty **magical stuff**, too. Is it a **liquid**? Is it a **solid**? Is it both? Let's make some and find out.

HAT TO DO:

ur one good-sized p of **cornflour** into ur container.

2

Add **half** as much **water**. **Mix it up.**



WHAT IF?

What happens if you grab the mixture and give it a **squeeze**?

Try adding **twice as much water**. Is the quicksand effect still the same?

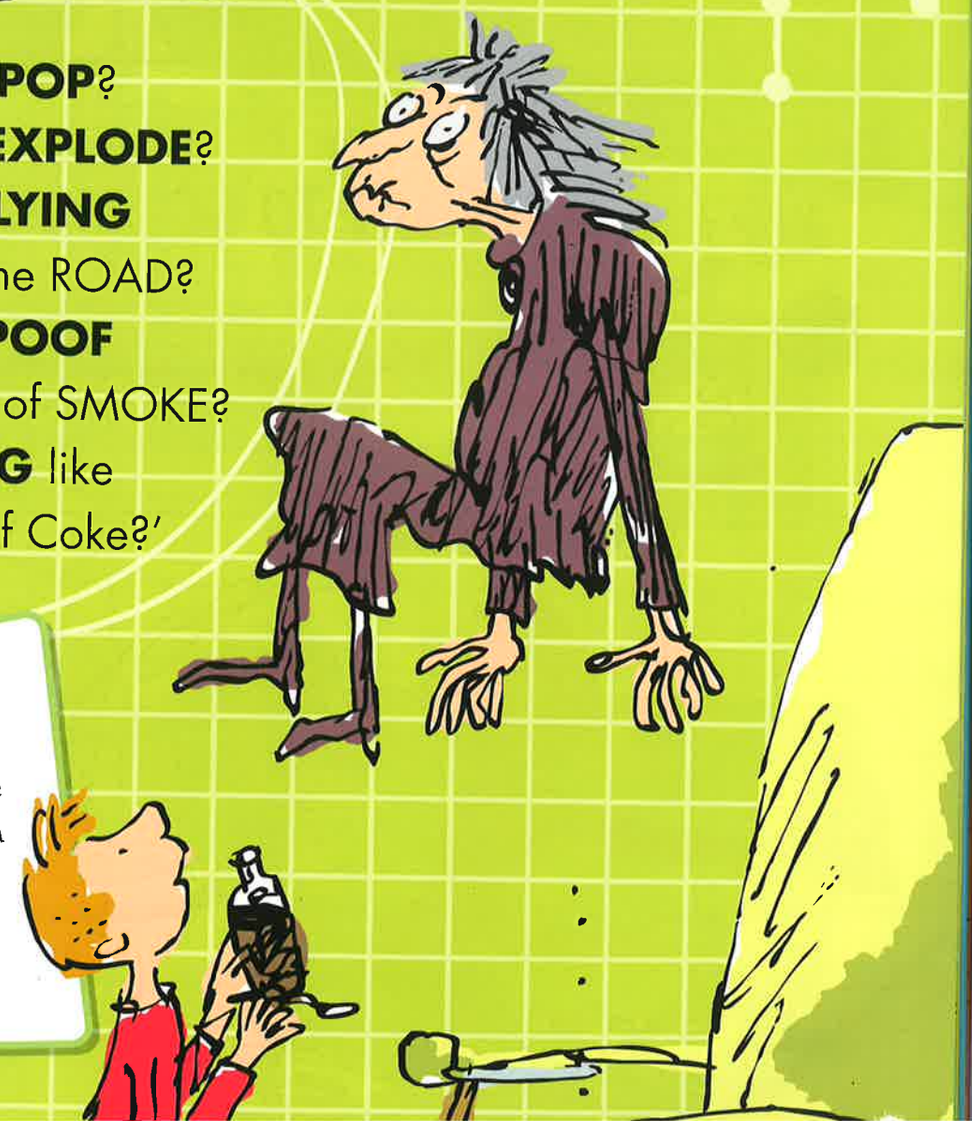
T'S NING RE:

This **quicksand** is similar to the **dancing gloop** on pages 10–11. If you **stir the mixture slowly**, it stays liquid-like. This is because the water is able to flow between the cornflour grains fairly easily. **Stir it quickly**, though, and the grains have no room to move, so they get **stuck together**, turning the mixture k, clumpy and almost solid. Try jabbing a pencil into it to see your cksand **instantly harden** in that one spot. If you want to **really** ress people, you can tell them that this is an example of a **non-wtonian fluid**, which defies the laws of (Newtonian) physics.

CHAPTER TWO EXCELLENT ERUPTIONS

'Will she go **POP**?
Will she **EXPLODE**?
Will she go **FLYING**
down the ROAD?
Will she go **POOF**
in a **PUFF** of SMOKE?
Start **FIZZING** like
a can of Coke?'

George has no way of knowing quite how explosive his medicine will be – but Grandma soon finds out, with very exciting consequences!



BAG-GO-BOOM!

WHAT YOU'LL NEED:
- Bicarbonate of soda
- Kitchen roll or toilet tissue
- White vinegar
- A ziplock sandwich bag
- Warm water

Grandma suspects George is up to **mischief** when she hears **noises** from the kitchen – but she could never guess how much mischief he's brewing! **Have a blast** (literally) by trying this completely safe – but brilliantly noisy – **explosive experiment**.

Things will get **messy** with this one, so it's best to do it **outside**, and to **wear old clothes**.

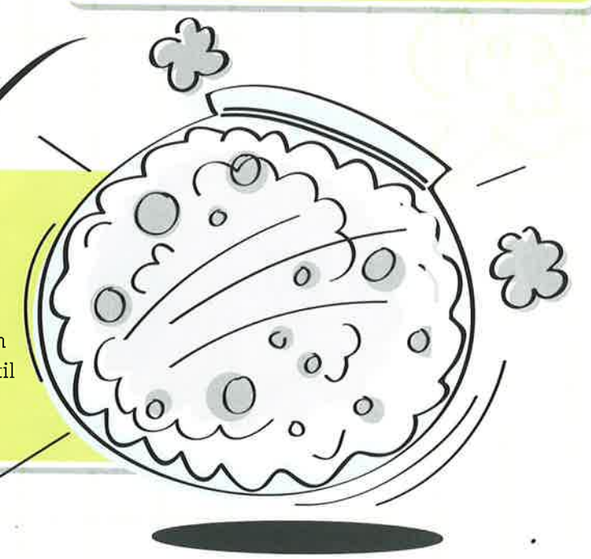
WHAT TO DO:

1 Place a **tablespoon** of **bicarbonate of soda** on a sheet of kitchen roll (or a couple of sheets of toilet tissue) and **twist it into a packet**.

2 Pour **half a cup of vinegar** into the **bag**.

3 Add around **half as much warm water as you did vinegar**. Zip up the bag, leaving **just enough room** for you to squeeze your **packet of bicarbonate of soda** in through the gap.

4 This is where it gets a bit tricky. **Push** the packet into the bag, but **squeeze the bag** so the bicarbonate of soda **doesn't drop into the liquid**. Zip the bag the rest of the way up, making sure there are **no gaps**.



5 Give the bag a **quick shake** so the kitchen roll or toilet tissue gets wet.

Drop and retreat – then watch the bag expand until it goes **POP!**

WHAT IF?

What if you don't put **water** into the **vinegar mixture**?

What if you put your **bag inside another bag**, which also contains a vinegar mixture, **before** letting the bicarbonate of soda fall in?

WHAT'S HAPPENING HERE:

This is **carbon dioxide** at work again. In previous experiments, the gas was able to escape freely into the air. In this experiment we've **trapped it**; so, when the reaction between the **sodium bicarbonate** and the **acetic acid** takes place, the gas rapidly fills the bag until there's no more space inside.

FLYING FILM CANISTER

Just a spoonful of **George's concoction** sends one of his dad's **chickens** straight up into the air like a **rocket**! This is one of the simplest rocket-type experiments, but the results are pretty **spectacular** (with no chickens required!).

WHAT YOU'LL NEED:

- Safety goggles
- An Alka-Seltzer or similar fizzing antacid tablet
- An empty 35mm plastic film canister with lid (find them in camera shops)
- A glass of water

Always do this one **outside** where you have **plenty of space** for your rocket to fly.

WHAT TO DO:

1

Put on your **safety goggles**. You really don't want the flying film canister to hit you in the eye.

Break the **antacid tablet** in two.

2

Take the **lid off** the film canister and tip in a **teaspoonful of water**. From here on, everything is going to happen very fast, so make sure any **spectators** are standing **two to three metres away**.

3

Drop in **half a tablet** and **VERY QUICKLY** replace the canister lid. You should hear a snapping sound to let you know it's secure.

WHAT'S HAPPENING HERE:

When the **antacid tablet** mixes with the **water**, it begins to create **carbon dioxide gas**. As the reaction continues, more and more of the gas is created, building **pressure** inside the canister. Eventually, the pressure becomes **too great** and the **lid is forced off**. Because the lid is against the ground and has nowhere to go, the rest of the canister **launches into the air**.

4

Place the canister on the ground **upside-down**, so the lid is at the bottom. **Quickly stand back.**

5

Five to fifteen seconds later, the canister will **blast off** into the air, leaving the lid behind. If it doesn't go off, **wait at least a minute to check it**, then try the experiment again. Chances are the lid wasn't on tightly enough.

WHAT IF?

What happens if you use a **whole tablet** or change the **amount of water**?

What if you **don't turn** the canister upside-down when placing it on the ground?

ECTACULAR SONIC BLASTER

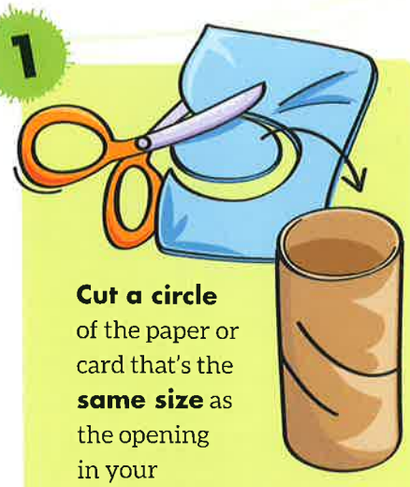
AT YOU'LL NEED:

- cardboard tube (the tube rom a toilet roll is ideal)
- tiff paper or card
- cissors
- A sharp pencil
- Sticky tape
- Thin plastic (try cutting up a sandwich bag)
- An elastic band
- Some fluff (or other light object)

Sound waves are onstantly **whizzing** ough the air, just like chicken after a dose **Grandma's medicine**! wever, we can't hear em until they bump o our **eardrums** and ake them **vibrate**. A enough **sound wave** even **move objects**, this experiment will demonstrate.

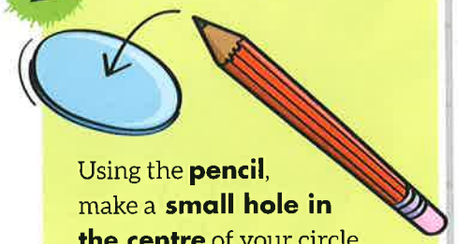
WHAT TO DO:

1



Cut a circle of the paper or card that's the **same size** as the opening in your **cardboard tube**. The easiest way to do this is to draw round the tube first.

2



Using the **pencil**, make a **small hole in the centre** of your circle of paper or card.

3 **Tape** the circle to one end of the **tube**, being careful **not to cover** the hole you made. Make sure there are **no gaps** around the join (use more tape, if necessary).

4

Cut a piece of **thin plastic** and place it over the **other end of the tube**. Use the **elastic band** to fix it in place. Make sure the plastic is stretched nice and **tightly**.

5 Aim the **end of the tube with the hole** in it at the **fluff**. **Tap** the plastic and watch the fluff move. The harder you tap it, the further your **fluff will fly**!

WHAT IF?

What happens if you try moving a **heavier object**?

Does a **longer tube** make the sound blaster **more** or **less powerful**?

WHAT'S HAPPENING HERE:

When your **fingers drum** on the tightly stretched plastic, it **generates sound**. The **sound rushes down the tube** and, as it has nowhere else to go, it gets **compressed** through the **small hole**. Being compressed makes the **sound wave powerful** enough to move objects in its path.

MARVELLOUSLY MINTY GEYSER

WHAT YOU'LL NEED:
- A large bottle of diet cola
- Thin card or stiff paper
- A packet of Mentos mints
- Quick reflexes!

George can't be sure what will happen when Grandma **drinks the mixture**, but anything is possible! Will she go **flying** down the road? Will she go **poof** in a **puff of smoke**? Start **fizzing** like a can of Coke? This is one experiment that calls for cola – and lots of space outside! You may want to put on your **waterproofs** and have an **umbrella** on standby before you attempt this **enormously explosive experiment**.

Do not, under any circumstances, try this one **indoors**, or **the room will never be the same again**.

WHAT TO DO:

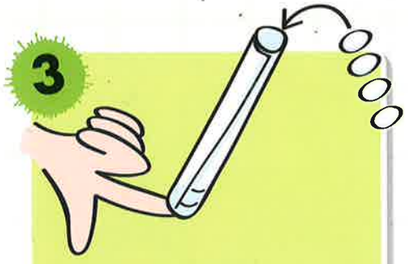
1

Place your bottle **upright** in an **outside space**, with **plenty of room on all sides (especially above)**.

2

Roll the cardboard into a **tight tube**. It should be **wide enough** to hold the Mentos mints and **narrow enough** to fit inside the neck of the bottle.

3



Remove the mints from their packet and line them up in the tube, **keeping your finger over the hole** at the bottom to stop them from falling out.

4

Place the **end** of the tube **over** the **top** of the bottle.

Remove your finger, allowing all the mints to fall into the bottle. **Run for cover** as the diet cola shoots high into the air, then rains down on top of you.

WHAT'S HAPPENING HERE:

Scientists are actually quite **puzzled** as to why the Mentos mints and diet cola react together the way they do. Previously, they believed it was a **chemical reaction**, but now they think the **reaction is physical**. When the mints are dropped into the fizzy drink, their **pitted surface collects lots of carbon dioxide molecules**. As they **sink** to the bottom, the **carbon dioxide is released all at once** and goes rushing upwards towards the open spout.

WHAT IF?

What happens if you use a **different type of fizzy drink**?

What if you put the Mentos mints in **one at a time**?

Turn to **page 28** for another use for your mints and cola!