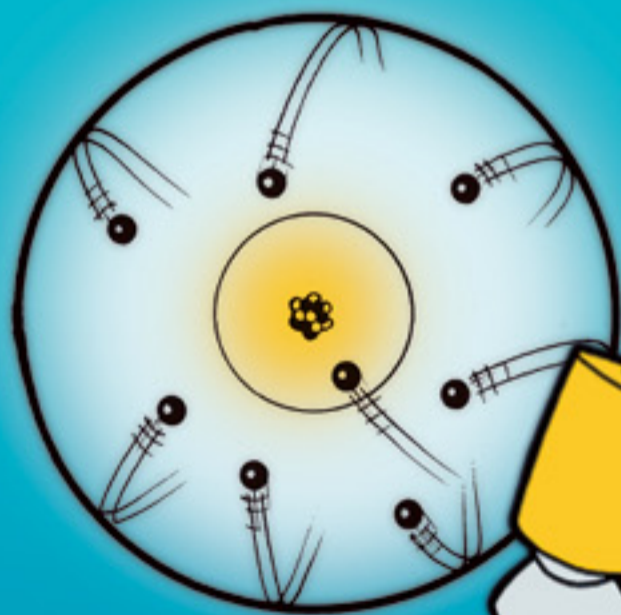


**BOREDOM-BUSTER**

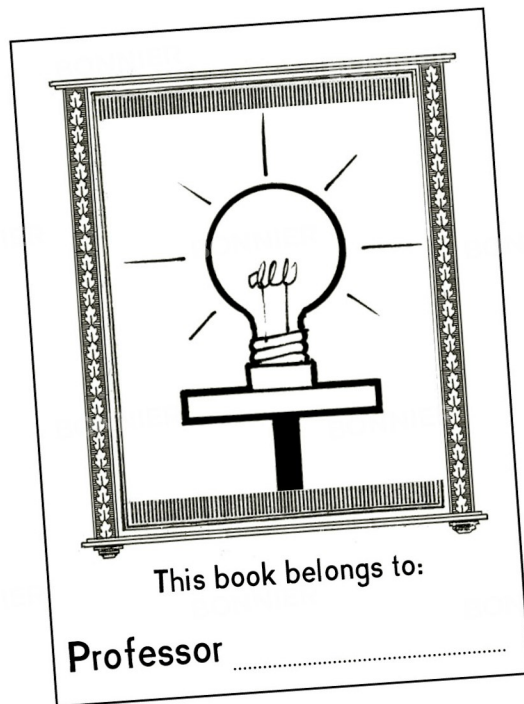
PUZZLE ACTIVITY **BOOK OF**  
**SPECTACULAR**  
**SCIENCE**



OVER 100  
PAGES OF  
ATOMIC  
ACTIVITY!

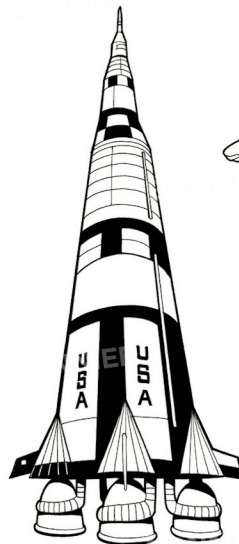
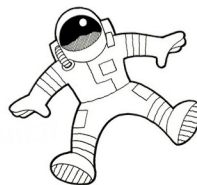
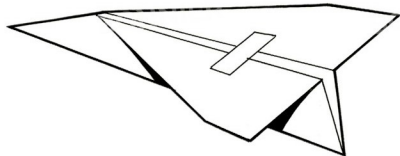
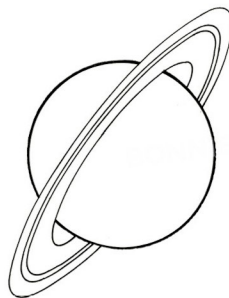
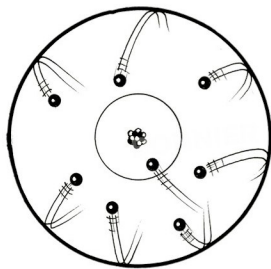
**DR. JEN GREEN**





This book belongs to:

Professor .....



Colour in  
your science  
experiments!



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# BOREDOM-BUSTER

## PUZZLE ACTIVITY BOOK OF

# SPECTACULAR

# SCIENCE



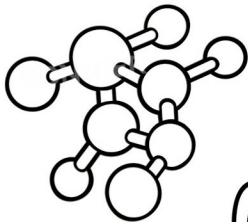
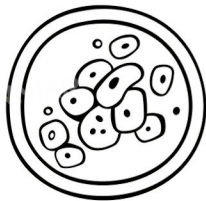
# SPECTACULAR SCIENCE

Welcome to the exciting world of science! Science helps us to learn more about our world and brings us one step closer to answering some big questions about life. Are we alone in the universe? Is time travel possible? And how did we come to be?

There are many different branches of science to explore. Each unique area has its own name. Below are just a few!

## BIOLOGY

Biology is the study of living things. Biologists examine the natural world and everything that lives in it.

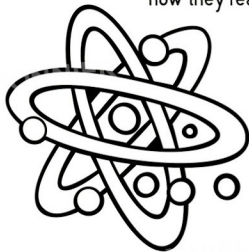


## CHEMISTRY

Chemistry is the study of elements and substances. It examines how they are made up, their properties, and how they react.

## PHYSICS

Physics is the study of energy, forces, and matter. It helps us to understand the way things move, and the behaviour of energy, such as heat and light.



Scientists devote their lives to discovery, and their contributions have shaped the world we live in today. From experimenting with new medicines to studying outer space, scientists are constantly expanding our understanding of life itself!

Can you unscramble the names of some of the most famous scientists in the world below?

ENITNESI

UCIRE

NIDRAW

TOWNEN

GINKHAW

YADARAF

UPREATS

LAGOILE



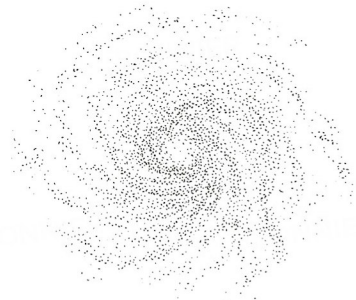
# EXPLORING THE UNIVERSE

The universe is **HUGE!** It contains everything you can imagine, including galaxies, planets, stars, energy, matter, and, of course, you! Scientists believe that the universe began about 14 billion years ago. It is so large that we don't actually know where it ends. It could go on forever!

A galaxy is a sprawling system of stars, planets, gas and dust, all held together by gravity. At the centre of the galaxy is a bulging cluster of stars called the nucleus.



We live in a spiral galaxy called the **Milky Way**. From far away, it looks like a giant pinwheel. It is made from around 100–400 billion stars. That sounds enormous, but much larger galaxies exist. Scientists suggest that our closest neighbour, the **Andromeda** galaxy, is even bigger with twice as many stars!



There are billions of galaxies just waiting to be discovered, and they all come in different shapes and sizes. The largest ones contain trillions of stars.

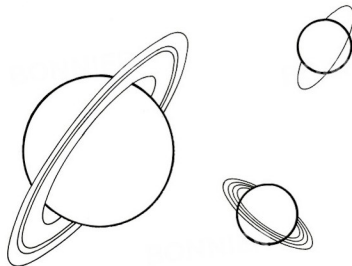
Design and colour in your own galaxy in the space below.

It can include anything you want, from colourful planets to shooting stars, daring astronauts, crashing comets and even aliens!



## SCIENCE FACT

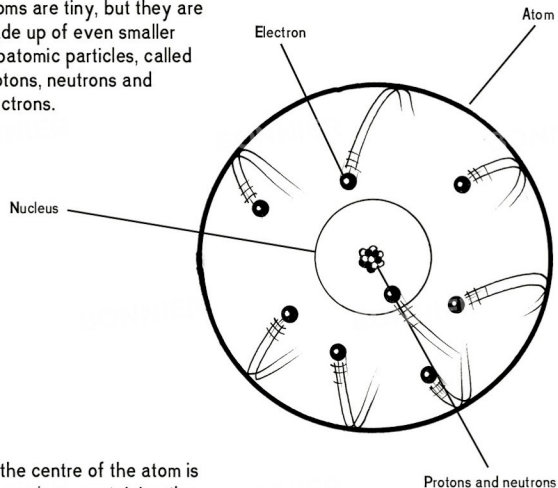
To measure distances in space, scientists use a unit called a 'light-year'. This is how far light travels in one year. One light-year is around 9.5 trillion kilometres.



# EXTRAORDINARY ATOMS

Atoms are small but mighty. They are the smallest building blocks of all matter and they make up everything, even you! It is difficult to see atoms under a microscope because they are so small.

Atoms are tiny, but they are made up of even smaller subatomic particles, called protons, neutrons and electrons.



At the centre of the atom is the nucleus, containing the protons and neutrons. Electrons exist outside the nucleus, spinning in orbits. All protons have a positive charge, and all electrons have a negative charge. Neutrons have no charge at all – they are neutral.

Not all atoms are identical. The number of protons in an atom determines which atom it is. Each different kind of atom makes up an element.

An element is a pure substance made up from just one type of atom. Scientists have discovered 118 different elements, though only 98 of them naturally occur on Earth. How many can you find in the wordsearch below?

M	E	R	C	U	R	Y	T	F	T	D	H	V	M
L	J	I	H	M	U	N	I	T	A	L	P	E	Z
Y	Z	R	C	N	I	T	Y	R	G	Y	R	W	S
A	X	Z	T	G	S	I	L	V	E	R	B	D	H
I	K	L	R	Z	H	M	N	Z	N	K	O	U	E
Z	E	I	P	Y	J	K	L	L	Z	I	V	A	L
N	I	T	R	O	G	E	N	J	E	O	D	S	I
K	K	Z	G	O	F	T	P	Z	S	X	A	P	U
M	E	S	X	A	N	P	C	U	C	Y	O	K	M
L	C	G	U	P	W	T	A	O	P	G	H	R	F
Z	N	L	X	L	S	R	L	V	A	E	E	U	V
B	I	O	G	P	P	K	C	R	C	N	M	Y	Z
P	Z	L	I	H	Y	H	I	F	T	B	Z	N	G
C	A	R	B	O	N	V	U	Z	T	J	G	Y	I
E	N	W	O	Z	I	A	M	R	A	G	O	L	D

## HINT:

Words may overlap, or appear backwards or diagonal!

CALCIUM  
CARBON  
GOLD  
HELIUM  
IRON  
MERCURY

NITROGEN  
OXYGEN  
PLATINUM  
SILVER  
SULPHUR  
ZINC

# MOTION PICTURES

Flickbooks are really fun. As you flick the pages the figure seems to move. It's like making your very own cartoon show!

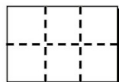


Trace one of the figures opposite onto each page. Flick the pages to make the figure run.

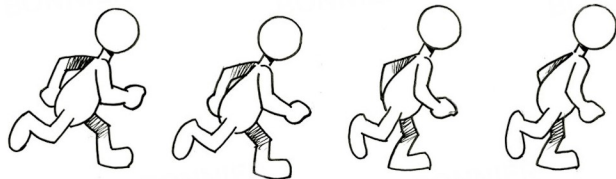
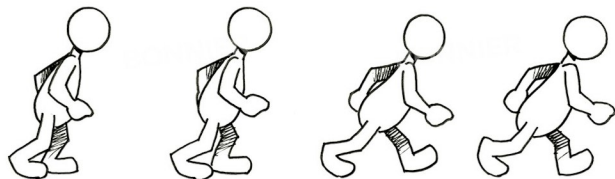
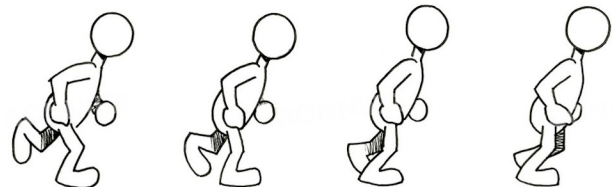
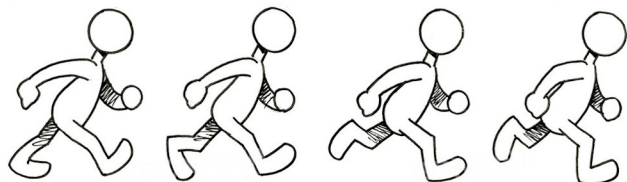
You could draw your own figures instead. Make each figure only slightly different from the one before.

## MAKE A FLICKBOOK

Fold a piece of A4 paper in half, then fold again into three. Unfold so it looks like this:



Cut along the lines to make six pages. Repeat to make more pages. You could also use a notebook or a pad of sticky notes.





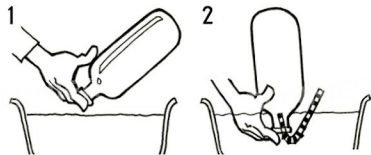
# BREATHING

HOW MUCH AIR DO YOU HAVE IN YOUR LUNGS?

Air is made from a mixture of gases. One-fifth is oxygen, which humans and animals need to survive.



Have a competition with your friends to see who can breathe out the most air. Write the results down here.



Mark a scale on a plastic drink bottle as shown. Fill the bottle with water. Put your hand over the mouth of the bottle and push the neck into a bowl of water (1). Keeping the neck underwater, insert a bendy straw (2). Take a deep breath and blow into the straw (3).



Use a ruler and a felt-tip pen to mark the scale on the bottle.

The air you breathe out rises to the top. See how far up the scale it goes.

Name	Number on scale

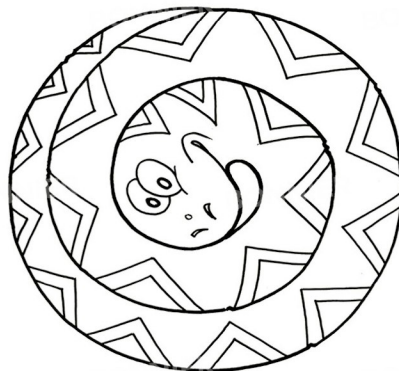
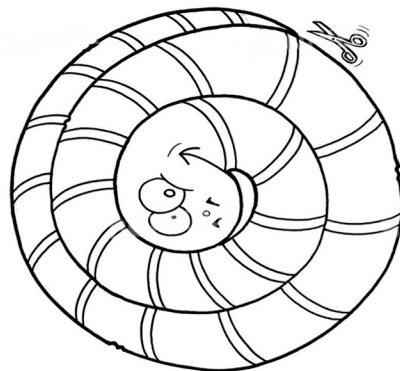
# RISING AIR

When air is heated it rises. This is what makes a hot-air balloon rise. Air spirals upwards in currents called thermals where the sun heats the air near the ground.

This experiment uses the warm air from a radiator.

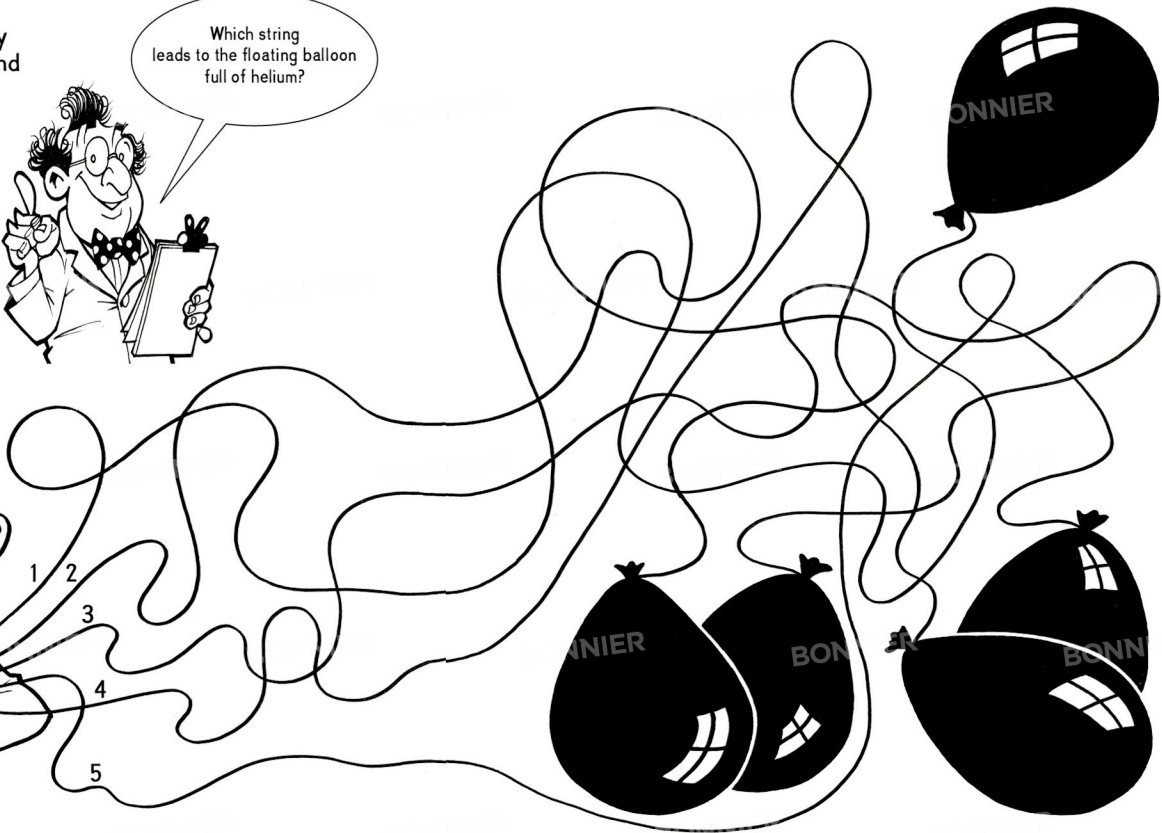
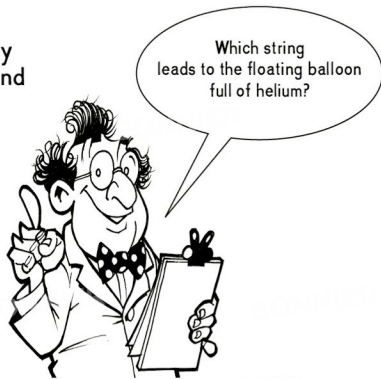


Colour the snakes, then cut them out to make a spiral. Gently pull the head and tail apart. Use scissors to make a hole in the nose, and attach a string. Hang the snakes over a radiator and watch them spin around!



# LIGHTER THAN AIR

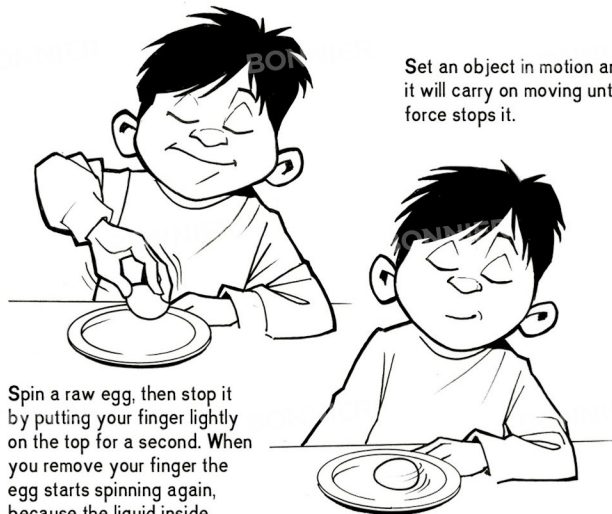
Helium is a gas that is lighter than air. That's why a helium balloon rises – and carries on rising if you let the string go!



# IN A SPIN

If you spin an egg on a plate, friction (a resistant rubbing force) between the plate and the egg will eventually stop the egg.

Try the raw egg experiment on a friend. Then, trick your friend by giving them a hard-boiled egg to spin. The hard-boiled egg won't start spinning again, because the inside is solid.

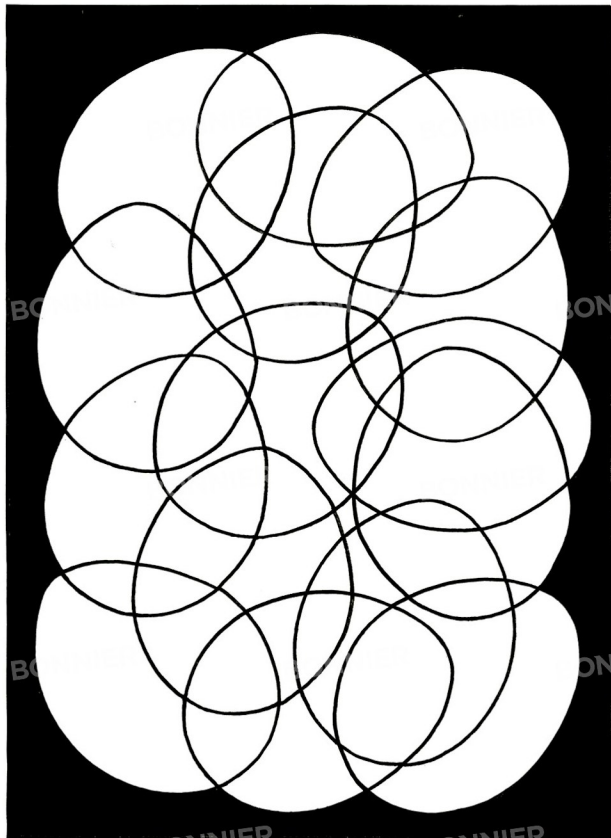


Set an object in motion and it will carry on moving until a force stops it.

Spin a raw egg, then stop it by putting your finger lightly on the top for a second. When you remove your finger the egg starts spinning again, because the liquid inside carries on spinning.

A raw egg wobbles because of the liquid sloshing inside. A hard-boiled egg spins smoothly on its top.

How many eggs can you find in this picture?  
Colour them to make them easier to count.



# MAKING MUSIC

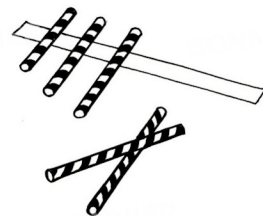
Fill glass bottles with slightly different levels of water. Tapping the bottles with a spoon makes them vibrate and produce a sound.



When you blow across the top of a bottle, you cause the air inside to vibrate. The more water you put in, the less air there is to vibrate, and the higher the noise will sound.



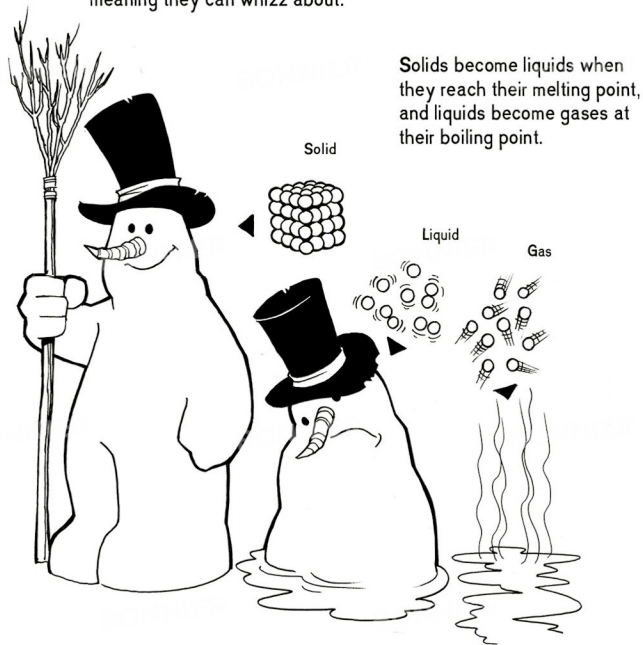
Cut straws to different lengths and tape them together to make a set of panpipes. Again, the air inside vibrates to produce varying sounds.



# STATES OF MATTER

Solids, liquids and gases are all states of matter. They have different qualities because their particles (tiny pieces of matter) are arranged differently.

In a solid, particles cling together and cannot move, making them rigid and fixed. In a liquid, particles are close together but can slide past one another, so they can be poured. Gas particles are widely spaced and randomly arranged, meaning they can whizz about.

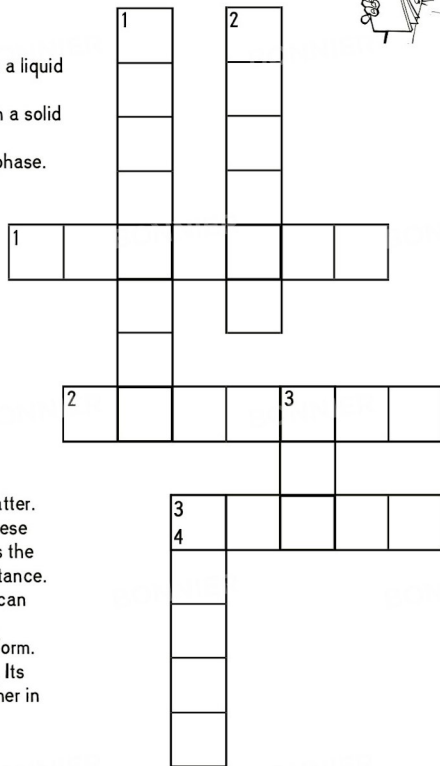


It's time to test your knowledge! Can you fill out the following crossword on this topic?



## ACROSS

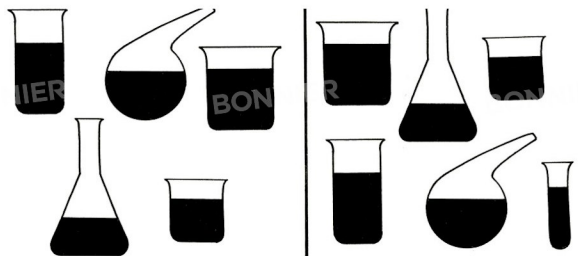
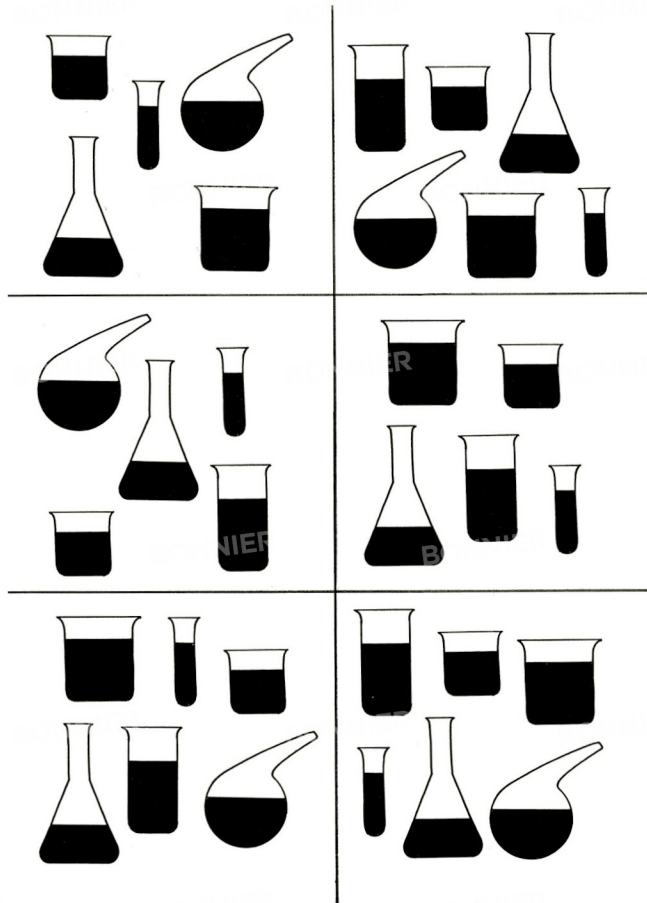
- The point at which a liquid turns into vapour.
- The point at which a solid turns into a liquid.
- Water in the gas phase.



## DOWN

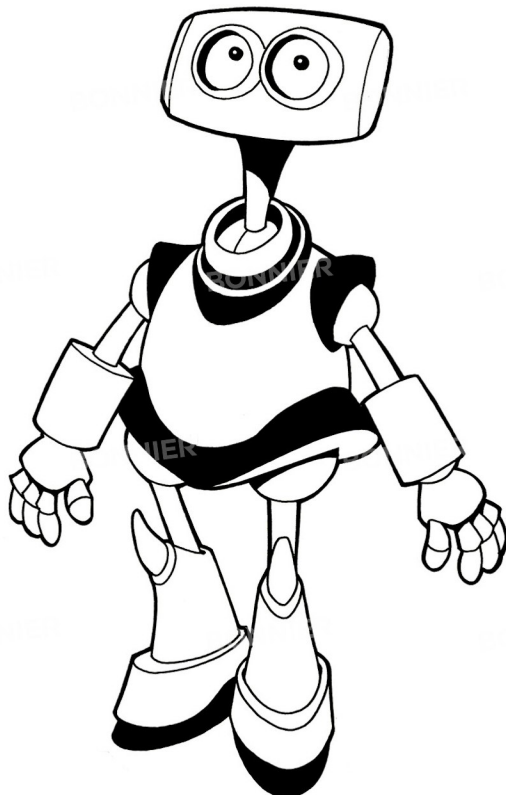
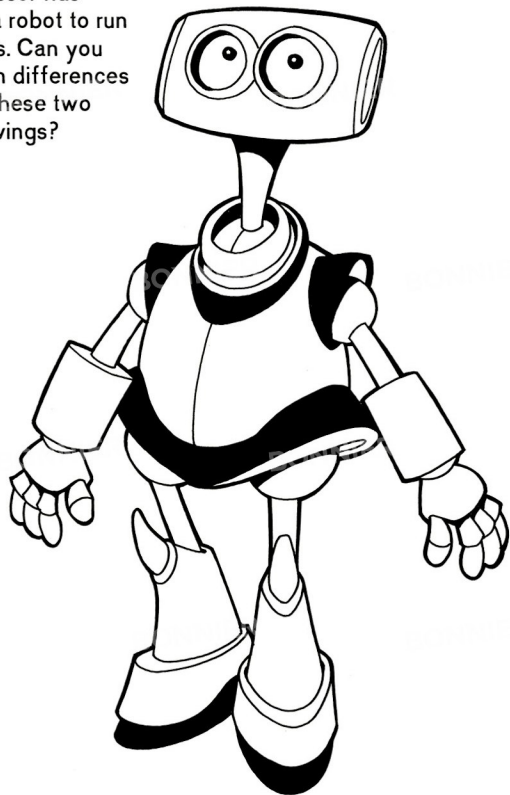
- Small pieces of matter. The way in which these are arranged affects the properties of a substance.
- A substance that can flow and be poured.
- Water in its solid form.
- A rigid substance. Its particles cling together in a fixed position.

# FIND THE FLASKS



# ROBOTS

The Professor has invented a robot to run his errands. Can you spot seven differences between these two robot drawings?





# CLOUDS AND RAIN

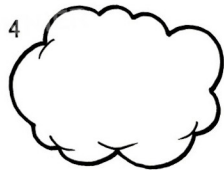
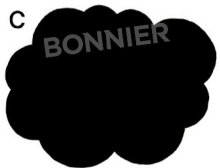
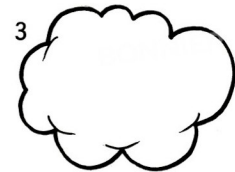
The air contains moisture in the form of a gas called water vapour. As air rises it cools, and water vapour turns into tiny drops of liquid moisture. These gather to make clouds, which later shed rain.



## MAKE A CLOUD IN A JAR!

Pour warm water into a jar. Balance a tray of ice cubes on top. When warm, moist air in the jar rises to meet the cold ice cubes, the air cools. Water vapour turns to liquid water drops, which form a cloud.

Match each cloud to its shadow.



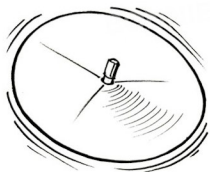
# LIGHT AND COLOUR

Sunlight looks colourless, but it is actually made up of seven colours: red, yellow, orange, green, blue, indigo and violet. You can see these colours in a rainbow. In physics, the three 'primary colours' of light are red, blue and green.



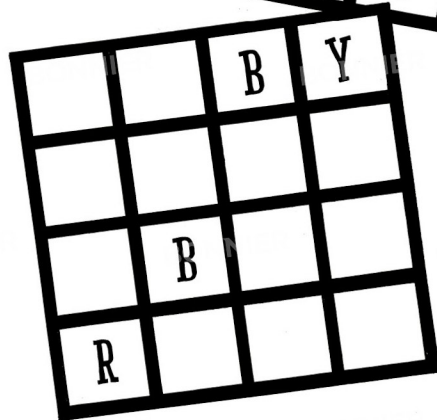
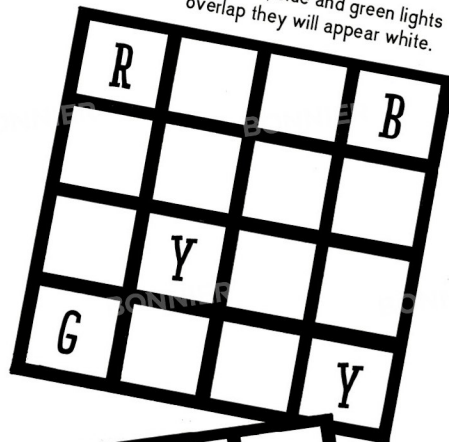
## THE EXPERIMENT

Make a spinning top by cutting out a circle of stiff card with scissors. Divide the circle into three and colour these sections red, blue and yellow. Make a hole in the centre with scissors and push a pencil through the hole. When you spin the top, what colour do you see?



## COLOUR PUZZLE

Colour in the boxes according to the key. Now colour the remaining boxes so that each row across, each column down and each diagonal line (from corner to corner) contains all four colours.



## KEY:

R = Red  
B = Blue  
G = Green  
Y = Yellow

*DID YOU KNOW?*  
When red, blue and green lights overlap they will appear white.

# ON THE LEVEL

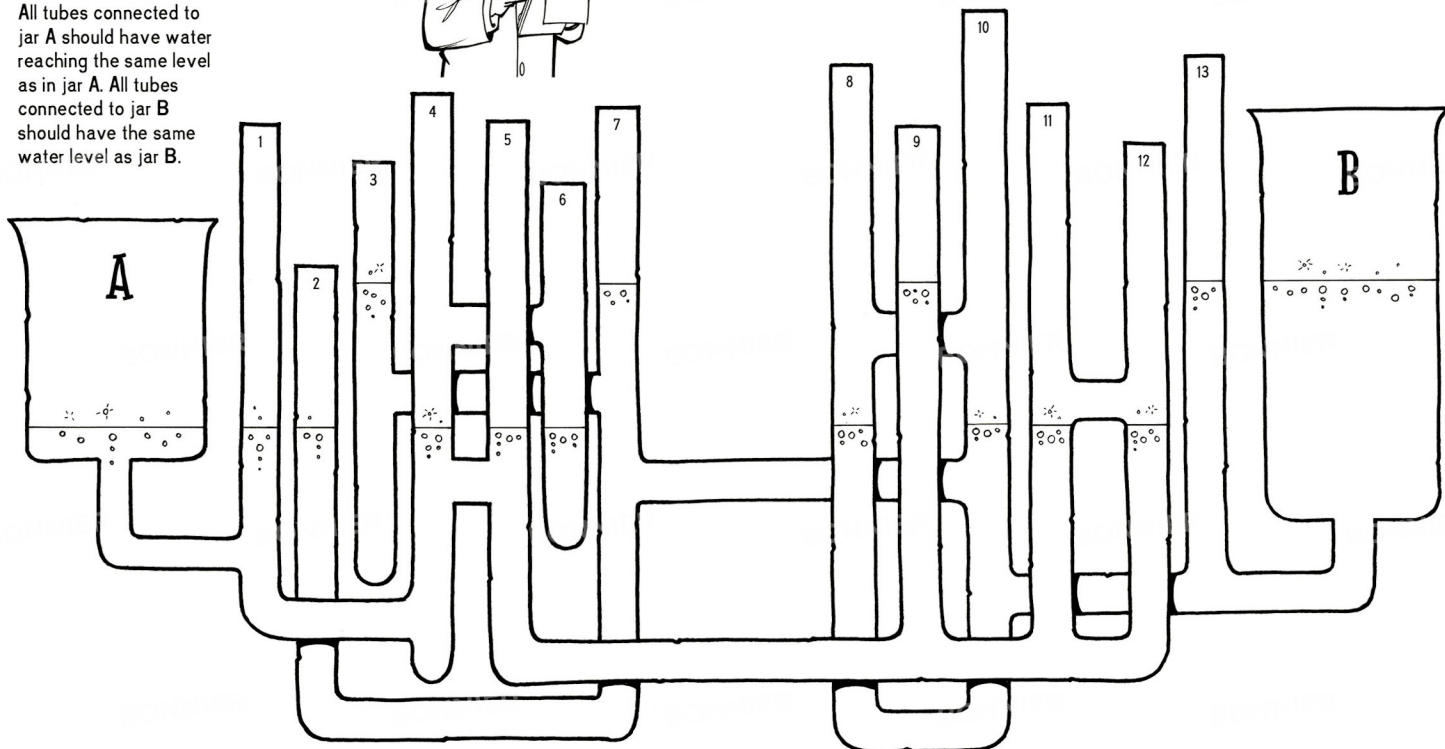
If you pour water into a series of tubes that are connected together, the water finds the same level in all the tubes.

All tubes connected to jar A should have water reaching the same level as in jar A. All tubes connected to jar B should have the same water level as jar B.



But some of these tubes have been drawn wrongly! Can you find which tubes contain water at the wrong level?

**HINT:**  
It will help if you colour all the tubes connected to jar A red, and all the tubes connected to jar B blue.



# SUDOKU

Sudoku is all about problem-solving. It's a workout for your brain, based on maths, perception, logic and memory. Each puzzle has one unique solution.

2		4	
	1		
			3
		1	

Try my fiendish Sudoku puzzles!



	3		
	4		1
		2	
3			

Write the numbers 1 to 4 in the boxes. Each row, each column and each 2 x 2 square must have all four numbers.

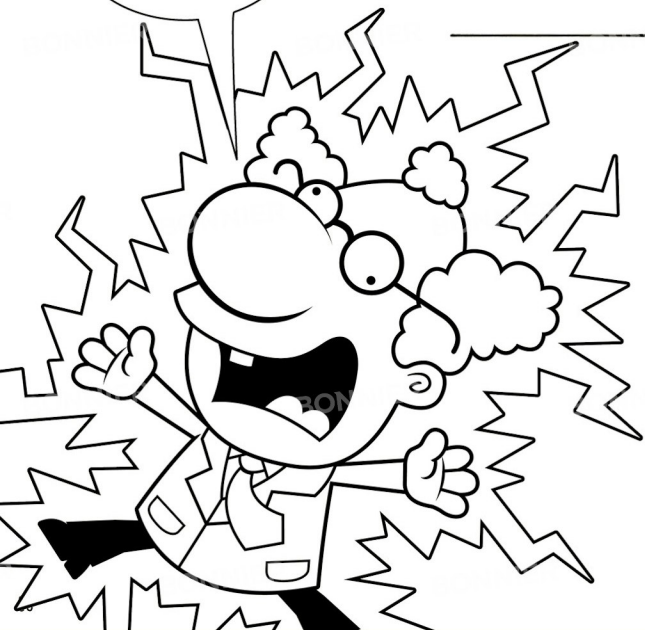
1			
4			
		3	
		1	

4	3		
		4	1

# ELECTRICITY PUZZLE

How many words can you make  
using the letters in the word  
ELECTRICITY?

Here are a few  
words to start you off.  
What's the longest word  
you can make?



RICE \_\_\_\_\_  
CITY \_\_\_\_\_  
LETTER \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## DID YOU KNOW?

A bolt of lightning is a giant electric spark that leaps from a thundercloud to the ground.

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

# LIGHT AND SHADOW

LIGHT ALWAYS TRAVELS IN STRAIGHT LINES.

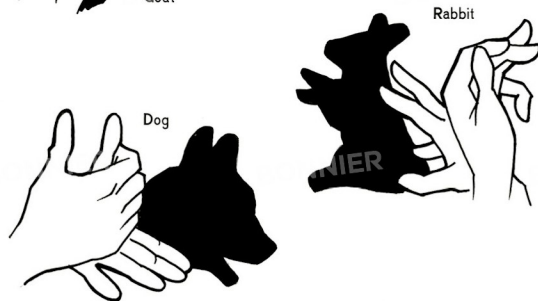
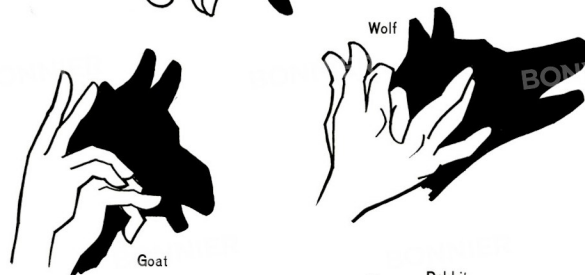
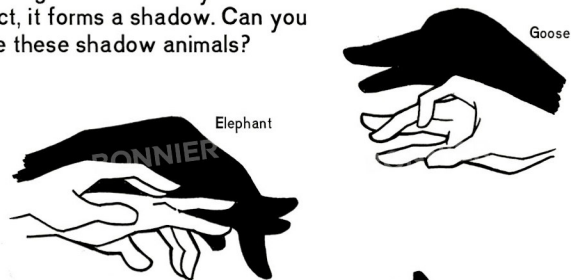
When you shine your torch at a mirror, the light bounces off at the same angle it hit the mirror.



## DID YOU KNOW?

Light travels at a speed of 300,000km (186,000 miles) per second. It takes 8.5 minutes for the Sun's light to reach Earth.

Where light is blocked by a solid object, it forms a shadow. Can you make these shadow animals?



Now invent your own shadow animals!

# CREEPY SHADOWS

Cut around the white shapes and use a torch to cast scary shadows!

(If you don't want to cut the book, trace the shapes onto thick paper or thin card.)



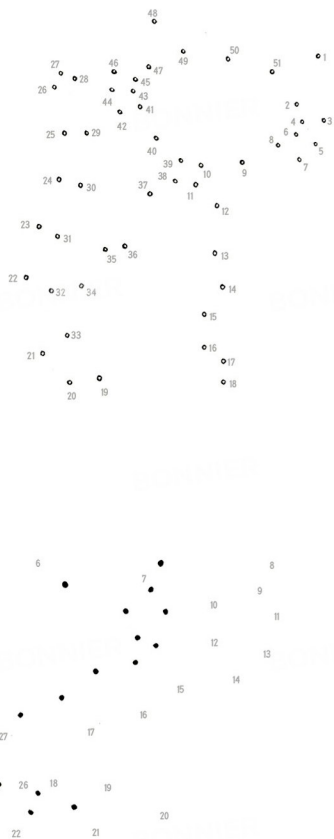
The closer your torch is to the shape, the larger the shadow. Move the torch further away to make the shadow smaller.



Try using a dim and a bright torch, and see what difference it makes.

# MYSTERY SHADOWS

Join the dots, then  
colour in the shapes  
to find out what words  
make these shadows.



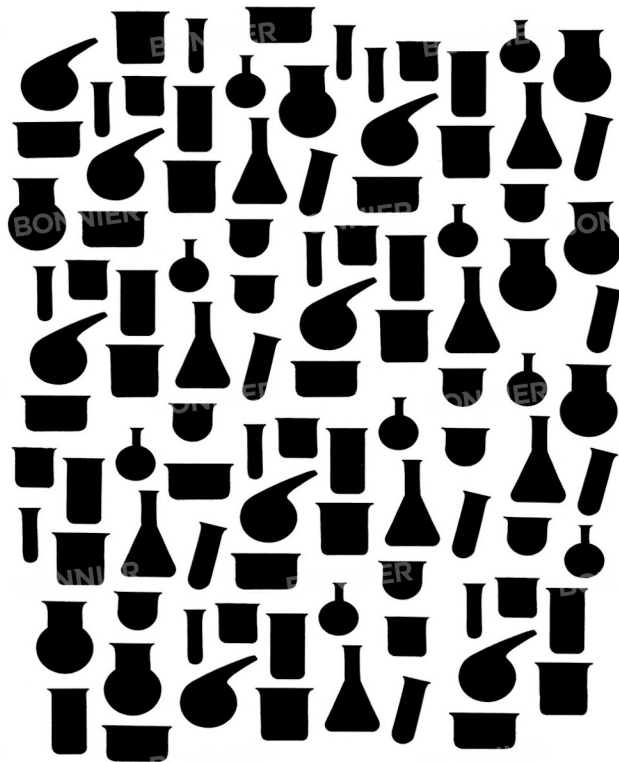
**DID YOU KNOW?**  
Natural shadows are longest  
just after dawn and just  
before dusk, when the sun is  
low in the sky.



# SPOT THE FLASK



Flasks, jars and test-tubes are used in all sorts of science experiments. How many containers of these three types can you find on these pages?



# GENIUS!

Albert Einstein is probably the world's most famous scientist.



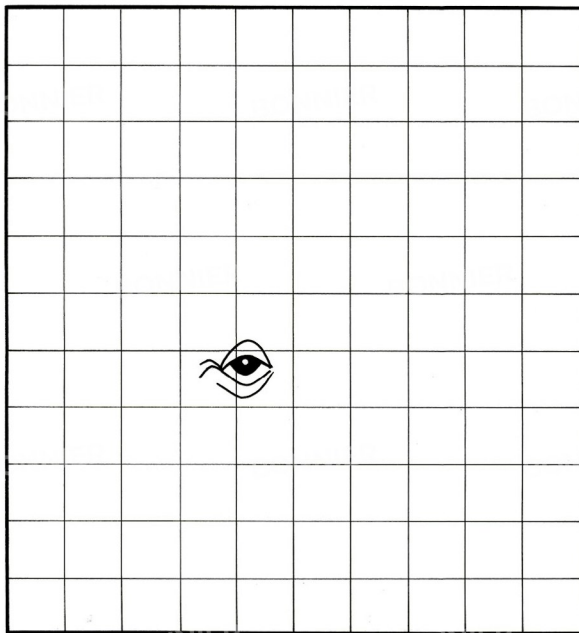
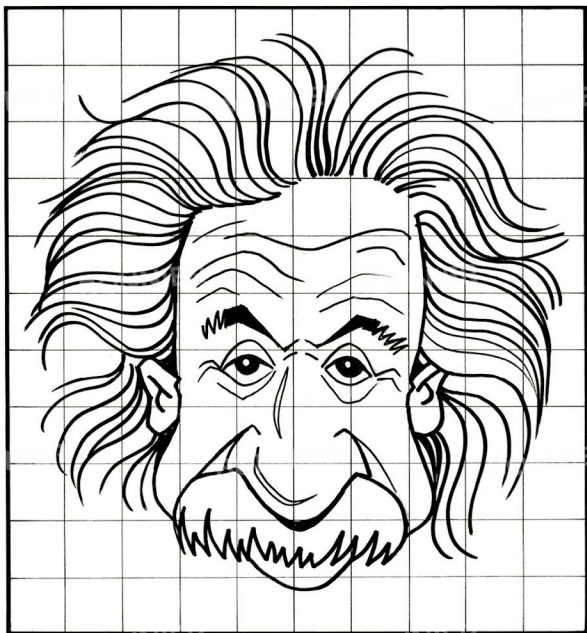
Einstein was born in Germany in 1879. As a boy, he was bad at spelling, but brilliant at maths, music and science.

Einstein was awarded the Nobel Prize for physics.

At the age of 26, he came up with an amazing theory about energy. It was so revolutionary that it took years to prove.

In 1932, he left Germany and settled in America. He died there in 1955, at the age of 76. His scientific discoveries continue to change our lives today.

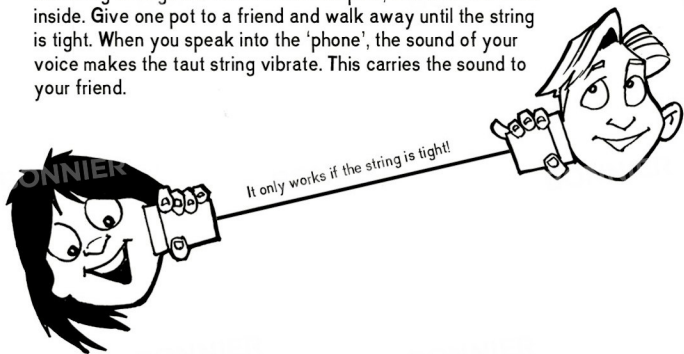
Copy Einstein's face on the grid below. Use the squares to guide you.



# MAKE A TELEPHONE

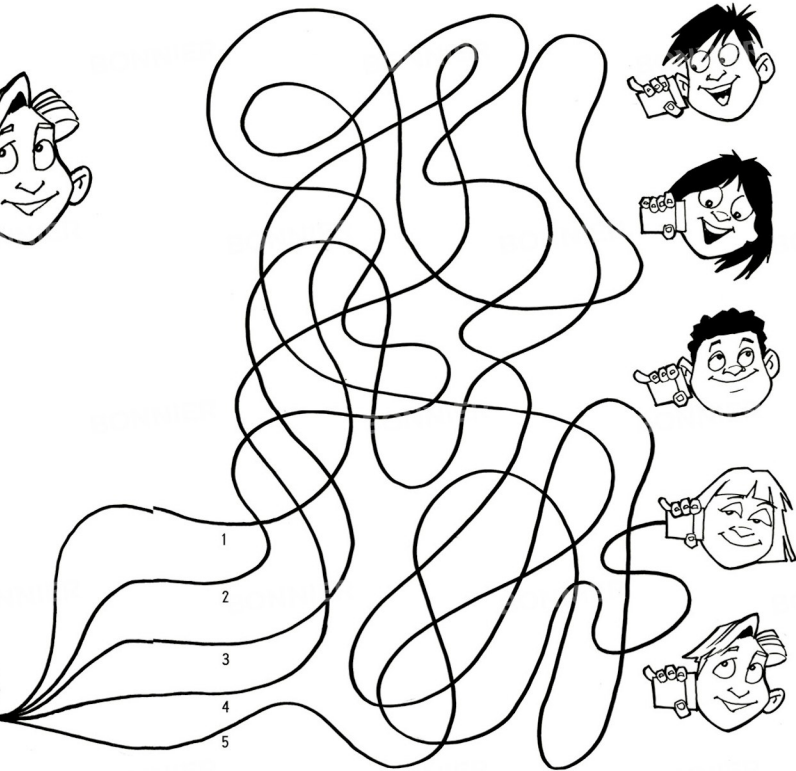
You'll need two clean, empty plastic yoghurt pots and a piece of string.

Ask an adult to punch a hole in the bottom of each pot. Thread the string through the holes in the two pots, and knot the ends inside. Give one pot to a friend and walk away until the string is tight. When you speak into the 'phone', the sound of your voice makes the taut string vibrate. This carries the sound to your friend.



## DID YOU KNOW?

When you use a real phone, a microphone inside changes your voice into an electrical signal. This is sent as radio waves to your friend's phone, which changes the signal back into sounds that are similar to your voice.

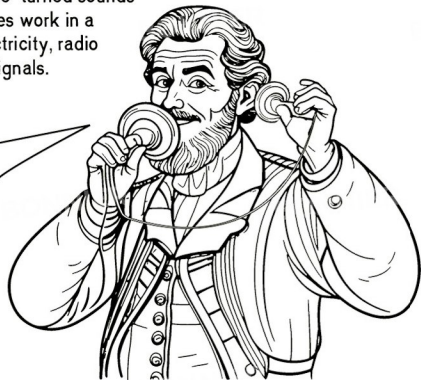


# THE FIRST TELEPHONE

Scottish scientist Alexander Graham Bell invented the telephone in 1876.

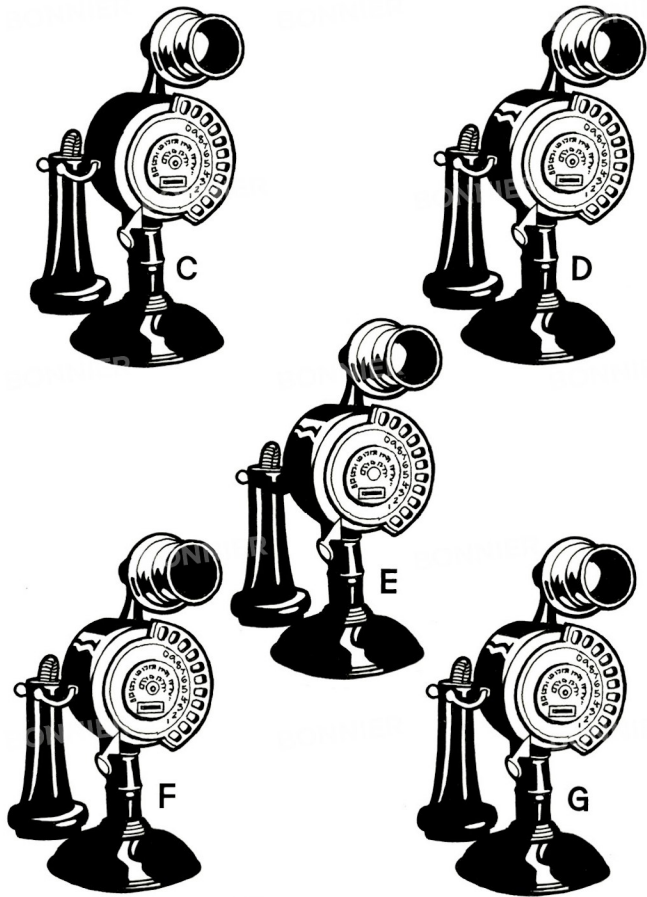
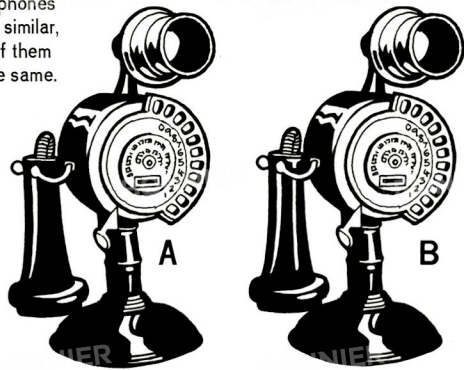
His 'electrical speech machine' turned sounds into electricity. Modern phones work in a similar way, but may use electricity, radio waves or light rays to send signals.

Hello? I thought I'd just give you a bell!



## MATCH THE PHONES

These old telephones may look very similar, but only two of them are exactly the same. Which ones?



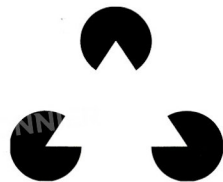
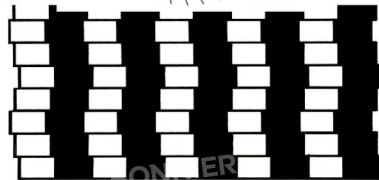
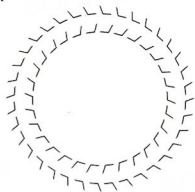
# TRICKS WITH LIGHT

Optical illusions are tricks that fool the eye. They make you see something that's not really there.

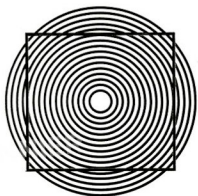
Hold the book up in front of you and tilt it to the left or right. What happens to the curved lines in the drawing below?



Stare very hard at the picture below, then slowly move it towards and away from you. What happens?



Can you see a triangle here?  
There isn't one in the drawing!

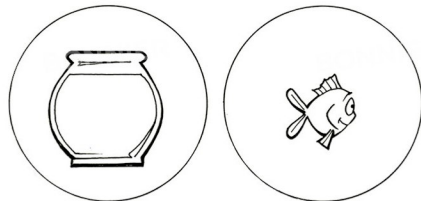


Are the sides of the square straight or curved? Check with a ruler.

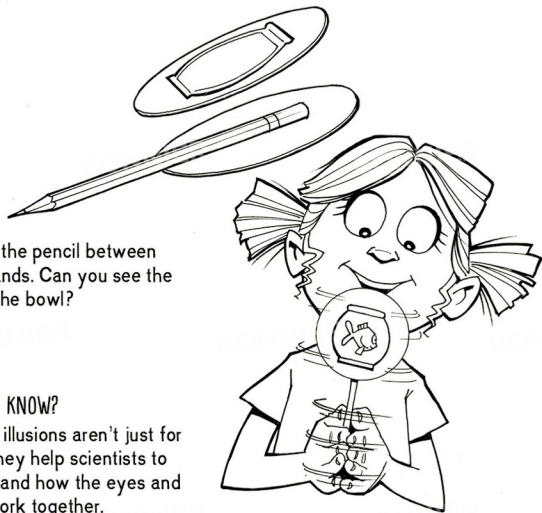
Are the horizontal lines level or slanting?

# PUT THE FISH IN THE BOWL

1. Trace the fish and bowl onto card. Colour them in, then cut out the two circles.



2. Tape the two pictures to a pencil, so both pictures face out.



3. Spin the pencil between your hands. Can you see the fish in the bowl?

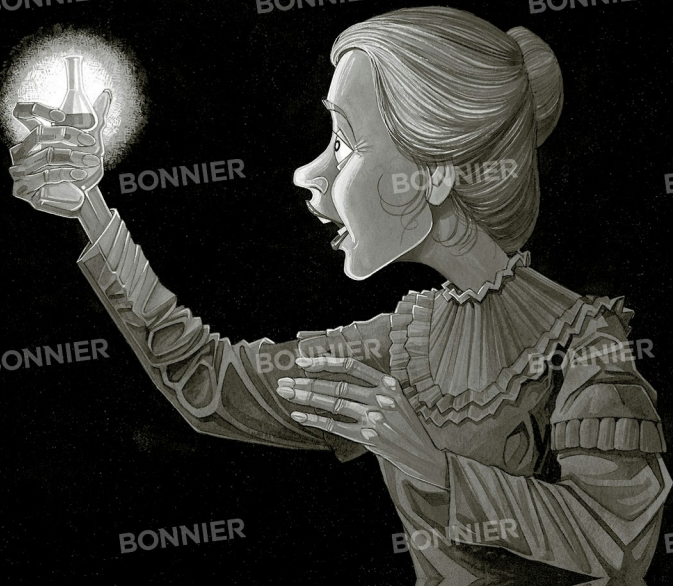
## DID YOU KNOW?

Optical illusions aren't just for fun – they help scientists to understand how the eyes and brain work together.

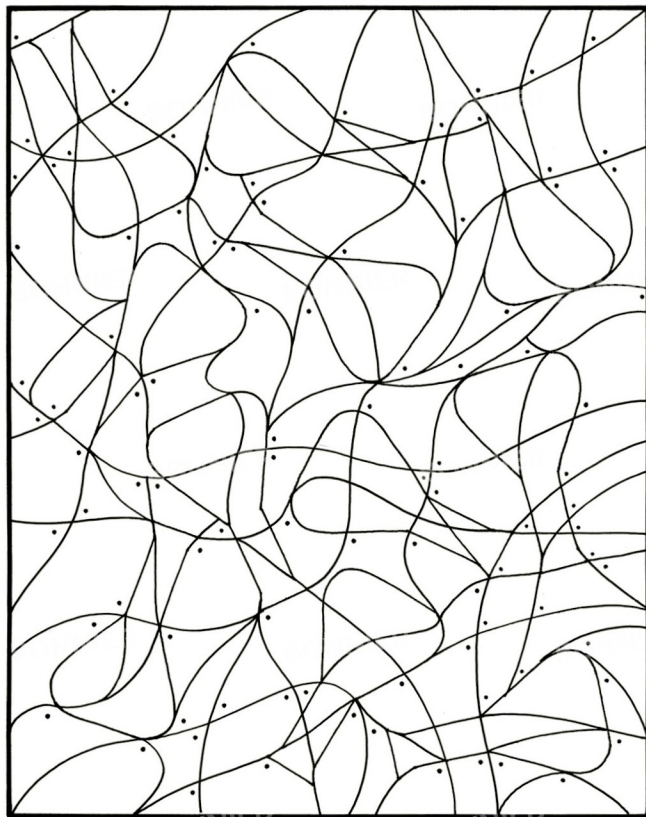
# RADIOACTIVITY

Marie Curie was one of the great scientists of the 20th century.

She was born in Poland in 1867. Her father was a science teacher. He taught Marie at home. Later she went to university in Paris, France, to study physics. There she met and married a fellow scientist, Pierre Curie. The Curies spent their lives finding out about radioactivity. They discovered a new radioactive element called radium. Their work was vital for the use of X-rays in medicine.



How many laboratory flasks (bottles) are hidden in this picture?  
To find out, colour in all the shapes that have dots in them.



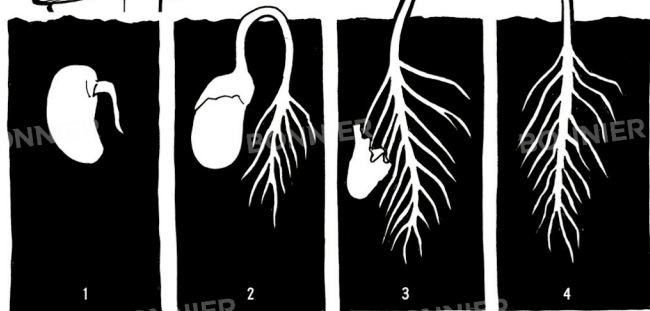
# GERMINATION

Most plants grow from seeds. If you plant a seed in a moist, sunny place it will start to germinate (sprout).

The tough seed case splits open (1).  
First, a little root grows downwards (2),  
so the plant can take in water.  
Then, a little green shoot begins to grow  
upwards towards the sky (3).  
The new plant spreads its leaves in the light (4).

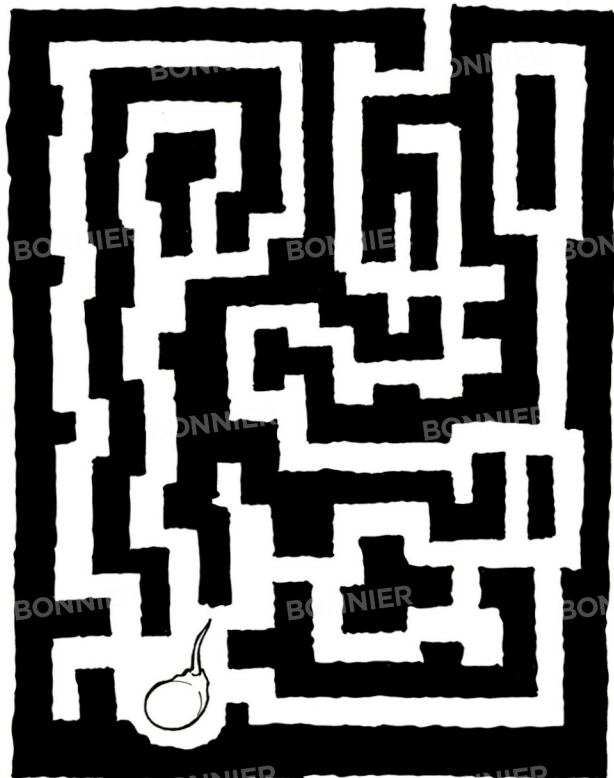


You can plant bean sprouts yourself and see how fast they grow!



## BEANSPROUT MAZE

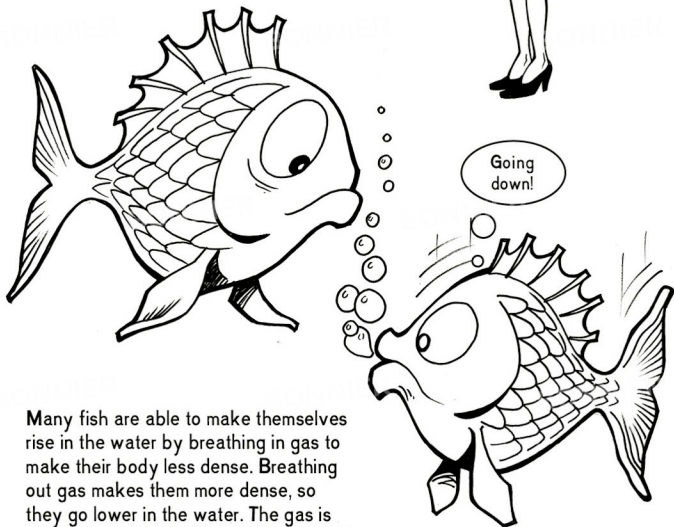
Help the new shoot find its way through the soil towards the light.



# SINK OR SWIM?

When you drop things in water, some objects float, while others sink. Why does this happen?

Objects that are lighter (less dense) than water float. Objects that are heavier (more dense) than water sink. A huge, heavy ship made of metal floats because it contains a lot of air; the ship and the air together are less dense than the water.



Many fish are able to make themselves rise in the water by breathing in gas to make their body less dense. Breathing out gas makes them more dense, so they go lower in the water. The gas is stored in a part of the fish's body called a swim bladder.



# WHICH OBJECTS FLOAT?



OBJECT	FLOAT	SINK	RIGHT OR WRONG?
ELASTIC BAND			
PENCIL			
PAPER CLIP			
COIN			

It isn't always easy to guess which objects will sink or float! Collect some small objects, such as a paperclip, an egg, a grape, a cork, an ice cube, a feather, and a spoon. First guess which ones will float, and write your guesses in the 'float' or 'sink' columns. Then test the objects and see whether you were right.





# SOLAR SYSTEM

The Sun is our local star. The solar system is the family of planets that circle our sun. There are eight planets and one dwarf planet, Pluto. The planets move around the Sun in paths called orbits.



UNS

---

EPITRUJ

---

○ SVNEU

---

○ ASRM

---

○ CRERUYM

---

○ TRAHE

---



Unscramble the letters to find the names of objects in the solar system.

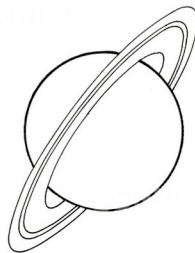
TPNEEUN

---



○  
OTLPU

---



NUTASR

---



NAURUS

---

## DID YOU KNOW?

The Sun's gravity holds the planets in place. The Sun makes up 99 per cent of all the matter in the solar system. The Sun is so huge that a million Earths would fit inside it.

# LIFE IN THE UNIVERSE

IS ANYONE OUT THERE?

The Earth is the only planet we know of that has life. But, with billions and billions of planets circling all the stars in the universe, there may well be life out there somewhere! Alien creatures may look very different from any life on Earth.

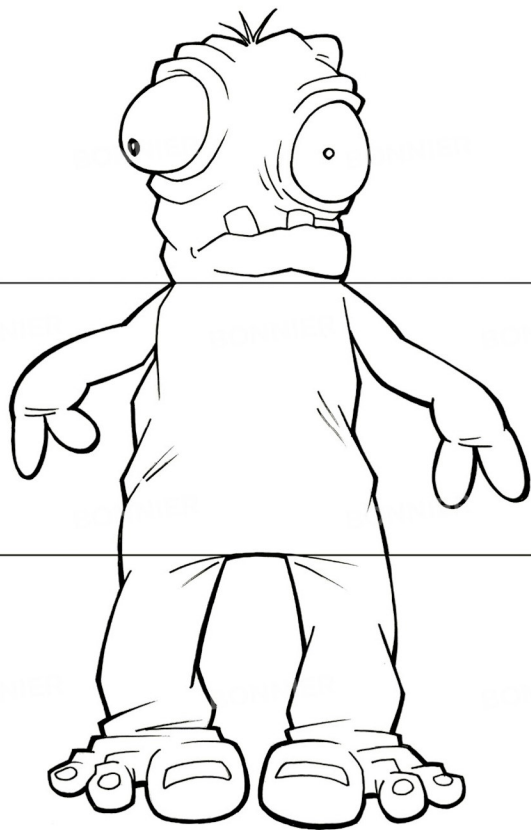
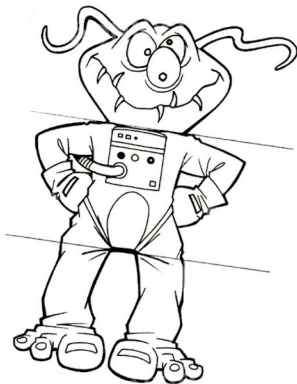
Scientists believe there are over 100 billion galaxies in the universe!



## MIX AND MATCH ALIENS

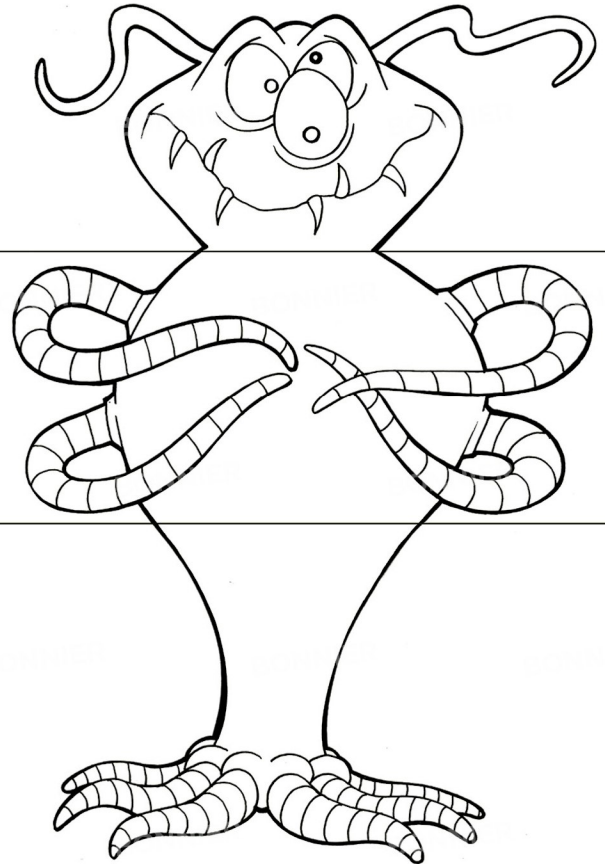
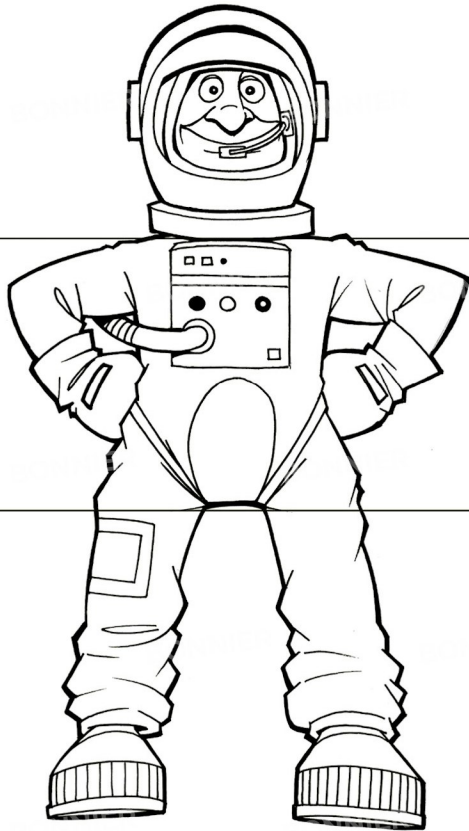
Colour in the aliens on the next six pages. Cut along the lines to separate the heads, bodies and legs of the aliens. Swap the strips to make weird and wonderful aliens that have never been seen before!

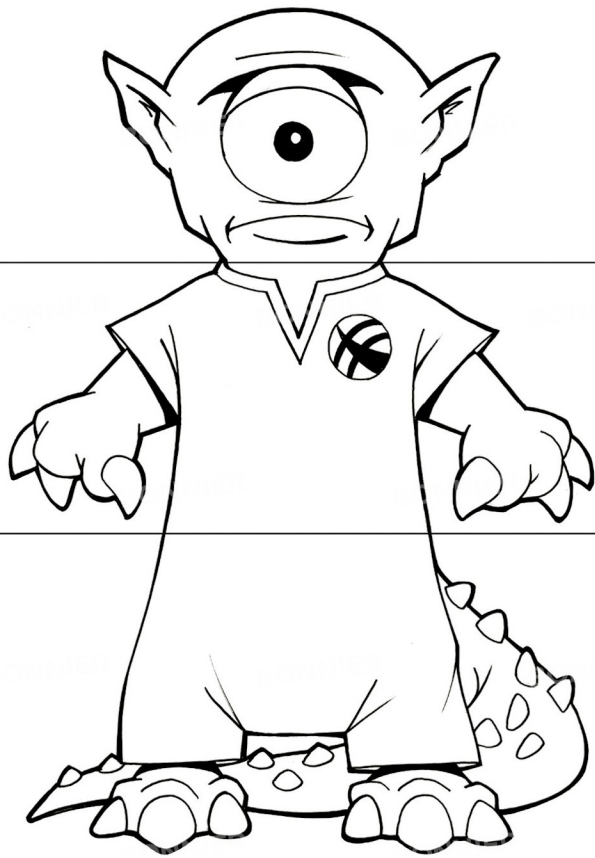
(If you don't want to cut the book, you can trace the pictures instead.)

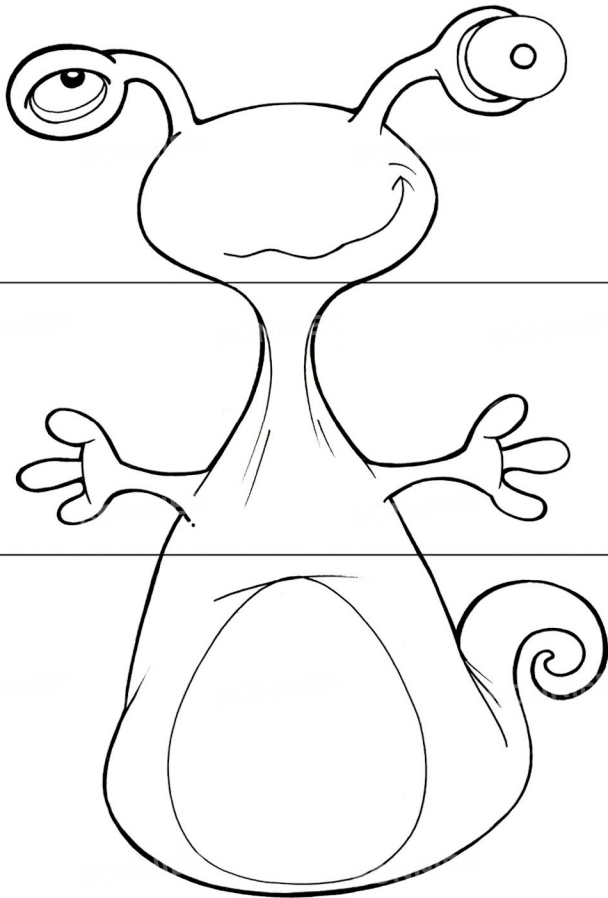


cut  
here

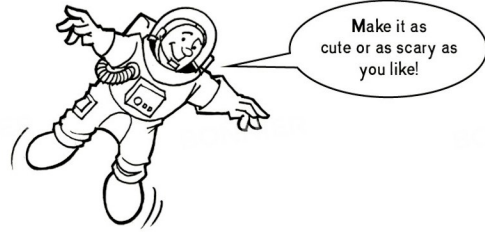
cut  
here







Draw your own alien character floating in space.

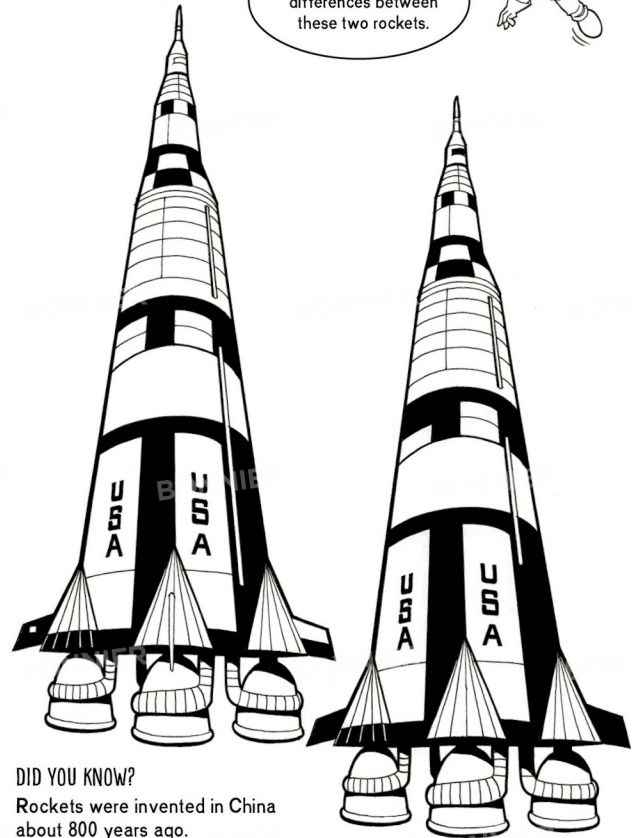
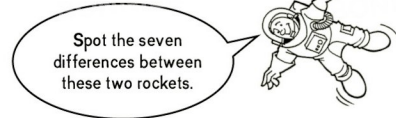
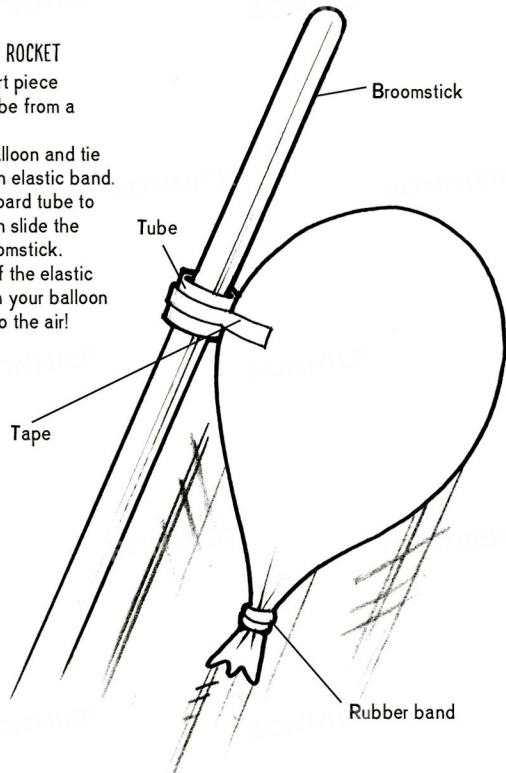


# LAUNCH YOUR OWN ROCKET!

Rocket engines burn up huge amounts of fuel to escape Earth's gravity. The rocket must be travelling at around 30,000 kilometres per hour to reach space.

## MAKE A BALLOON ROCKET

1. Cut off a short piece of cardboard tube from a kitchen roll.
2. Blow up a balloon and tie the neck with an elastic band. Tape the cardboard tube to the balloon, then slide the tube onto a broomstick.
3. Now take off the elastic band and watch your balloon rocket shoot into the air!



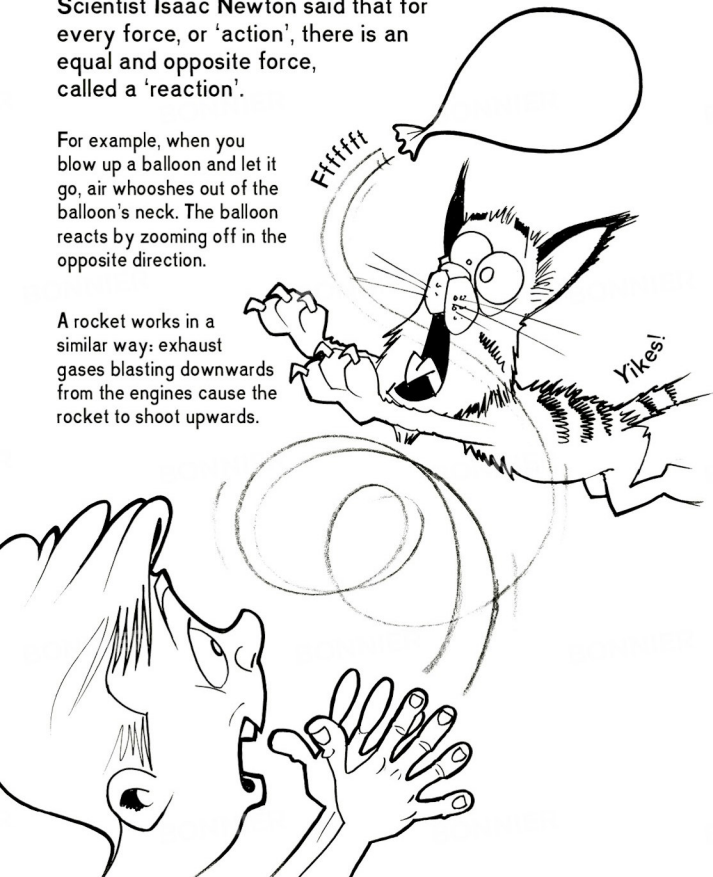
**DID YOU KNOW?**  
Rockets were invented in China about 800 years ago.

# ACTION AND REACTION

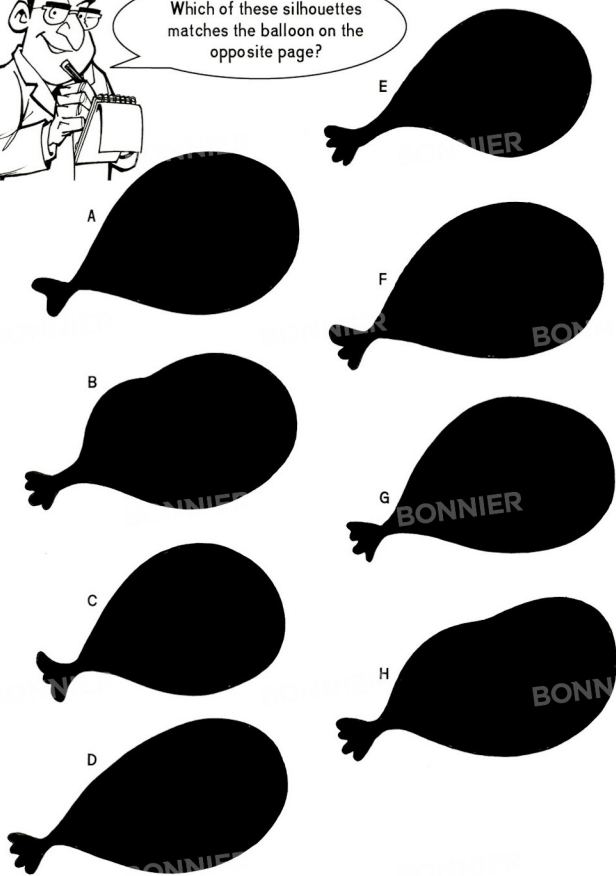
Scientist Isaac Newton said that for every force, or 'action', there is an equal and opposite force, called a 'reaction'.

For example, when you blow up a balloon and let it go, air whooshes out of the balloon's neck. The balloon reacts by zooming off in the opposite direction.

A rocket works in a similar way: exhaust gases blasting downwards from the engines cause the rocket to shoot upwards.

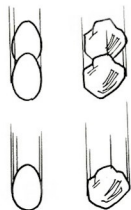


Which of these silhouettes matches the balloon on the opposite page?



# GRAVITY

Gravity is an invisible pulling force that makes objects fall to the ground. On Earth, the force of gravity pulls everything towards the planet's centre.

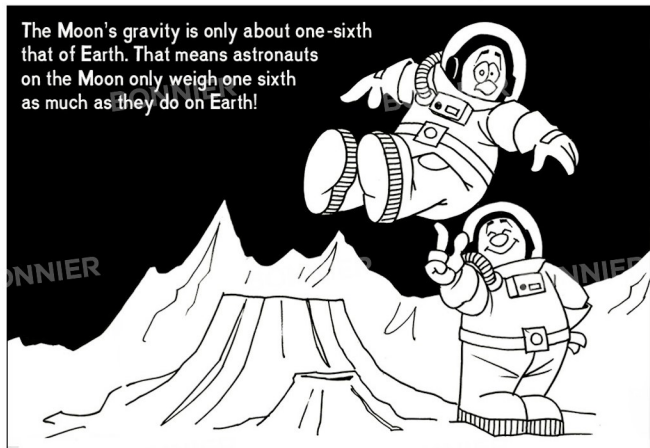


A heavy rock weighs much more than an egg of the same size, but gravity makes them fall through the air at the same speed.

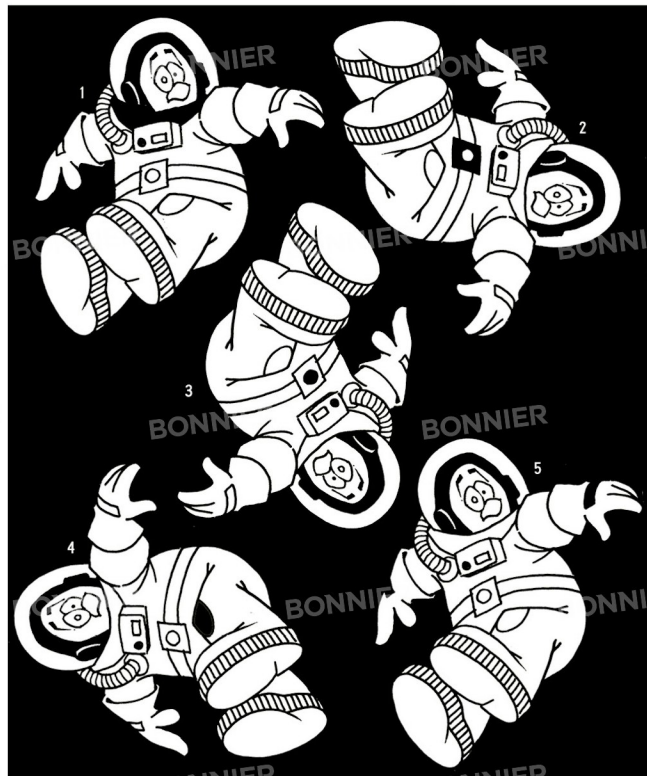


The Sun, Moon, Earth and other planets all have different gravity.

The Moon's gravity is only about one-sixth that of Earth. That means astronauts on the Moon only weigh one sixth as much as they do on Earth!



What goes up must also come down! When you jump in the air, gravity is the force that makes sure you come back down again. Take a good look at the images below. Which one is an exact match to the page opposite?

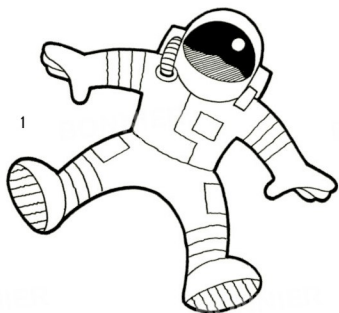




# WALKING IN SPACE

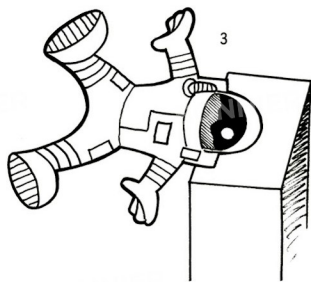
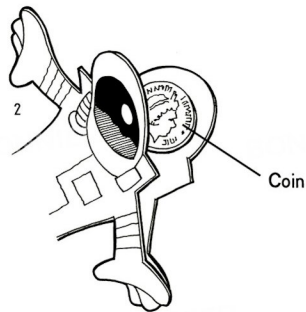
Astronauts walk in space to do experiments and fix equipment.

The space suit provides oxygen and protects the astronaut from very hot or freezing conditions in space.



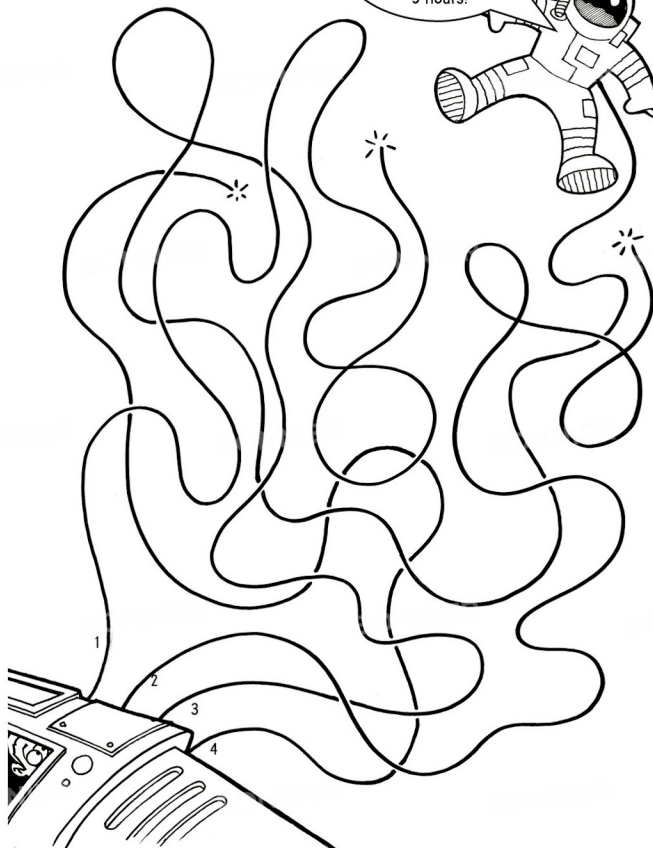
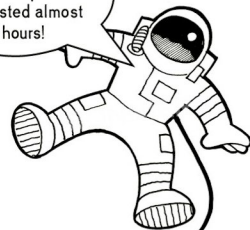
## MAKE A SPACE-WALKING ASTRONAUT

1. Trace or copy the astronaut twice on paper.
2. Colour your two astronauts, cut them out and stick them together with a coin sandwiched between the two heads.
3. Place the astronaut's head on the edge of a table or other object. The weight of the coin makes the figure appear to defy gravity!



Which cord stops our astronaut from floating off into space?

**DID YOU KNOW?**  
The longest spacewalk ever lasted almost 9 hours!

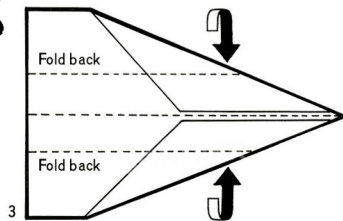
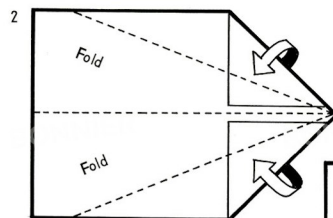
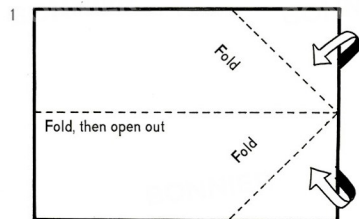




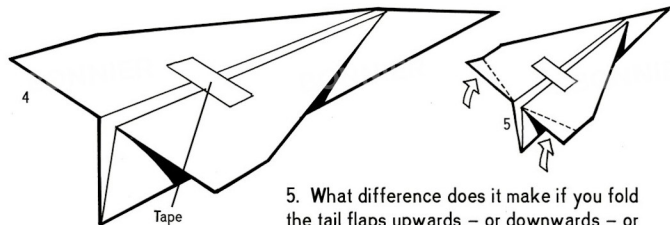
# FLIGHT

Aeroplanes stay in the air because of a force called lift.

Aircraft wings have a special shape like a bird's wing – curved on top, flatter below. When air flows over the wing, it flows faster over the curved top surface, which reduces the air pressure above the wing. This produces lift, sucking the plane upwards and keeping it in the air.



4. Fold upwards along the central crease and tape together as shown. Now try out your paper plane.



5. What difference does it make if you fold the tail flaps upwards – or downwards – or one up and one down?

## MAKE YOUR OWN PLANE

1. Fold a sheet of A4 paper in half, then open it out again. Now make diagonal folds as shown. Fold the flaps upwards.
2. Make two more diagonal folds as shown. Fold the flaps upwards.
3. Fold back the wings.

# BINARY NUMBERS

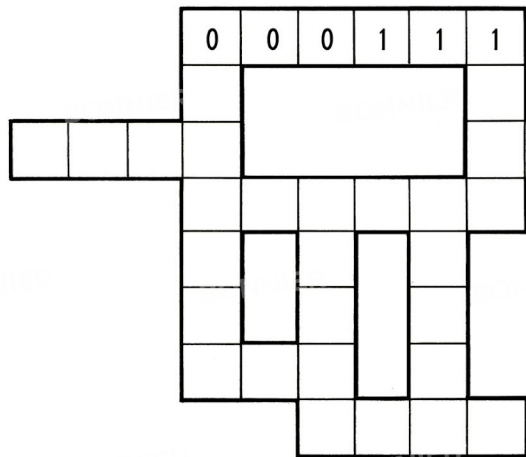
Binary means 'double' or 'in two parts'.

The binary system is used in computers to represent numbers and letters. The binary system uses only two numbers: 0 and 1. These represent 'on' and 'off' in computer circuits.



Here's how to write the numbers 1 to 10 in binary.

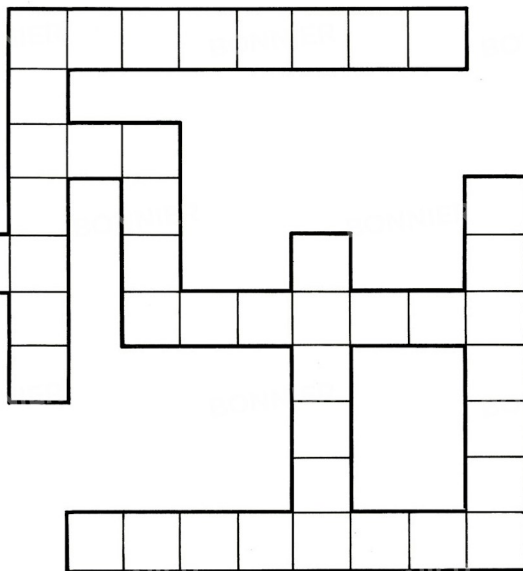
1	=	1
2	=	10
3	=	11
4	=	100
5	=	101
6	=	110
7	=	111
8	=	1000
9	=	1001
10	=	1010



Fit the following numbers into the grid below:

100, 000,  
 1111, 1110, 0011, 1001  
 01010, 10001,  
 001001, ~~00011~~, 100000, 110011  
 0000101, 1000011, 1011100, 1011011  
 10010010, 10001000

Hint: Count the number of squares in each branch of the grid.



# BINARY NUMBER SEARCH



Find the following numbers in the grid below.

10010  
10100  
10101  
11100

Note: Some of these numbers read from left to right on the grid, and some read from top to bottom.

1	0	1	1	0	1
0	1	1	0	0	0
1	0	0	1	0	1
1	1	1	0	1	0
0	1	1	1	0	0
1	1	0	1	1	1

1	1	0	1	0	0	1
1	1	0	1	0	0	0
1	0	1	0	0	1	1
0	1	0	0	1	0	0
1	0	1	1	0	0	1
0	1	1	1	0	0	1
1	0	1	0	1	1	0



Did you solve my colleague's puzzle?  
Now try mine.

110011  
100100  
111001  
001001  
101010

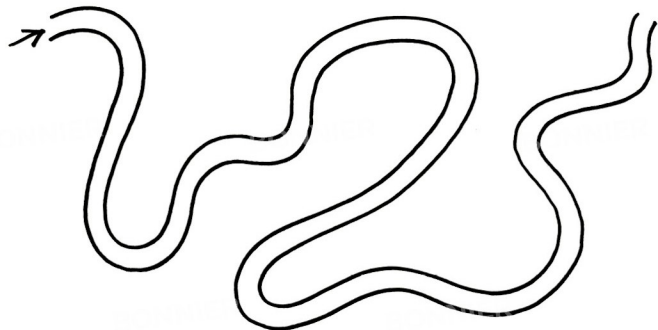
# ELECTRIC CURRENT

Electricity is a flow of tiny charged particles called electrons, along a path called a circuit. An electric current can only flow if the circuit is complete, without any gaps.

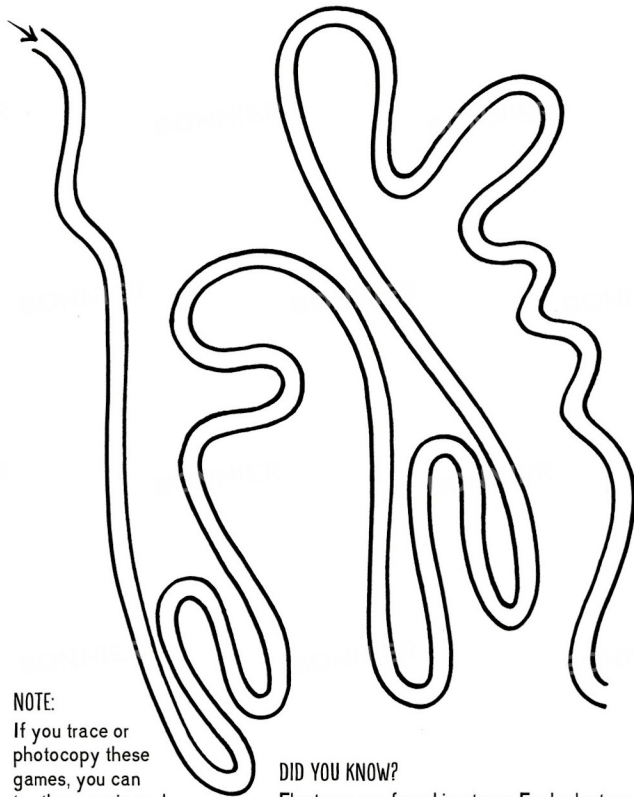
You've probably seen games like the one in this picture. If the loop touches the wire, the circuit is completed and the light comes on.



Here's part of a circuit like the one shown above. Use a pencil to draw a line along the path without touching the sides. Time yourself, rub the line out and try again. Can you improve your time?



Now try this longer, trickier circuit. Time yourself against a friend.



## NOTE:

If you trace or photocopy these games, you can try them again and again!

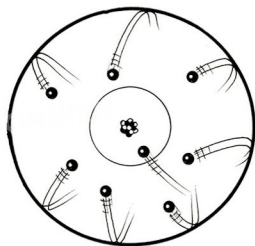
## DID YOU KNOW?

Electrons are found in atoms. Each electron carries a tiny electric charge.

# POWERFUL PROTONS

Inside the nucleus of an atom, you can find tiny subatomic particles called protons and neutrons.

The most important thing to know about an atom is how many protons it contains. This is its atomic number, and it helps scientists know what element they are looking at. Every element has its own unique atomic number.

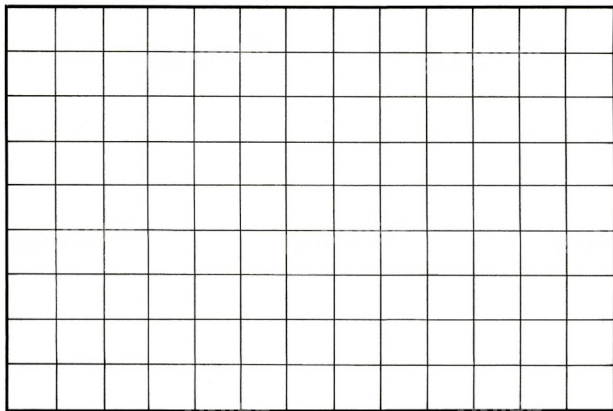
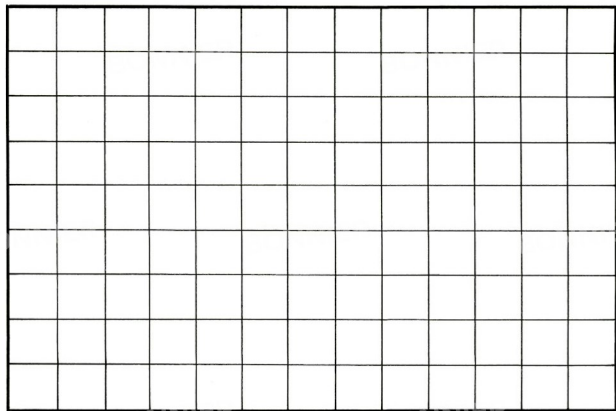
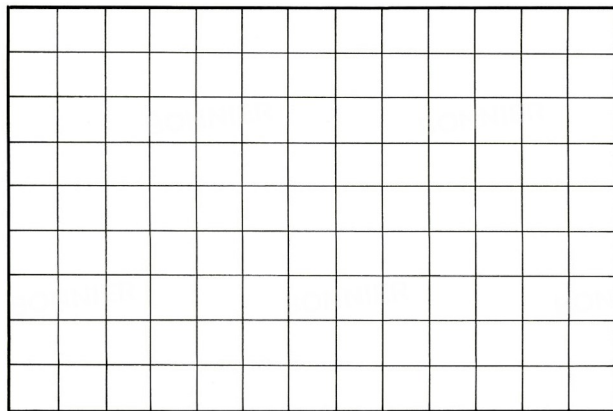


## PROTONS VS. NEUTRONS GAME

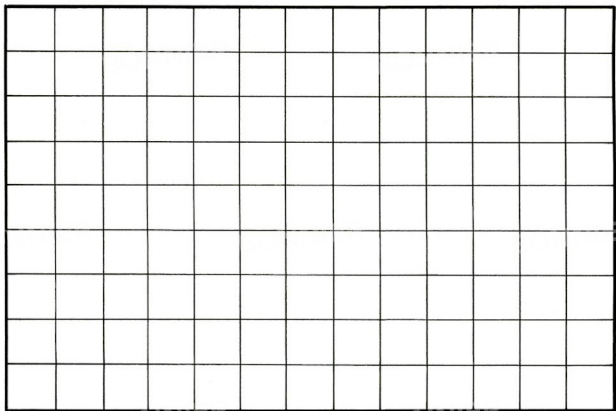
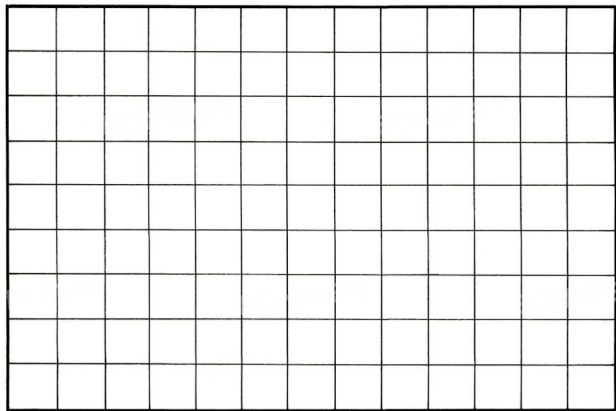
One player chooses protons, the other neutrons. Take turns to mark your symbol in a square. The first player with five symbols in a row – running horizontally (along), vertically (up/down) or diagonally – wins the game.



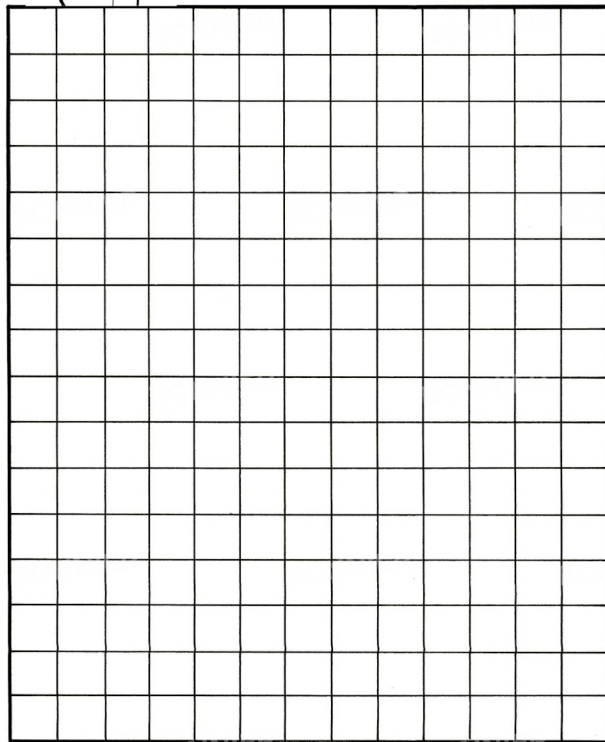
There are five grids printed for this game, but if you photocopy the grid you can play it as many times as you like.



Proton ● Neutron ○



In this giant version of the proton-neutron game, the winner is the one who gets the most sets of five in a row, horizontally, vertically or diagonally.

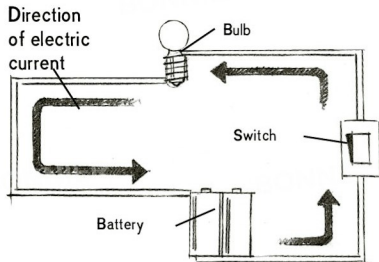


# ELECTRONS AND CIRCUITS

Electricity powers our lives. Just take a look around!  
How many electronic gadgets and machines can you count?

## ELECTRIC CIRCUITS

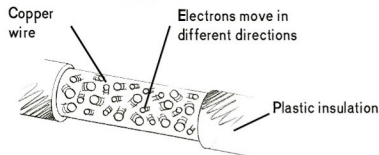
An electric circuit is a pathway made of wires, along which electricity can flow. This simple circuit is made up of a battery, three wires, a bulb and a switch. When the switch is turned off it breaks the circuit, so electricity cannot flow – and the light goes out.



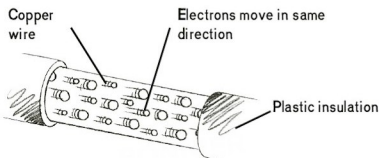
## ELECTRONS

Usually, electrons move in different directions. But, when a battery is connected and the circuit is completed, all the electrons flow along the wire in the same direction. This is an electric current.

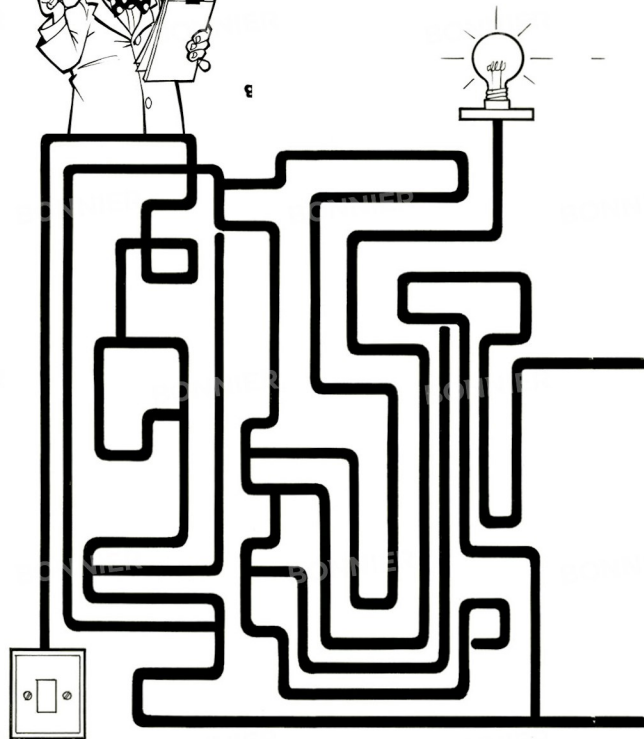
### BATTERY NOT CONNECTED



### BATTERY CONNECTED



Follow the wiring from the switch to the light.





# STATIC ELECTRICITY

Static electricity usually stays in the same place, rather than flowing through a circuit.

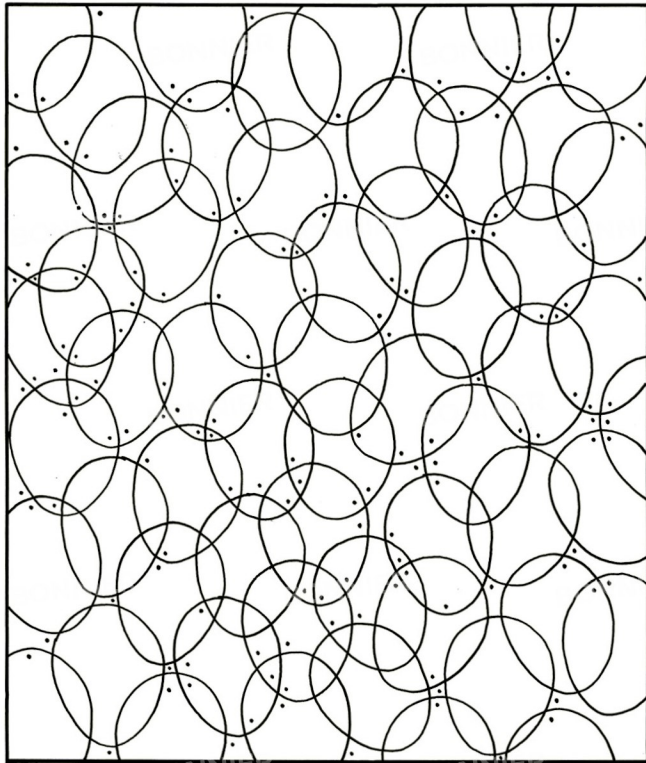
## HAIR-RAISING!

Rub a balloon against your T-shirt in one direction about 20 times. This will give the balloon a small static charge. This force will attract light objects, such as your friend's hair! It will also make the balloon stick to the ceiling.



## BALLOON SEARCH

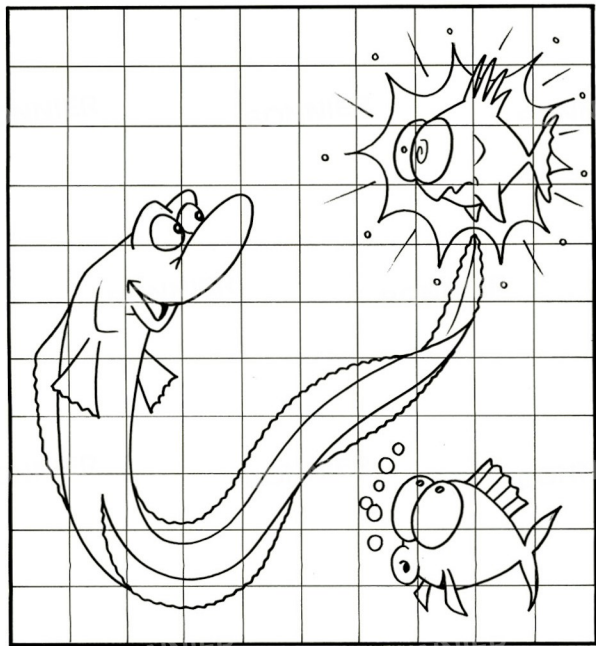
Colour the shapes with dots in them to find out how many balloons are hidden in the picture.



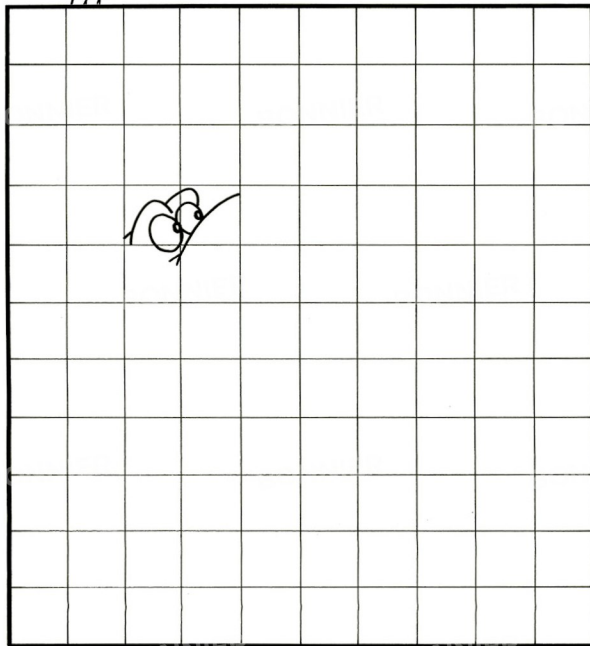
# SHOCKING FISH!

THE ELECTRIC EEL IS A FISH THAT CAN MAKE ITS OWN ELECTRICITY!

The eel uses special muscles in its long, slender body to produce an electric charge. It can use this electricity to shock and stun other fish before eating them. It can also give its enemies a shock to avoid being eaten. The older the eel, the more powerful a shock it can give.



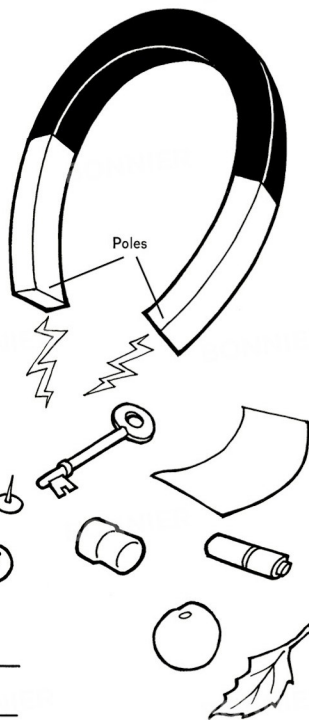
Copy the scene opposite, using the grid of squares to help you. You could finish your drawing by adding speech bubbles.



# MAGNETISM

Magnets are materials that attract metals such as iron and steel.

The invisible magnetic force is concentrated at points called poles, such as the ends of a horseshoe magnet. The Earth is a giant magnet, with poles in the far north and south.



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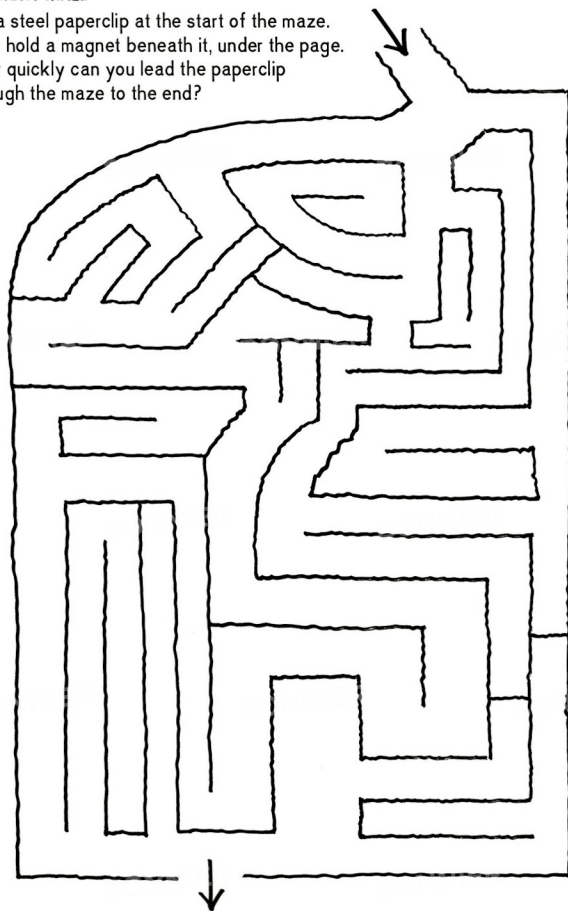
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Which of the objects shown here will be attracted by a magnet? Write down your answers first, then check with a magnet to see if you guessed right!

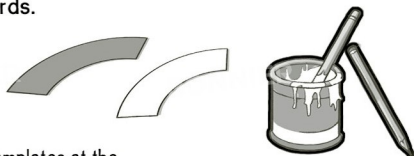
## MAGNETIC MAZE

Put a steel paperclip at the start of the maze. Now hold a magnet beneath it, under the page. How quickly can you lead the paperclip through the maze to the end?



# CURIOUS CURVES

This is a simple optical illusion or trick of the eye created by using two curved cards.

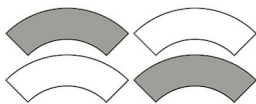


## THE EXPERIMENT

1. Trace the two curved templates at the bottom of the page. Paint one blue and one red (or any other colours you like).
2. Hold the red one above the blue one. The blue one will look longer than the red. Now hold the blue one above the red one. Now the red one looks the longer of the two!

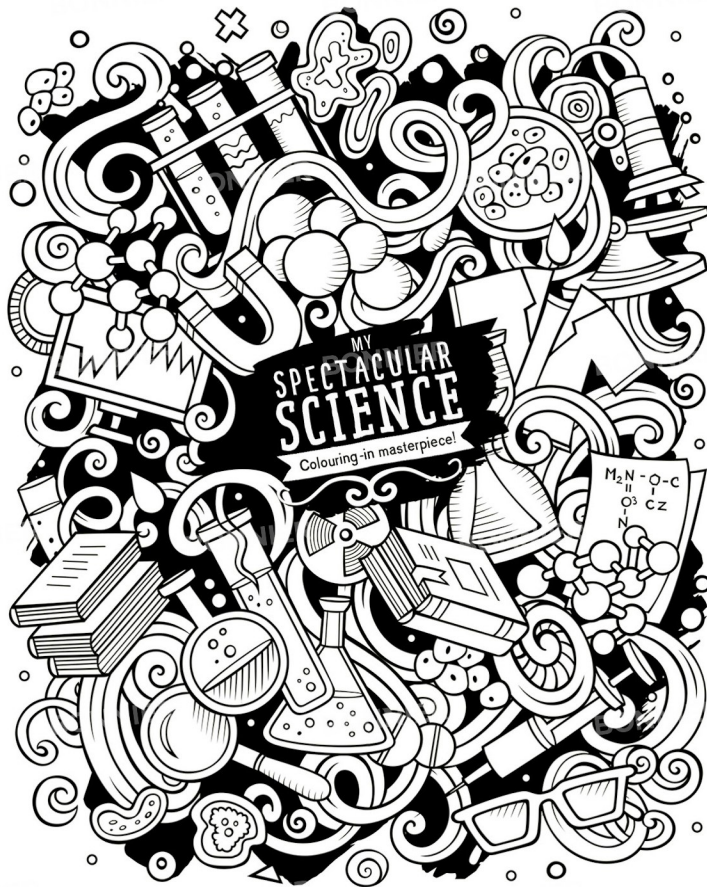
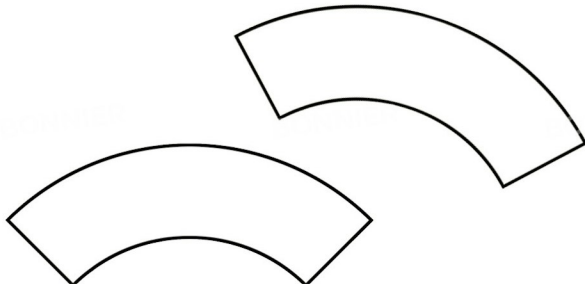
## YOU WILL NEED:

Templates  
Pencil  
Paint and paintbrush



## WHY?

Because the top curves are longer than the bottom ones, this tricks the brain into thinking that one of the cards is bigger than the other.



# THE ULTIMATE SCIENCE QUIZ

GET READY TO TEST YOUR KNOWLEDGE IN THIS SUPER SCIENCE QUIZ!

Don't forget to colour in your certificate on page 112 to mark yourself as a certified science genius!

1. What subatomic particles can be found inside an atom?
2. How many elements have scientists discovered?
3. What is gravity?
4. The particles in a gas, liquid and solid are arranged differently. How are they arranged in a liquid, and what does this allow liquid to do?
5. Who invented the first telephone?
6. Name a gas that is lighter than air.  
Hint: it makes balloons rise!
7. How many planets are in our solar system?  
Can you name them?
8. The binary system is used in computers to represent numbers and letters. What numbers does it use?
9. Which branch of science is the study of energy, forces, and matter?
10. What is seed germination?



11. True or false: hot air rises?
12. Who said that for every force, or 'action', there is an equal and opposite force, called a 'reaction'.
13. How can you decipher an element's atomic number?
14. Scientists have theorised the universe began how many years ago?
15. What force relates to two surfaces rubbing, or trying to slide, across each other?
16. Rocket engines burn up huge amounts of fuel to escape Earth's gravity. How fast must a rocket travel to reach space?
17. What is the name of Earth's closest galactic neighbour?
18. What animal can produce its own electricity? Hint: it can be found in the ocean!
19. How many minutes does it take for the Sun's light to reach the Earth?
20. Primary colours are unique because they are the origin of all other colours and cannot be created by mixing other pigments. Can you name all three of these primary colours?

# GLOSSARY

**Atom:** The basic building block for all matter. Atoms are extremely small and contain even smaller particles called protons, neutrons and electrons.

**Binary numbers:** The binary system uses only two numbers, 0 and 1, which signify 'on' and 'off' in computer circuits and represent numbers and letters.

**Biology:** The scientific study of all living things and their natural processes, such as its origins, growth, behaviour, evolution and distribution.

**Chemistry:** The scientific study of elements and substances, including their composition, structure, properties and how they react.

**Electricity:** The flow of electric power or charge, such as protons and electrons.

**Electron:** Negatively-charged subatomic particles that orbit the nucleus.

**Friction:** The force that occurs when two surfaces rub against each other.

**Galaxy:** A vast collection of gas, dust, stars, planets, comets and solar systems, all held together by gravity. Our galaxy is called the Milky Way.

**Gas:** One of three states of matter. Gases are made of randomly-arranged particles which move freely.

**Germination:** When a seed or spore begins to sprout and grow.

**Gravity:** An invisible pulling force that makes objects fall to the ground and pulls everything to the planet's centre.

**Liquid:** One of three states of matter. Liquids are made of close together particles that can slide past each other, and so have no set shape. Water is an example.

**Neutrons:** Subatomic particles with no charge that exist within the nucleus.

**Physics:** The scientific study of energy, forces, and matter, including the way things move and the behaviour of energy, such as heat and light.

**Protons:** Positively-charged subatomic particles that exist within the nucleus.

**Solar system:** A collection of planets and smaller objects that all revolve around a central star.

**Solid:** One of three states of matter. Solids are made of closely-packed particles in a fixed, rigid position. Ice is an example.

# ANSWERS

Page 7:

ENITNESI = EINSTEIN  
UCIRE = CURIE  
NIDRAW = DARWIN  
GINKHAW = HAWKING  
TOWNEN = NEWTON  
YADARAF = FARADAY  
UPREATS = PASTEUR  
LAGOILE = GALILEO

Page 11:



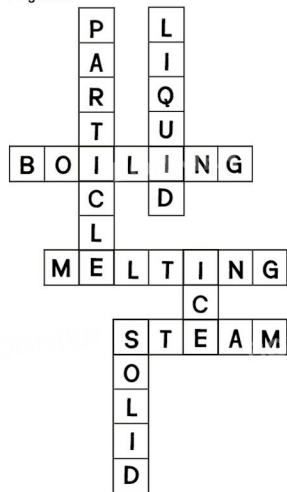
Pages 18–19:

String 1.

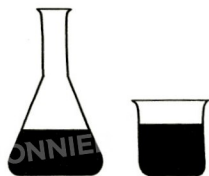
Page 21:

15 eggs

Pages 25:

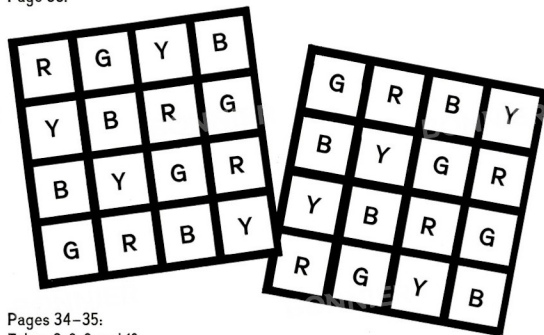


Pages 26–27:



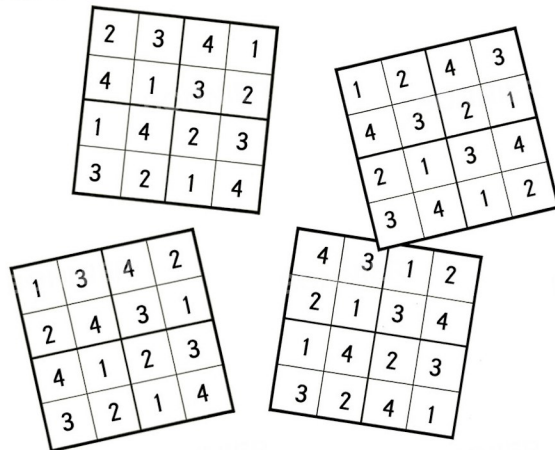
Pages 30–31:  
1 and C, 2 and D, 3 and A, 4 and B.

Page 33:

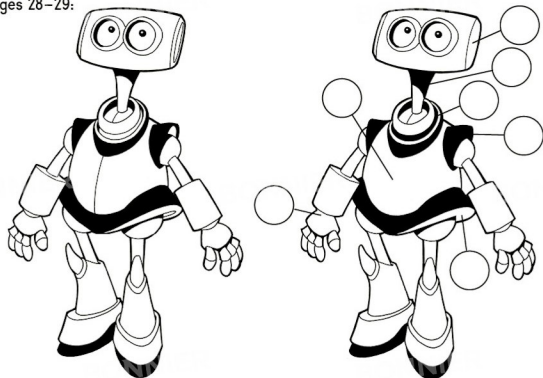


Pages 34–35:  
Tubes 2, 8, 9 and 10.

Pages 36–37:



Pages 28–29:



Pages 38–39:

There are at least 60 words of three letters or more that can be made. Here are some of the more interesting ones:

3 letters: eel, eye, ire, ice, icy, rye, try, tie, cry, lie, lye, lee, yet

4 letters: Eric, tree, tilt, yeti, tire, tyre, tier, tile, reel, rely, rite

5 letters: elect, elite, litre, Cyril, lyric, relic, Crete, trice, creel

6 letters: circle, cleric, critic, relict, Celtic, celery, citric, recite

8 letters: tricycle, celerity

You may have to look some of these up in the dictionary.

Pages 46–47:

There are 17 of each type.

Pages 50–51:

String 4

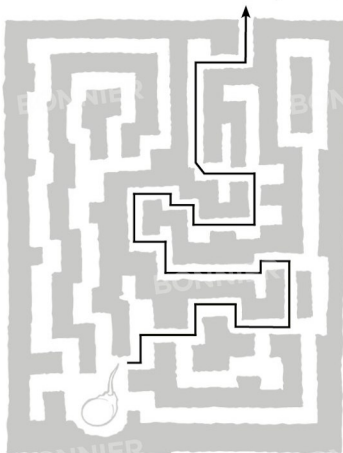
Pages 52–53:

B and D

Page 57:

11 flasks

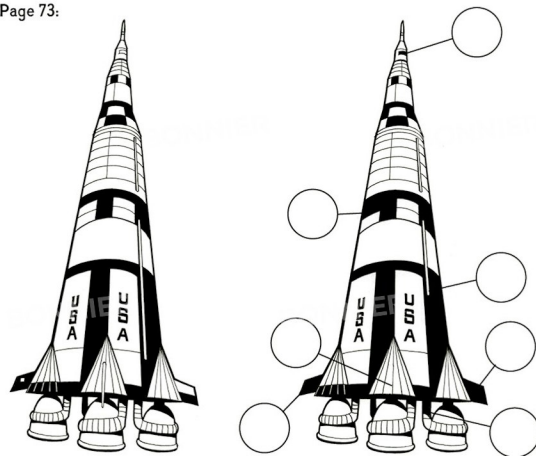
Page 59:



Pages 62–62:

Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto.

Page 73:



Page 75:

G.

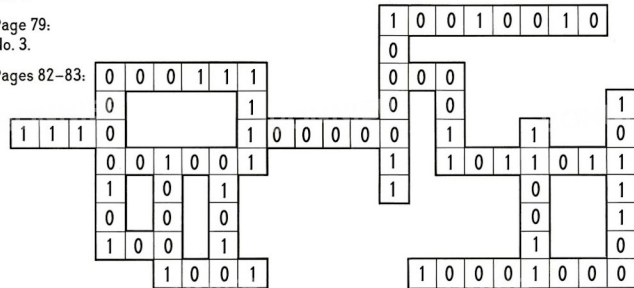
Pages 76–77:

No. 4.

Page 79:

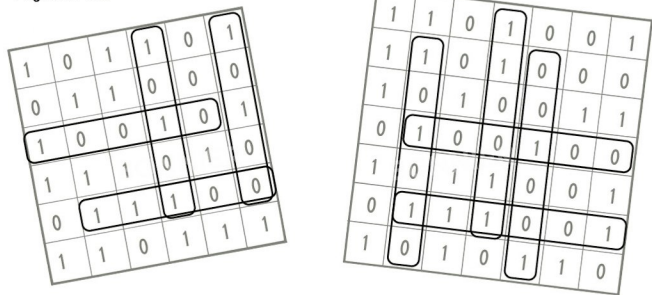
No. 3.

Pages 82–83:

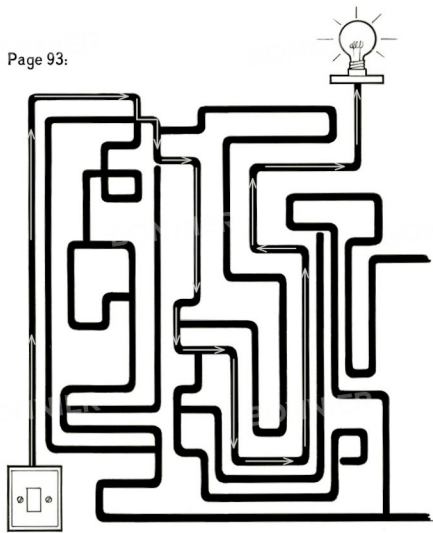




Pages 84–85:

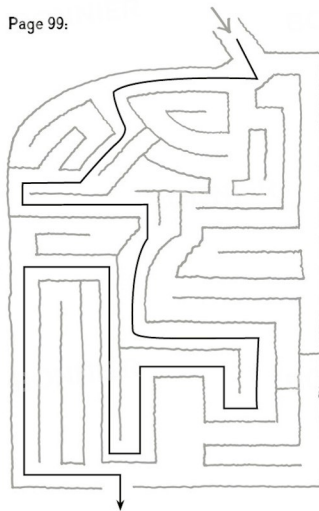


Page 93:



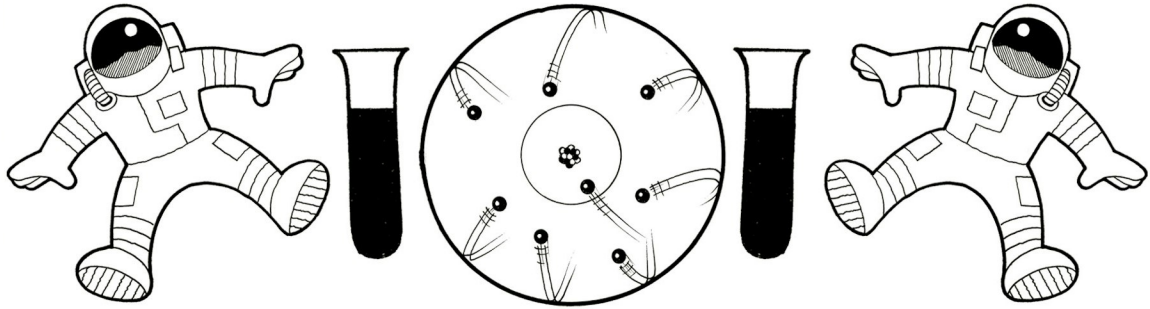
Page 95: 11 balloons.

Page 99:



Pages 102-103: The Ultimate Science Quiz

- 1: Electrons, protons and neutrons.
- 2: 118 different elements, though only 98 of them naturally occur on Earth.
- 3: Gravity is an invisible pulling force that makes objects fall to the ground and pulls everything to the planet's centre.
- 4: In a liquid, particles are close together in no distinct arrangement. Particles can move around and slide over one another, meaning liquids can flow and be poured.
- 5: Alexander Graham Bell.
- 6: Helium.
- 7: There are eight planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. There is also a dwarf planet called Pluto.
- 8: The binary system uses only two numbers: 0 and 1.
- 9: Physics.
- 10: Germination is when a seed or spore begins to sprout and grow.
- 11: True.
- 12: Sir Isaac Newton.
- 13: You can determine an atom's atomic number by counting how many protons it contains in its nucleus.
- 14: 14 billion years ago.
- 15: Friction.
- 16: At around 30,000 kilometres per hour.
- 17: The Andromeda galaxy.
- 18: An electric eel.
- 19: Around 8.5 minutes.
- 20: Red, yellow and blue.



# CERTIFICATE OF BOREDOM BUSTING

THIS CERTIFICATE IS PRESENTED TO

PROFESSOR .....

UPON THE COMPLETION OF ALL ACTIVITIES IN THIS BOOK.

## CONGRATULATIONS!

