The Spark Magazine

CHRISTMAS CRAFTS & PUZZLES

ISSUE No10



MAKE A VORTEX CANNON

SNOWFLAKE SCIENCE

MEET A PALEOCLIMATE MODELLER

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

GLASGOW SCIENCE CENTRE



WELCOME

Welcome to this bumper edition of The Spark, where we will be looking at the science of Christmas. It's jam-packed with festive activities, games and puzzles to amaze your family and friends.

In this festive edition, we'll discover how snowflakes are formed and why they are hexagonal in shape. Plus, follow along as we make our very own festive wreath and gingerbread house.

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

Season's Greetings from all of us at Glasgow Science Centre.

SHARE YOUR PICS



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 on Twitter.** We'll print a selection of your pictures in the magazine.

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

CHRISTMAS TREE CROSSWORD

Help us finish decorating our Christmas tree! Fill in the answers for each row using the clues given.

Once you have completed your answers, look vertically down the middle of the tree – what well known tree decoration have you spelled?

1. A vortex is a large spinning column of _ _ _ (3)
2. Who travels with Rudolf in his sleigh to deliver presents all around the world? (5)
3. Snowflakes begin when water vapour freezes to form an ice _ _ _ _ _ _ _ (7)
4. What might you post your Christmas card through, at a friend's house? (9)
5. Where would you hang your stocking from, at a fireplace? (11)





FAMILY QUIZ

All questions linked to activities in this issue

Answers on back page

DID YOU KNOW?



Every December the UK uses 227,000 miles of wrapping paper - that's long enough to reach all the way to the Moon

The longest ever Christmas stocking was over 51 metres long and 21 metres wide

QUESTIONS

1. Which fairy tale increased the popularity of gingerbread houses as a Christmas treat?
2. True or false: Rudolph the red nosed reindeer is male.
3. How much food waste does Scotland generate during the month of December? a) 10,000 tonnes b) 25,000 tonnes c) 50,000 tonnes
4. True or false: Every snowflake is unique.
5. Which country has started a new Christmas tradition of eating fried chicken as a Christmas meal?
6. When was the last widespread white Christmas in the UK? a) 2005 b) 2010 c) 2015
7. In Austria, children fear Santa's evil cousin, but what is his name?
8. Some animals, including reindeer, use micro-organisms in a special part of their stomach to help with digestion. What do we call this type of animal?
9. If we stretched out all the wrapping paper the UK uses every year, it would reach from Earth to... a) Mars b)The Moon c) Venus
10. True or false: Gingerbread was first made by Romans at the time of the Roman Empire.

HINT

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

I'M A... PALEOCLIMATE MODELLER

Meet Louise Sime

Louise works for British Antarctic Survey, a component of the Natural Environment Research Council (NERC). A paleoclimate modeller works to understand past climate change and predict future climate change using computer models.

Please give us a brief description of your job/what are you working on right now?
Understanding when and why the sea ice in the Arctic last all melted away during the summer (it was about 127 000 years ago!).

Have you always wanted to do the job you have now?
No. When I was 7, I loved Monopoly so much that I wanted to be a banker.

What do you wish people knew about your job?
That you can get so engrossed in ideas, code, and output from climate models that hours pass like seconds.

What's your favourite thing about your job?
The people. Most people who work in climate science are kind and love their work - and are often reassuringly odd.

What inspired you?
A lecturer at Glasgow University who created models of rivers. He obviously loved his work – and spotted that I might also be good with numerical models.

Favourite food: Homemade pizza with lots of chilli

Hobbies: Skiing and reading

Skill: I can finish a 500+ page book within four hours (lots of practise!).



ACTIVITY

Snowflake Science

What will you do?

In this activity you will create beautiful, unique snowflakes that you can use to decorate your home.

What will you need?

- Paper
- Scissors



Ensure you have permission from an adult and their supervision before starting.

Watch the Snowflake Science video on #GSCAtHome Facebook or YouTube page

How to do this activity

If you have ever caught a snowflake on your glove and had a close look at it, you may notice that it is symmetrical and has six sides: it's shaped like a hexagon. You might think that a snowflake is just frozen water, but it looks a little different from an ice cube, wouldn't you agree? That's because an ice cube is frozen water, our snowflake is frozen water vapour.

Snowflakes start life as a tiny speck of dust or pollen that catches water vapour out of the air. When it is really cold, the water vapour will freeze and form an ice crystal. This is the beginning of our snowflake. But why is it a hexagon shape? When water gets cold enough its molecules arrange themselves in the most efficient way, which just so happens to be a hexagon. (Molecules are the small building blocks that something is made of. If we add more and more water molecules, we can make a puddle, or even an ocean).

Every snowflake has a unique pattern because it follows its own path to the ground; it gets blown about in the wind and bumps into different water molecules in the air. Changes in temperature and humidity will also change its design. Let's make our own paper snowflakes as wonderfully unique as the real ones.

Step 1. If you're starting with a rectangular piece of paper, like a sheet of A4 paper, you need to turn it into a square. To do this fold down one corner to form a triangle, lining up your edges, and cut off the excess.

Step 2. Take your square piece of paper and fold it in half diagonally to make a triangle.

Step 3. Fold the triangle in half so the pointed corners meet.

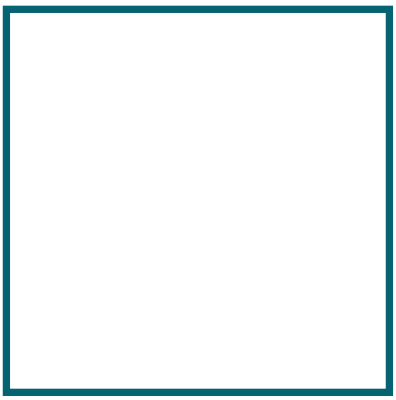
Step 4. Fold the paper triangle in thirds, first overlap the left-hand pointed corner over the triangle.

Step 5. Overlap the right-hand pointed corner over the triangle. Top tip: you need your edges to line up so don't crease the paper until the folds are just right.

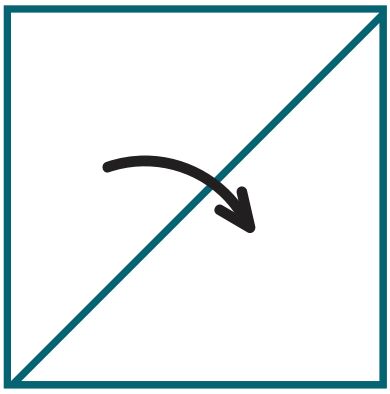
Step 6. Trim off the pointed ends so your triangle looks like the picture.

Step 7. Time to get creative. Cut shapes out of your triangle to create your amazing snowflake design.
Top tip: Straight lines are a little easier to cut than curvy lines.

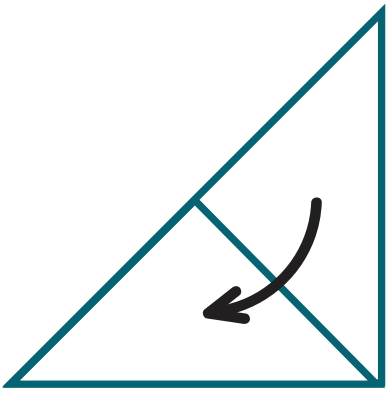
Step 8. Gently unfold your snowflake to see your unique pattern. Use your beautiful snowflakes to decorate your windows or even a Christmas tree.



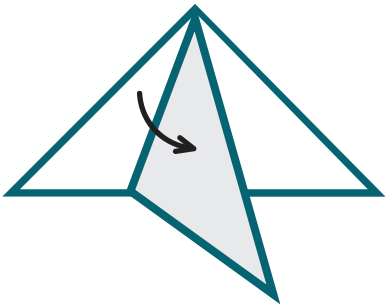
Step 1



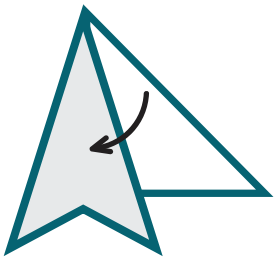
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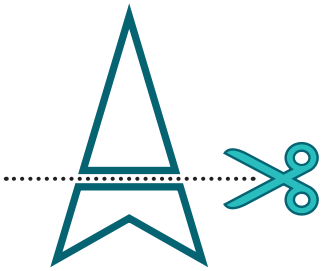
Step 3



Step 4



Step 5



Step 6

More to try

Can you think of other hexagon patterns in nature? Clues: Buzzzzz or a reptile with a hard shell?

Can you find any hexagon patterns in your house? Clues: Take a peek at your colouring supplies or head to the garden and find something that's fun to kick.

Take your grown up on a walk and see if you can spot any other patterns hidden in nature. Clues: Keep your eyes peeled for flowers, trees and animals. Why not try and draw what you find?

Fun facts

Snow isn't actually white, it's translucent! Snowflakes reflect all wavelengths of visible light, which makes them appear white.

Snow makes different noises depending on how cold it is. When you step on snow, it causes grains of snow to rub against each other and cause friction. When it's colder there's more friction between the grains of snow, which makes a crunching sound.

Snow can actually keep you warm. We get cold because air carries our heat energy away from us, but in snow the air is packed so tightly that it can barely move. Some humans build igloos out of snow to stay warm and animals, like polar bears and Arctic foxes, build burrows or caves in the snow to stay warm.

Share pictures of your snowflakes with us on social media using #GSCAtHome

ACTIVITY



Gingerbread House DIY

What will you do?

We're going to have a go at making our own gingerbread house. This will need the whole family's help; grown-ups to deal with the hot and sharp things and the little ones to help build and decorate.

Ensure you have permission from an adult and their supervision before starting.

What will you need?

For gingerbread

250g unsalted butter
200g dark brown sugar
7 tablespoons of golden syrup
600g of plain flour
2 teaspoons of bicarbonate of soda
4 teaspoons of ground ginger

To decorate

Royal icing to construct
Selection of sweets to decorate

Kit

Kitchen scales
Baking tray(s)
Greaseproof paper
Piping bag (optional)
Knife
Cookie cutters
Template Our house will be made of 6 panels in total, a front, a back, two sides and two roof panels
Bowl, saucepan, spoon

Watch the Gingerbread House DIY video on #GSCAtHome Facebook or YouTube page

Recipe

Baking

Step 1. Preheat the oven to 200 °C/180° fan / gas mark 6 and get your baking trays ready.

Step 2. In a large bowl add the flour, bicarbonate of soda and ground ginger, and mix together.

Step 3. Melt the butter, sugar and golden syrup in a saucepan. When it's all melted together add the wet ingredients into the dry and mix well. This should combine into a dough. You can add a small amount of water if it doesn't come together.

Step 4. Put some baking paper on your surface and put the dough onto it. Sandwich it with another piece of paper and roll out a large rectangle to 1 cm thick. If it is too thin, it will snap when we try to construct our house. Too thick and it will take too long to bake.

Step 5. Place your templates on top of your rolled-out dough and cut around them with a sharp knife. Keep rolling the trimmings out until you have two sides, a front and back, and two roof panels. If you have any dough left over, you can make trees or gingerbread people to use as decorations.

Step 6. To create windows or an open door for your house, press a cutter into the gingerbread but leave the piece in place. They will be removed after baking which helps to create clean crisp edges in our doors and windows.

Step 7. Gently pick up the greaseproof paper with your shapes on and place onto your baking tray.

Step 8. Bake your panels for 12 minutes or until the edges are darker in colour.

Step 9. A few minutes before the end of baking, remove the panels from the oven. Re cut the windows and remove that piece. Bash some boiled sweets into small pieces and put the crushed-up sweets into the window spaces. Put this back in the oven for a few minutes until the sweets have melted into a syrup.

Step 10. Remove the panels from the oven and allow to cool slightly.

Step 11. Our pieces will have spread slightly during baking. Using your template again trim the edges with a knife, making the straight edges needed for construction.

Step 12. The panels need to be left to cool completely until they are firm.

Construction

Step 1. Put your royal icing into a piping bag. Alternatively, you can use a knife, but the piping bag will give you more control.

Step 2. Pipe some royal icing onto the bottom and along one side of both the back and right-side panels. Press these onto the board/plate and fix the side to the back by pushing the royal icing together. It will help to have someone hold the panel steady while you prepare the side.

Step 3. Fix the left-side and front panels of your gingerbread house to the existing structure, using the same method. We now must leave it to dry before attaching the roof. You can use a jar or tin to support the structure as it sets.

Step 4. When it's solid to the touch, it's time to add the roof. Pipe some icing along the edges of the roof panel. Attach one panel at a time. Holding it in place until it sets a little. Once both roof panels are in place, pipe some icing along the joins of the roof to strengthen it.

Step 5. Now it's time to decorate! Using your selection of sweets, decorate your house however you like.

Step 6. Finish it off with a dusting of icing sugar snow!

More to try

You can experiment with different shapes and sizes, or design your own style of house - the only limit is your imagination. You can even fill with sweets or treats to be discovered when you break your house open.

Fun facts

Some of our oldest traditions, which includes the introduction of gingerbread, date back to the ancient Greeks. They also believed bringing evergreens indoors would ward off evil spirits and serve as a reminder that life will regrow after the winter is gone.

There are millions of people across the world who don't celebrate Christmas or have different traditions/ celebrations across the festive season. For example, lighting the Menorah during Hanukkah.

Heart-shaped gingerbread cookies were often traded as love tokens.

In Austria, Santa's evil cousin Krampus, scares children into being good. Children are scared with stories of being kidnapped by Krampus if they are naughty.

Iceland's "Yule Book Flood" is the tradition of gifting books to each other on Christmas Eve and spending the evening reading them.

In the last few years some Japanese families have made changes to their traditional Christmas dinner. They go to KFC! In recent years KFC have added a festive menu in Japan for Christmas Day, with pre-orders starting months in advance.

Share pictures of your gingerbread house with us on social media using #GSCAtHome

COLOURING PAGE



Science Christmas Cracker Jokes



How do NASA organise their Christmas party?

They planet

What is a scientist's favourite Christmas decoration?

A Chemis-tree

What do you call people who are afraid of Santa?

Claus - trophobic

What do you get if you eat Christmas decorations?

Tinsilitus

Why did Santa put atoms on the naughty list?

Because they make up everything

What do naughty scientists get for Christmas?

Mole-coals (like molecules, get it?)

What do scientists get on the first day of Christmas?

A partridge in a petri dish!

What's a mathematician's favourite food at Christmas?

Mince π

ACTIVITY

Vortex Cannon



What will you do?

In this activity you will build an air vortex cannon and try to topple lightweight targets using the power of a torus vortex.

Ensure you have permission from an adult and their supervision before starting.

What will you need?

- Cup (paper is preferred for recycling purposes, but plastic also works)
- Scissors
- A balloon
- Tape or rubber bands
- Some lightweight objects like a ball of crumpled wrapping paper or some tinsel



How to do this activity

Step 1. Using your scissors, cut a hole into the bottom of the cup. Make sure the hole is slightly smaller than the entire diameter of the cup.

Step 2. Blow up the balloon and then let out the air. This ensures that the balloon will be stretched and not too tight. Once the air has been let out, tie a knot in the end of the balloon.

Step 3. Using your scissors, cut off the top rounded half of the balloon (the part of the balloon that is furthest away from your knot). Make sure to cut the balloon at its widest point.

Step 4. Take the balloon and stretch it over the mouth of the cup, with the knotted tail facing out and as near the centre of the opening as possible. This can be difficult, so you may need an extra pair of hands to help. It is ok if your cup crumples a little, as long as it mostly keeps its shape.

Step 5. Using your tape, tape down the edge of the balloon to the cup to make a nice airtight seal. This will also make sure the balloon doesn't snap off the cup. If you are using rubber bands, wrap them over the balloon and around the edge of the cup for the same airtight seal.

Step 6. You have now made your very own vortex cannon. To test it out, point the opening of the cannon towards some tinsel or a crumpled ball of wrapping paper, pull back on the tail of the balloon and let it snap quickly forward.

More to try

Try using different materials as targets like a recycled drinks bottle or a cardboard box.

How far away can you get from your target and still be able to knock it over?

Can you knock over some heavier objects?

Have a competition with your family to see who can make the most powerful vortex cannon.

Fun facts

One of the reasons it is so very cold at the North Pole is because of the polar vortex, a large spinning mass of very cold air. There is also a polar vortex hovering above the South pole.

The Sun is so powerful and energetic that it creates a type of wind, called solar wind, that travels throughout the solar system. When the solar wind reaches Earth's atmosphere it can create aurora borealis also known as the northern lights.

Severe snowstorms, known as blizzards, can have wind speeds as strong as a category one or two on the hurricane wind scale (74-95mph and 96-110mph)

Wind chill is the temperature your body feels when the air temperature is combined with the wind speed. The higher the wind speed, the faster exposed areas of your body lose heat and the colder you feel.

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

Watch the Captain Vortex video on #GSCAtHome Facebook or YouTube page



ACTIVITY

Make your own Sustainable Festive Wreath



What will you do?

In this activity you will make a festive wreath, using items you have at home, plus evergreen sprigs and berries from the great outdoors. This is one small way to make your Christmas more sustainable. By reusing items you have at home or repurposing something into a new gift, you can reduce the amount of waste going into landfill and help protect our environment.

Ensure you have permission from an adult and their supervision before starting.

What will you need?

Outside

You'll need to wrap up warm and take an adult outside, either to your garden or a safe outdoor space like a park. Gather some of the following items:

Green foliage
Leaves
Twigs with berries (don't eat the berries!)
Holly
Pinecones



From your house

Wire , Wool or String - whatever you have handy
Metal coat hanger (or cardboard)
Ribbon (optional)
Scissors
Dried oranges (optional)



How to do this activity

Step 1. Pull out the wire coat hanger to make a circle shape or cut a large circle shape out of cardboard.

Step 2. Gather your green foliage and some berries into small bundles and use wire to secure them. Be careful with scissors if you need to trim the foliage.

Step 3. To attach the individual bundles to the frame, place the first bundle over the frame at an angle and wrap the wire around three times or until secure.

Step 4. Take your second bundle and place it partly over the first bundle covering the wire, securing in the same way. Make sure to alternate each bundle's direction. For example, one should point towards the middle of the circle and then one facing away from the circle, alternating all the way round. Carry on until you can no longer see the wire frame.

Step 5. To finish off the wreath you can add a bow, some pinecones and even dried orange slices. It'll create a beautiful scent in your home.

Step 6. To make sure it survives the festive season spray a light mist of water to the back of your wreath every two to three days. The evergreens will drink the water and they'll last longer and keep their fragrance.

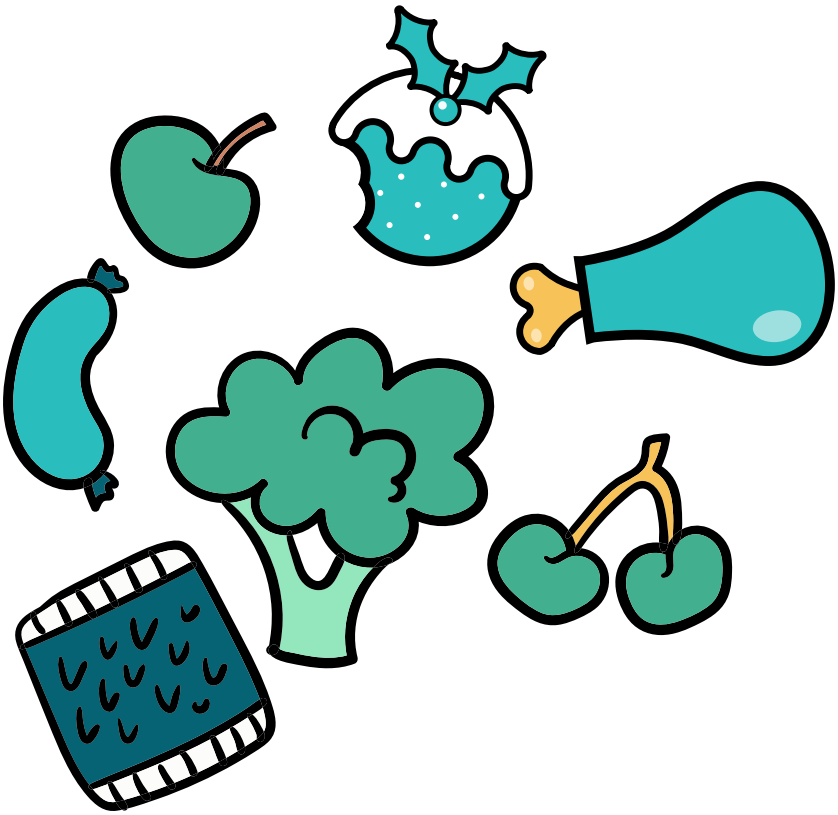
More to try

If you don't have a metal coat hanger you could use a couple of rings of cardboard stuck together. Wrap wool or string around it to add strength, before you attach your bundles of green foliage.

Fun facts

Here in Scotland we use on average 19,000 miles of Christmas wrapping paper every year. That means we could wrap it around the coast of mainland Scotland two and a half times!

As a country we throw away 50,000 tonnes of food and drink in December. If we cut that down by just 10%, the difference in the carbon output would the equivalent of taking 2,600 cars off the roads for a year!



Watch the Sustainable Festive Wreath video on #GSCAtHome Facebook or YouTube page

Share pictures of your festive wreaths with us on social media using #GSCAtHome

ACTIVITY

Share your Christmas card loop with us on social media using #GSCAtHome

Make a Christmas Card Loop

What will you do?

Challenge your friends and family to cut a hole in a Christmas card that's big enough for them to fit through, without tearing the edges. Afterwards, you can amaze them with the solution below.

Ensure you have permission from an adult and their supervision before starting.

What will you need?

- Christmas card
- Scissors



How to do this activity

Step 1. Put the card on the table with the folded side closest to you.

Step 2. Cut into the folded side, about 1 cm from the left-hand edge, and start cutting straight towards the far side of the paper, in a nice straight line. Stop cutting about 1 cm before the opposite edge, so you don't cut all the way across the paper.

Step 3. Turn the paper around so the fold is away from you this time. Cut around 1 cm from the last cut, and stop about 1 cm before you get to the folded side.

Step 4. Alternate between cutting from the folded side, and the side opposite. Keep your cuts 1 cm apart, and always stop cutting 1 cm before you get to the far side of the paper. When you have finished, you should have a zig-zag of paper.

Step 5. Look along the folded side of the paper. You should have a series of loops of paper. Cut along the fold of each of the loops EXCEPT the first loop and the last loop. Leave these intact.

Step 6. Carefully pull the paper apart, being careful not to tear it. You should have a large loop.
Now try to fit yourself through the loop!

More to try

- To get really creative, try using cards of different sizes. See if you can fit more than one person in the loop.

Fun Facts

The first Christmas card was sent to King James the VI of Scotland (James 1 of England) in 1611, although at 80cm x 60cm it would probably have been pretty easy to cut a hole in it big enough to fit through!

The first known commercialised Scottish Christmas card was sent from Glasgow in 1891 by Annie Oakley, which featured her wearing tartan.

Around 900 million boxed Christmas cards (plus more than 100 million single Christmas cards) are sent every year in the UK.

The perimeter of a circle is called its circumference.

The most Christmas cards sent by one person in a year, is 62,824.

Anatomy of a reindeer

Antlers Male and female reindeer have antlers that they shed throughout the year. Males lose their antlers in November, but females keep theirs until May. Since Rudolph has antlers in December, she must be female!

Fur Reindeer have hair from their nose to the bottom of their toes! Their coats have two thick layers to help keep them cosy. The top layer of hair is hollow and can fill with air, which might help reindeer's to float when they swim.



Eyes

Reindeer have colour changing eyes! In summer their eyes are golden but in winter, when there's almost no sunlight, their eyes turn deep blue. Scientists think this helps reindeer spot food hidden in the snow, even when it's dark.

Nose

Reindeer can survive in freezing cold climates, even as chilly as minus 60°C! To stop their lungs from freezing, reindeer warm the air they breathe with blood vessels in their nose. Using special thermal imaging cameras that show heat, you can see that reindeer noses really do glow!

Hooves

Reindeer hooves are soft and spongey in summer but become hard and sharp in winter. These sharp hooves can be used for breaking through ice to find food like moss.

Stomach/mouth

Burrrrrrrpp! Reindeer are ruminants which means they have a special part of their stomach where tiny micro-organisms help breakdown food, which makes gas. To get rid of all this methane and carbon dioxide gas, reindeer burp it out!

Spot the difference!

Answers on back page





#GSCAtHome
Presents:



THE CHRISTMAS EXTRAVAGANZA

Celebrate the festive season with GSC At Home presents... the Christmas Extravaganza! Don your best festive jumper and grab a mug of hot chocolate as we explore the science of the season. Join our elves on an exploration of their favourite things about the festive season, with a mix of wonderous workshops and science shows for the whole family to enjoy.

Streaming live | Friday 11 Dec 2020 | 7pm
Book your free ticket and find out more at
glasgowsciencecentre.org/christmas-extravaganza

QUIZ ANSWERS

1. Hansel and Gretel by the Brothers Grimm. In this German fairytale, a witch lures two children into a house made of delicious gingerbread. Don't worry, they both escape!

2. False, Rudolph is female. Male reindeer lose their antlers in November but female reindeer keep their antlers until May, so Rudolph must be female.

3. c. 50,000 tonnes of food goes to waste each December in Scotland, which is the equivalent of 280,000 turkeys!

4. True, as snowflakes fall through the air their shape is affected by the wind, temperature and water molecules all around.

5. KFC is a popular Christmas meal in Japan, where orders for Christmas day are taken months in advance.

6. b. The last widespread white Christmas in the UK was in 2010, when there was snow lying on the ground at 83% of weather stations.

7. Krampus is the name of Santa's evil cousin. In Austria, stories are told about Krampus punishing children who misbehave, while St. Nicholas, or Santa, rewards good behaviour.

8. These animals are ruminants. They use micro-organisms to help get more nutrients from their plant-based diet.

9 b. It would reach from the Earth to the Moon. The UK uses 227,000 miles of wrapping paper every year.

10. False, the earliest gingerbread was made by the ancient Greeks.

CHRISTMAS TREE CROSSWORD ANSWERS



PUZZLE SOLUTION Spot the difference



WE WANT YOUR FEEDBACK

We would love to hear what you think!

We hope you liked this issue, but if you didn't, what could we change? What other things would you like to see? What topics are you most interested in?

You can send feedback and pictures to CLDteam@GSC.org.uk or message us on Twitter @TheBothyGSC

KEEP IN TOUCH

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