

The Spark

Magazine

PUZZLES, QUIZZES, OUTDOOR LEARNING

ISSUE
No11

**THE SCIENCE
OF CHOCOLATE**

**EXPLORE
CHROMATOGRAPHY**

**LEARN ABOUT
TANGRAMS**

**MEET A
SOFTWARE
ENGINEER**

With support from the Inspiring
Science Fund provided by BEIS,
UKRI and Wellcome.



GLASGOW
**SCIENCE
CENTRE!**



Inside

This issue

SHARE YOUR PICS WITH US



If you try any of our activities this week, please show us how they turned out! Send your favourite pictures to CLDteam@gsc.org.uk or share with us [@TheBothyGSC](https://twitter.com/TheBothyGSC) on Twitter. We'll share a selection of your pictures in the magazine.

Share @TheBothyGSC
email to CLDteam@gsc.org.uk

WELCOME

Welcome to another jam-packed issue of The Spark!

In this Spring edition, we'll be getting cryptic with Caesar Ciphers, geometric with Tangrams, curious with Chromatography, and explore beautiful bubbles! Plus, use your recycling to play the Zero Waste Scotland Board Game, meet a Software Engineer, and discover the science of chocolate.

You can watch the videos that go along with the experiments in this issue on the Glasgow Science Centre Facebook page or YouTube channel.

We also have our brand-new competition! Do you love The Spark? Would you like to win some science goodies? Enter our competition! You can find full details on how to enter at the back of this magazine.

Best wishes,
Glasgow Science Centre



EASTER EGG HUNT GAME



There are 7 Easter eggs hidden in the pages of the Spark Magazine, each one has a letter on it. Can you find all 7 eggs and rearrange the letters to make the hidden word?

CLUE

The name of the astronomical phenomena that results in 12 hours of daylight and 12 hours of night.





FAMILY QUIZ

All questions linked to activities in this issue

Answers on
back page

QUESTIONS

- Q01.** What tree do we harvest seeds from to make chocolate?
- Q02.** How many wings does a butterfly have?
A. 2 B. 4 C. 6
- Q03.** Which chemical found in coffee and chocolate helps make us feel more alert and active?
- Q04.** Chocolate can be toxic to some animals – can you name one?
- Q05.** True or false: your brain can show when you've eaten too much chocolate?
- Q06.** What important gadget did a bar of chocolate help engineers invent?
A. Microwave B. Hairdryer C. Hoover
- Q07.** What does Wi-Fi stand for?
A. Wireless Field B. Wireless Fidelity C. Nothing
- Q08.** Which frozen gas forms dry ice?
- Q09.** Which planet has the most moons?
- Q10.** True or false: bacteria can eat some of the plastic that fills up our landfill sites?
- Q11.** This year famous code breaker Alan Turing will appear on what bank note?
A. £10 B. £20 C. £50
- Q12.** Out of the seven colours of the rainbow, which one is in the middle?
- Q13.** What land animal lays the biggest egg?
- Q14.** How much water does it take to produce a typical loaf of bread?
A. 10 litres B. 150 litres C. 1200 litres
- Q15.** Tangrams are thought to originate from China during what time period?



I'M A... SOFTWARE ENGINEER

HINT

You may find some answers throughout this magazine or in our #GSCAtHome videos.

Meet Colin McGuire

A software engineer who develops computer programs to help make Wi-Fi in phones and homes as good as possible.

"Currently I am working with a new type of Wi-Fi which will be in everyone's phone in the next couple of years. I didn't always want to be a software engineer working with Wi-Fi. The amazing thing about engineering and technology is it changes very quickly. When I was in high school Wi-Fi hadn't been invented yet, so the job I do today didn't exist! Who can predict what amazing technologies the future engineers currently in school will be working on in 10 years. To be a good software engineer, you need to talk with customers to understand the problem, and work with a team of engineers to solve it. Writing good code is just a small part of being a good software engineer. It is really rewarding to solve a difficult problem that helps a customer. I also enjoy making friends and working with engineers all around the world."

Hobbies: I enjoy cycling. The steeper the hill the better!

Favourite Food: Pizza.



ACTIVITY

Chromatography

What will you do?

Explore the hidden colours in black ink using chromatography. Colour chromatography is a technique that uses capillary action to separate colours from different types of ink at different rates.

Make sure you have adult supervision before starting.

What will you need?

Scissors, a black marker or Sharpie, absorbent tissue paper or a coffee filter, a paper clip or clothes peg, a glass



Fill the glass half-full of water.



Cut your absorbent material into strips so they can fit into the mouth of the glass.



Use the marker to draw a line about one inch from the bottom of the strip.



Dip the bottom of the tissue or coffee filter in the water. Make sure the line of black ink is just above the water's surface, and fasten in place using a paperclip or clothes peg.



Wait a few minutes for the ink to move up the paper. What different colours can you see?

More to try

Use chromatography to make colourful butterflies!

You will need another piece of filter paper or tissue paper, colouring pens, a spray bottle of water, a peg, and a pipe cleaner.



Decorate your filter paper with polka dots or a few squiggly lines.



Lightly spray your design with some water. Watch how the water is absorbed and carries the colours with it.



Leave it to dry for a few minutes so the paper doesn't tear as you make your butterfly.



Once dry, pinch the paper in the middle and secure in place with a peg. The peg will be the body of your butterfly. The tissue paper will be its wings.



The final touch is to make some antennae. Fold a pipe cleaner in half and place it in the mouth of the peg with the wings to secure it in place. Curl up the end of the pipe cleaner to make nice twisty antennae.

FUN FACTS

The word **chromatography** comes from the Greek words 'chroma' meaning colour and 'graphe' meaning writing.

The earliest evidence of ink used for writing is from approximately **5,000** years ago, in Ancient Egypt.

The average ballpoint pen has enough ink in it to draw a line **900m** long!

That's the equivalent of writing **333 postcards**.



Share pictures of your designs with us by sending them to CLDteam@gsc.org.uk or message [@TheBothyGSC](https://twitter.com/TheBothyGSC) on Twitter

ACTIVITY

Tangrams

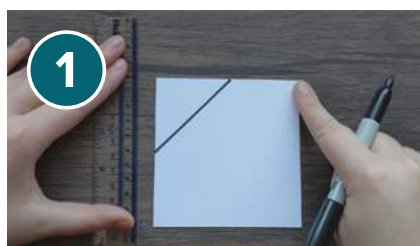
What will you do?

You will make your own tangram, a puzzle which has 7 geometric shapes. These shapes can be manipulated and moved around to make many different pictures and patterns.

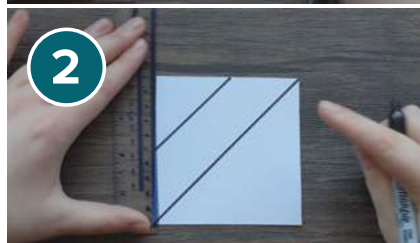
Make sure you have adult supervision before starting.

What will you need?

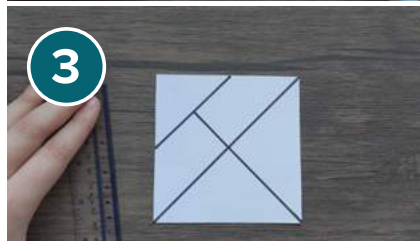
One square sheet of paper or card, 10cm by 10cm, in any colour.
Plus a ruler, pen or pencil, scissors, colouring pens, paints or crayons (optional)



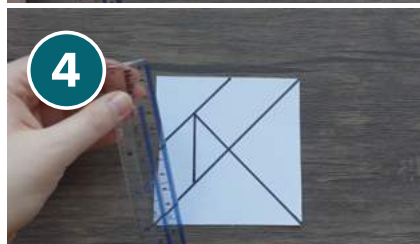
Take your square sheet of paper or card and measure 5cm along the top and left sides of the paper. Mark with a dot and then connect these two dots together.



Draw a line from the top right corner to the bottom left corner.



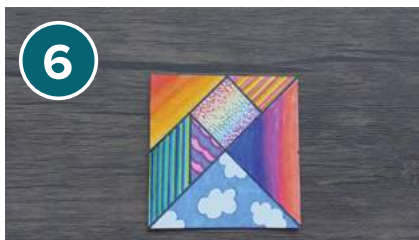
Line up your ruler from the top left and bottom right-hand corners. Draw a line, but this time don't go all the way, start at the very first line you drew and draw a line to the bottom right-hand corner.



From where you started in Step 3, draw a straight line down to the bottom of the paper but stop as you reach the line you drew in Step 2. This line is parallel to the left-hand side of the paper.



Measure 5cm down on the right-hand side of the page, mark with a dot. Line your ruler up with the top middle point and the new point you made on the right-hand side. Draw a line, from the top, stopping half-way, as you meet the line you have made in Step 2.



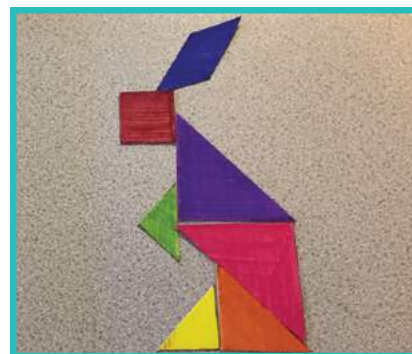
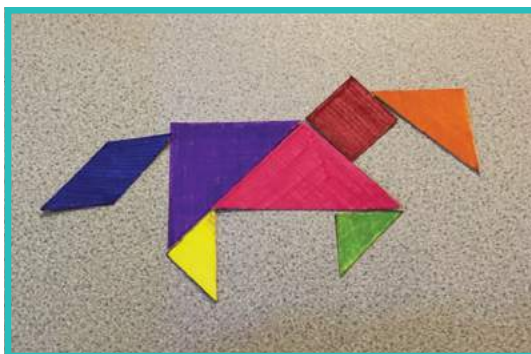
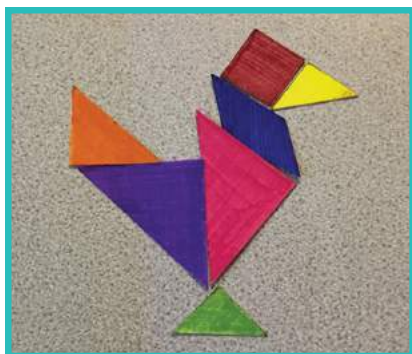
At this stage you could colour in your tangram set in bright bold colours, or maybe give each shape its own pattern.



Take your scissors and cut out your shapes. Now you will have 2 large triangles, 1 medium triangle, 2 small triangles, 1 square and 1 parallelogram.



Mix up your shapes and then see if you can arrange them back into one large square. Can you make the shapes below? What other pictures can you make?



More to try

Challenge your friends and family to make as many tangram animals as you can.

How big can you make your tangrams? Could you make a set from a sheet of paper 20cm by 20cm?

Can you write the letters of your name in tangrams?

Glue magnets onto your tangrams and use them on your fridge.

**FUN
FACTS**

Tangrams are thought to come from **China during the 18th century**.

Tangrams can be arranged into many different shapes and can be put together in an almost infinite number of ways. There have been over **6,500** documented tangram puzzle shapes.



Share pictures of your puzzles with us by
sending to CLDteam@gsc.org.uk or message
[@TheBothyGSC](https://twitter.com/TheBothyGSC) on Twitter

RECYCLING GAME

Can you make it to the finish?

Race to be the best recycler! Create your piece, roll the dice and try to get to the GOAL first!



if you don't have dice then you can roll the foil from your Easter egg into 6 small balls. Using your Easter egg box with a hole in the front, gently throw your foil balls above the hole. However many land in the hole is how many spaces you move.

The **CO₂** produced just by packing materials for Easter eggs is approximately **1,500 tonnes**.



This is equivalent to flying around the world **220** times or **500** return car journeys from Aberdeen to London.



Create your playing piece using the cardboard from your Easter egg. Draw and cut them out.



START

TAKE A SHORTCUT
IF YOU LAND HERE

YOU DIDN'T EAT
YOUR LEFTOVERS
MISS A TURN

RECYCLING
BONUS
MOVE FORWARD
2 SPACES

Tips to recycle your Easter egg

Check out the label on your Easter egg - does it tell you what can and cannot be recycled?

For cardboard cartons, remove any plastic windows, fold down and recycle with paper and card.

The plastic shell that comes with bigger Easter eggs is usually PET 1, look for this symbol. This is the same type of plastic that drinks bottles are made of. So if your local authority accepts plastic bottles then add this to your recycling pile.

Foil is widely recyclable so munch, scrunch and recycle!



PICKED UP
RUBBISH
MOVE FORWARD
1 SPACE

FORGOT YOUR
REUSABLE BAGS
MISS A TURN

RECYCLING
BONUS
MOVE FORWARD
3 SPACES

RECYCLING
BONUS
EXTRA
TURN

Check out our website for more fun activities
curiousabout.glasgowsciencecentre.org

RECYCLING
BONUS
MOVE FORWARD
2 SPACES

GOAL

YOU DIDN'T
RECYCLE YOUR
EASTER EGG BOX
MOVE BACK
2 SPACES

Packaging used in Easter eggs sold in Scotland is estimated to be nearly

900 tonnes

The split by material type is as follows:

**630
TONNES
CARDBOARD**

**270
TONNES
PLASTIC**

**ZERO
WASTE
SCOTLAND**

ACTIVITY

Bubbleology

What will you do?

Explore the science of bubbles and make your own bubble mix!

Make sure you have adult supervision before starting.

What will you need?

A tub to mix your bubble mix in, 240ml water, 4 tbsp dish washing liquid, 1 tsp baking powder, an A4 piece of card or paper, sticky tape, scissors



Mix the water, dish washing liquid and baking powder in a small tub to make bubble mix.



Roll your piece of card or paper into a cone shape and hold in place with sticky tape.



Use scissors to trim the wider end of the cone.

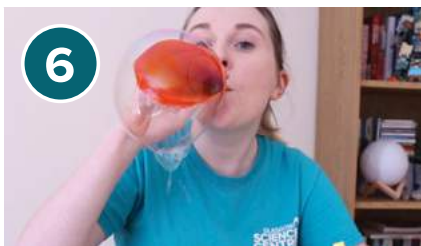


Trim the wide end of the cone until it can stand upright if placed on a table.



Gently dip the wide end of the cone into the bubble mix.

6



Blow through the narrow end to create your bubbles!

More to try

What happens when you try and touch your bubble? Bubbles pop when they dry up. Try covering your finger in bubble mixture and see if you can touch a bubble without it popping!

FUN FACTS

The **colours of a bubble** change depending on which way you are looking at it and where the light is coming from. If you see **blues and greens**, it suggests that the walls of the bubble are thick. **Yellows** suggest the walls are very thin.

No matter what **shape** of bubble cone or wand you have, you will always blow a bubble that has a **spherical shape**. This has got to do with the **surface tension** of water. The molecules of water have a very strong attraction to each other, they like to stick together.

When you **blow a bubble**, the resulting shape is a **sphere**. A sphere is the most efficient shape for storing the volume of air inside the bubble in the smallest possible area.



Share pictures of your bubbles with us by sending to CLDteam@gsc.org.uk or message @TheBothyGSC on Twitter

ACTIVITY

Caesar Ciphers

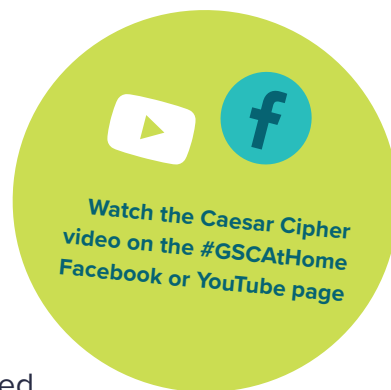
What will you do?

We are going to make a Caesar Cipher that you can use to make coded messages for your friends. The great thing is that only they will be able to understand (or decipher) the message.

Make sure you have adult supervision before starting.

What will you need?

Paper, ruler, pencils and pens, scissors



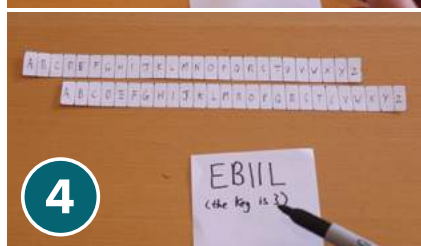
Our alphabet has 26 letters. Write down the alphabet in capital letters in a straight line. We are going to do this twice, with the second copy placed directly below the first.



Next, we are going to cut out these lines of the alphabet. We want to end up with two lines of paper that look like this. Ask a grown up for help if you need it, this can be quite tricky.



Lay both of your alphabets on a table, one above the other. The top one will stay in place – we will call this the 'plain', and the bottom one we will be moving left and right to make our secret codes – we will call this our 'cipher'.*



If we were to write the word 'HELLO' as an encoded message, we would use the letter that is underneath the letter that we want to use.

* For example, this would be your plain and cipher if you shift each letter by three spaces to the right.

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

If we moved the cipher three places to the right, we would say that our key was 3 and we would be able to start writing our secret messages. Notice how the 'X, Y and Z' of the cipher aren't underneath any letters. Move these letters to the spaces under the 'A, B and C' of the plain.

Let's Practice

Let's write 'HELLO' down as a practice. The first letter is 'H'. Looking underneath the letter 'H' we see the letter 'E'. Let's write that down. The next letter is 'E'. Underneath that is 'B'. 'L' is 'I', and 'O' is 'L'.

So, when you write your message, the letter H gets replaced with E, E gets replaced with B, and so on. For example, the word "HELLO" reads:

Plain: HELLO

Cipher: EBIL

More to try

Use your Caesar Cipher and create encoded messages as a guide to find hidden Easter eggs or prizes around your house.

Design and create your own cipher. How could it work and what could you use to create it?

 Cut out

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

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

The **Caesar Cipher** is named after Julius Caesar, who used it to **protect** important messages for his military.

The very first use of cryptography to send coded messages was by the **Spartan army** as early as **400 BCE**.

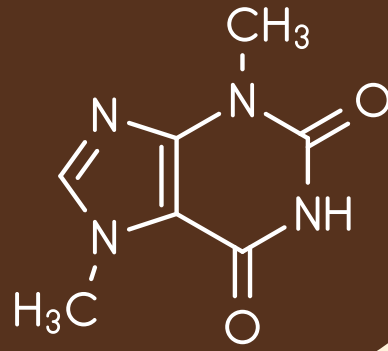
Famous British scientist **Alan Turing** and colleagues created a code breaking machine called the '**Bombe**' to decipher German military secrets during the second World War. By early 1942 the code breaking team were decoding about **39,000** messages a month.


**FUN
FACTS**



Share pictures of your codes with us by
sending to CLDteam@gsc.org.uk or message
[@TheBothyGSC](https://twitter.com/TheBothyGSC) on Twitter

The Science of Chocolate



Every year **80 million** chocolate eggs are sold in the UK alone, but where do they come from?



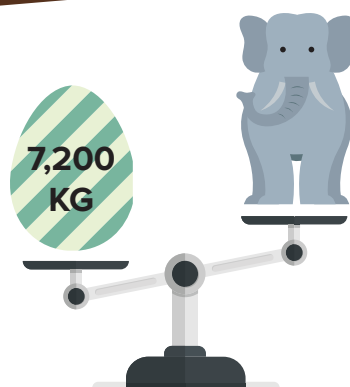
Our Easter egg starts its life deep **in the rainforest** where chocolate actually grows on cacao trees! The scientific name of these trees literally translates as 'food of the gods'! We can see why.

Cocoa seeds start off tasting **really bitter** but by using tiny organisms like fungus and yeast, we can change their chemical structure to make them way more delicious! This is called fermentation and we also use it to make bread and cheese!



As well as being **incredibly tasty**, chocolate contains hundreds of chemicals, some of them can even change our mood! Caffeine can help make us feel more awake and phenylethylamine can make us feel happier!

Since **1873** we've used chocolate to make Easter eggs but in 2011 the world's biggest chocolate egg was made! It weighed a whopping 7,200kg, that's heavier than an African elephant!



£220 MILLION
spent on Easter eggs each year in the UK

10%
of UK chocolate spending happens at Easter

COMPETITION

Do you love The Spark magazine? Has it made a difference to you or your family? Then let us know by entering our competition! The top 5 entries will receive £30 worth of science goodies and we'll feature some of your entries as part of the next issue.

To enter our competition, you can:

Post a video and/or photo on Glasgow Science Centre's social media or cut out and complete the freepost postcard below.

To enter via social media:

Post a photo or short video of you or your family with the magazine, using the hashtag #GSCSpark. Show us your experiments in action, your favourite activities or a photo/video that includes the magazine in a creative way. Tell us how The Spark has made a difference to you and your family. Have the activities given your family new things to learn and try out together? Has the quiz made you realise you know more about science than you thought? Whatever The Spark has helped with, we'd love to know. You can also give us feedback by completing our short survey:

www.surveymonkey.co.uk/r/GSCspark



HOW TO ENTER

Facebook

1. Like GSC Facebook Page
2. Take your photo or video
3. Post it with the hashtag #GSCSpark and tell us how The Spark magazine has made a difference to you or your family



Twitter

1. Follow @TheBothy on twitter
2. Take your photo or video
3. Post it with the hashtag #GSCSpark and tell us how The Spark magazine has made a difference to you or your family



Spark Reader

The Spark has helped my family learn about the science of bubbles! #GSCSpark



How has The Spark made a difference to you or your family?



Name

Postcode.....

Contact email address or telephone number

☐ Please tick this box if you do not want to be contacted further about The Spark magazine or other offers from GSC after this competition has ended.

This competition closes on Sunday 9th May 2021. Entries received after this date will not be entered into the competition. If you are using the Freepost postcard, please post by Wednesday 5th May 2021 to ensure we receive it on time.

curious
about

innovation

YOUR DIGITAL SCIENCE FESTIVAL | 19- 21 MAY

Look out for our next online science festival in the Curious About series. We'll be building on the idea behind our latest in-house exhibition, Idea No59, and celebrating the innovative spirit in us all and how that spirit can change the world.

Mark the date in your diaries to join us this
19-21 May for Curious About: Innovation.

curiousabout.glasgowsciencecentre.org



ABOUT US

Glasgow Science Centre is a 5-star visitor attraction located beside the River Clyde. We are home to hundreds of interactive exhibits where you can discover how the world works.

KEEP IN TOUCH



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QUIZ ANSWERS



1. The cacao tree, also known as Theobroma cacao, is the source of chocolate.
2. B. 4. Butterflies have 2 wings on either side of their bodies, when they fly their wings move up and down in a figure-eight pattern.
3. Caffeine. This chemical speeds up messages travelling between our brain and our body giving us a short boost of energy.
4. Dogs, cats, horses and parrots can't eat chocolate because they can't digest a chemical in it called theobromine.
5. True. Using brain scans scientists have shown that different areas of your brain light up when you start eating chocolate and when you've eaten way too much!
6. A. Microwave. The engineer, Percy Spencer, discovered that radio waves could be used to heat up food when he accidentally melted a chocolate bar in his pocket during an experiment.
7. C. Wi-Fi doesn't stand for anything! It is stated that Wi-Fi is a pun upon the word Hi-Fi.
8. Carbon dioxide. In winter, carbon dioxide freezes on Mars and makes seasonal dry ice caps at the north and south poles.
9. Jupiter. We currently think Jupiter has 79 moons and we've even captured a volcano erupting on one of them.
10. True. Scientists have discovered some strains of bacteria that can breakdown harmful plastics that usually take years to breakdown in landfill sites.
11. C. £50. This new polymer bank note will be released in 2021 and will feature Alan Turing and the Bombe code breaker that he helped develop.
12. Green. The colours of the rainbow are red, orange, yellow, green, blue, indigo and violet.
13. At 1.5kg (3.3lbs) the ostrich egg is the largest egg.
14. C. 1,200 litres. That's about the same amount of water as 15 baths!
15. Tangrams are thought to date from the 18th century

Easter egg hunt game



Scissors icon and text: Cut out

211

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