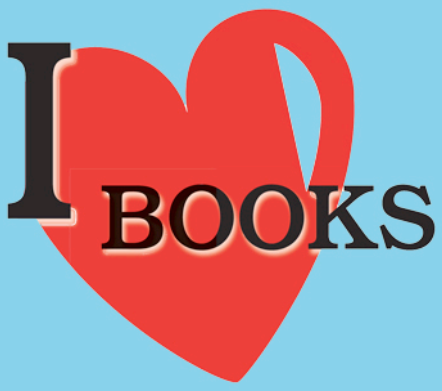

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Opening extract from

88 and ½ Science Experiments

Written by

Nick Arnold

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QED Publishing

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88½ SCIENCE EXPERIMENTS

NICK ARNOLD

QED

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THE THREE RULES OF EXPERIMENTING

All great scientists know the three golden rules of experimenting. These rules show you how to experiment safely and happily.

RULE #1

BE ORGANIZED

Before you start the experiment, read the WHAT YOU NEED list of materials and equipment. Make sure you have everything you need. If you go off in search of something halfway through an experiment, it may not be safe and it might ruin your results. If you can't find what you need, feel free to use a similar item, but ALWAYS ask before you borrow anything!

RULE #2

BE SAFE

This is a book for safe scientists. Adult supervision is always needed with experiments. Pay attention to all the DANGER warnings. In particular, NEVER drink or eat an experiment unless this book says you can.

- BEWARE of hot water.
- BEWARE of climbing on anything and falling off.
- BEWARE of harmful bugs or insects when trying some experiments.

This book doesn't need electricity, fire, or harmful chemicals—so don't use them in your experiments!

RULE #3

BE CLEAN

Take care not to spill messy materials like water or food colouring. Always clean up before you start a new experiment. Cleaning up sounds seriously boring, but it helps you. Yes, really! Cleaning up...

- Clears space for your next experiment.
- Keeps you from losing vital equipment.
- Keeps younger kids from playing with your experiments and hurting themselves or breaking your equipment.
- Means you won't get grounded and banned from experimenting!

WHAT'S NEXT?

Look out for the "What's Next?" challenge. Search for clues to explore and develop the experiments in the book – and find the answers for yourselves! See if you can set up your own lab area at home, with a box for your lab equipment. You could keep a notebook with the results of your experiments.

THE GREAT COASTER RACE

The way things fall – and the speed in which things fall – has everything to do with air.

WHAT YOU DO

1. Place the coaster on the paper and draw around it.
2. Carefully cut out the shape of the coaster.
3. Hold the coaster between the finger and thumb of one hand. Hold the paper cutout in the same way with your other hand. Stand on a chair and drop them both from a height of 1.5 metres (you will need an adult to help you). What do you notice?
4. Now place the paper cutout over the coaster and drop them both from 1.5 metres.

QUIZ QUESTION:

WHAT WILL HAPPEN AT STEP 4?

A) THE PAPER CUTOUT FALLS FASTER WITH THE COASTER

B) THE PAPER CUTOUT FLIES UPWARDS

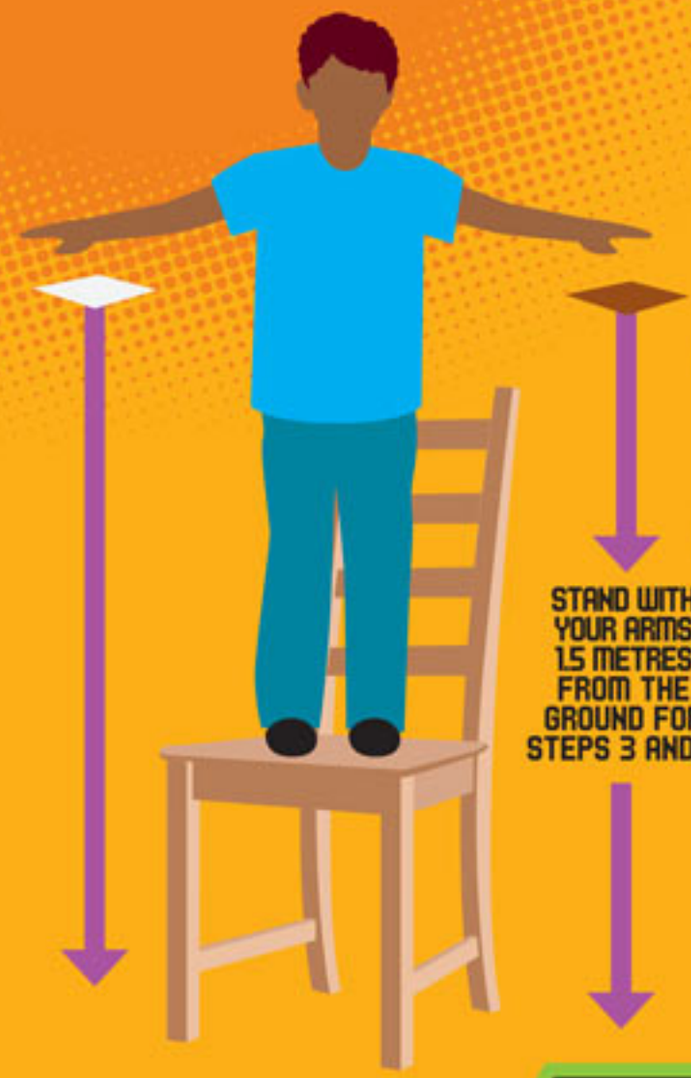
C) THE COASTER FALLS SLOWER WITH THE PAPER CUTOUT

WHAT HAPPENS?

ANSWER: A

For a simple experiment, there's a surprising amount of science. **Gravity** pulls on any object. As an object falls, air pushes back. This is called **air resistance**.

Air resistance tries to slow the object's fall. Objects with greater **density** fall faster because they push harder through the air. There is less air resistance with light paper, so it falls more slowly. Now, for Step 4, the air flowing around the paper cutout keeps it close to the coaster. This adds extra weight to the paper cutout, which helps it to fall faster.



STAND WITH YOUR ARMS 1.5 METRES FROM THE GROUND FOR STEPS 3 AND 4

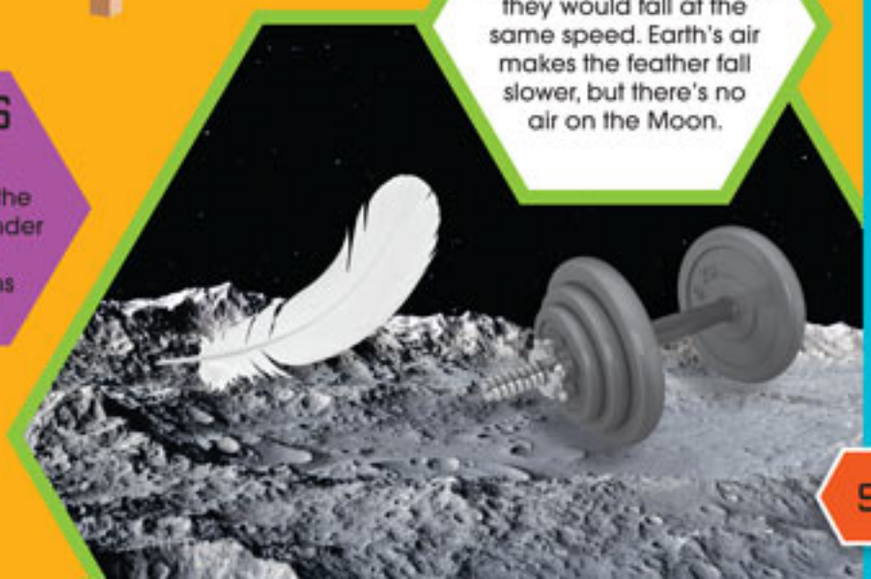
WHAT YOU NEED

WHAT'S NEXT?

Try Step 4 with the paper cutout under the coaster. What happens and why?

DID YOU KNOW?

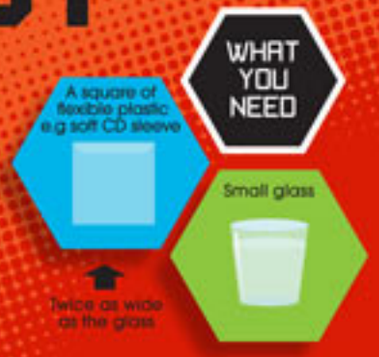
If you dropped a feather and a 1 kg weight on the Moon, they would fall at the same speed. Earth's air makes the feather fall slower, but there's no air on the Moon.



UPSIDE-DOWN GLASS TEST

This air pressure experiment sets powerful forces against each other. Try the experiment over a sink in case the wrong force wins!

WHAT YOU NEED



WHAT YOU DO

1. Fill the glass halfway with water.
2. Wet the square of plastic and the glass rim. Firmly press the plastic over the glass.
3. Holding the plastic in place, gently turn the glass upside down over a sink.
4. Remove your hand from the plastic.

QUIZ QUESTION:

WHY DOES THE PLASTIC STAY IN PLACE?

A) THE PLASTIC IS NATURALLY STICKY WHEN IT'S WET

B) THE FORCES KEEPING THE PLASTIC IN PLACE ARE STRONGER THAN THE FORCES TRYING TO DISLODGE IT

C) GRAVITY DOESN'T WORK WHEN THE GLASS IS UPSIDE-DOWN

WHAT HAPPENS?

ANSWER: B

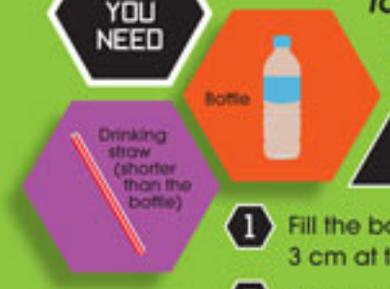
Gravity tries to make the square of plastic and water fall, but air pressure outside the glass pushes up to keep the plastic in place.

The plastic is also held by water **molecules** pulling on other water molecules to make a skin of water. This is called **surface tension**.

MAKE A TROMBONE

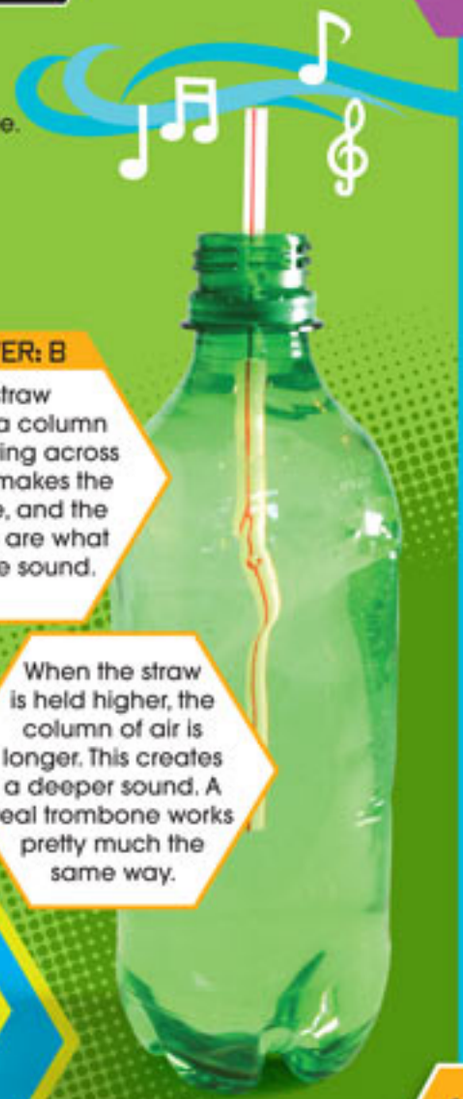
Ever heard the wind whistling? Don't wait for a windy day – it's easy to make your own musical wind instrument!

WHAT YOU NEED



WHAT YOU DO

1. Fill the bottle with water, leaving 3 cm at the top.
2. Place the drinking straw in the bottle.
3. Blow across the top of the straw while moving it up and down.



QUIZ QUESTION:

WHICH IS CORRECT?

A) THE HIGHER THE STRAW, THE HIGHER THE SOUND

B) THE HIGHER THE STRAW, THE LOWER THE SOUND

C) THE STRAW CARRIES ON WHISTLING AFTER I STOP BLOWING

WHAT HAPPENS?

ANSWER: B

The straw contains a column of air. Blowing across the straw makes the air vibrate, and the vibrations are what make the sound.

When the straw is held higher, the column of air is longer. This creates a deeper sound. A real trombone works pretty much the same way.

DID YOU KNOW?

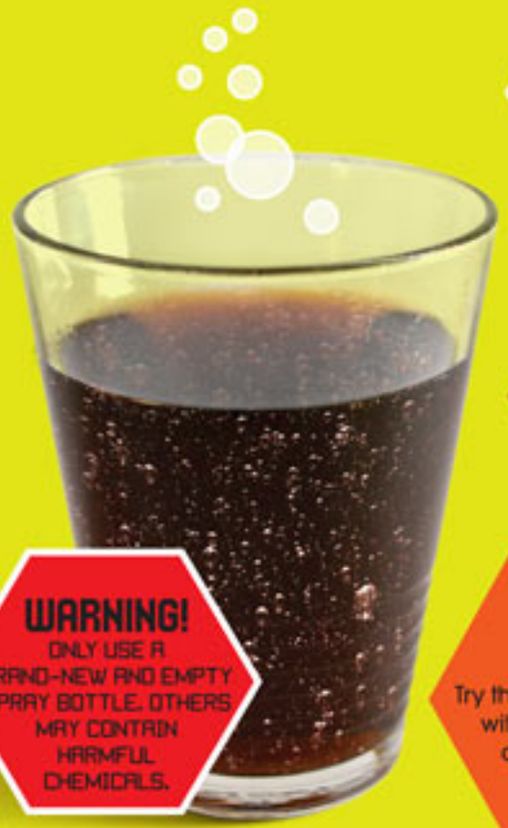
The longest time anyone has ever played one note on a wind instrument is one minute and 13 seconds. Can you beat that?

CRAZY COLA

Fizzy drinks are bad for you, but they reveal an amazing, bubbly secret....

WHAT YOU DO

1. Wash the spray bottle with soapy water. Fill with water.
2. Open the cola and pour it into a glass.
3. Wait for the cola to stop bubbling and then spray it with water.
4. Do not drink the cola—pour it all away!



WARNING!
ONLY USE A BRAND-NEW AND EMPTY SPRAY BOTTLE. OTHERS MAY CONTAIN HARMFUL CHEMICALS.

WHAT YOU NEED

QUIZ QUESTION:

WHAT WILL HAPPEN TO THE COLA?

A) IT FIZZES UP

B) IT MAKES A LOUD BURPING NOISE

C) IT GLOWS IN THE DARK

ANSWER: A

To make a fizzy drink, carbon dioxide is forced into the drink under pressure. Fizzy drinks contain **dissolved** carbon dioxide gas.

WHAT HAPPENS?

The spray pushes air into the cola, forms bubbles, and the dissolved carbon dioxide gas enters the bubbles. The bubbles get bigger, then rise and pop with a fizzing sound.

WHAT'S NEXT?

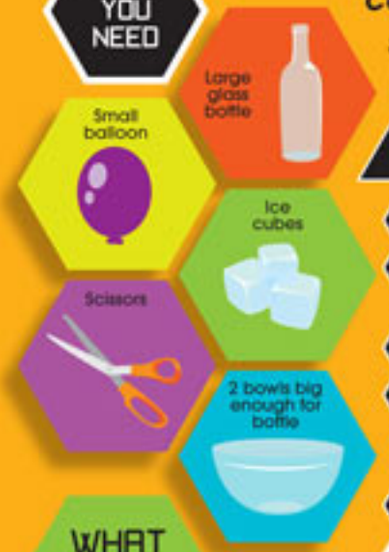
Try the same experiment with flat (non-fizzyy) cola. Does it still work—if not, why?

THE BALLOON-EATING BOTTLE

Air presses on objects with a force called air pressure. This experiment shows air pressure in action....

WARNING!
ASK AN ADULT WHEN USING HOT WATER

WHAT YOU NEED



WHAT YOU DO

1. Cut 2 cm off the neck of the balloon.
2. Fill the bowl with cold water, add a few ice cubes, and leave it in the fridge for two hours.
3. Fill the bottle with hot tap water and leave for 60 seconds.
4. Fill the sink with hot water. Empty the bottle into the spare bowl, then quickly roll the balloon neck over the top of the bottle. Place the bottle in the sink and watch what happens.
5. Then stand the bottle up in the bowl of cold water.

QUIZ QUESTION:

WHAT WILL HAPPEN TO THE BALLOON?

A) IT TURNS RED AT STEP 4

B) THE BALLOON IS SUCKED INTO THE BOTTLE AT STEP 4 AND SWELLS AT STEP 5

C) IT SWELLS AT STEP 4 AND IS SUCKED INTO THE BOTTLE AT STEP 5

WHAT HAPPENS?

ANSWER: C

Air consists of gas molecules, mostly nitrogen and oxygen. Trapped in the bottle, the molecules move around and crash into the balloon sides, creating air pressure. Air pressure increases with temperature, inflating the balloon.

As air in the bottle heats up, the air molecules move faster and need more space – the air expands. This makes the balloon inflate slightly.

When the bottle is in cold water, the air cools down and contracts (shrinks). Air pressure on the outside pushes the balloon into the bottle.

WHAT'S NEXT?

Place the bottle and balloon in a bowl of warm water. What happens?