The Spark Magazine

PUZZLES, QUIZZES, EXPERIMENTS

ISSUE No16

CLIMATE ON OTHER PLANETS

THE GREENHOUSE EFFECT

MAKE YOUR OWN WATER WHEEL

MEET A MECHANICAL ENGINEER



With support from the Scottish Government and Bloomberg

Net Zero Scotland Scottish Government

Bloomberg

GLASGOW SCIENCE CENTRE

Celebrating 21 years

Inside

This issue



HELLO!

Welcome to another exciting issue of The Spark - crammed full of creative and curious experiments, puzzles, quizzes and facts.

In this issue we will be looking at the climate, not just on our planet, but the climate of the other planets in our solar system. We will also explore the differences between weather and climate, and how these can change due to greenhouse gases and climate change. You'll also find some experiments inside that will show you how greenhouse gases can affect the temperature of Earth.

Glasgow Science Centre turns 21 this year! To celebrate we have shared our favourite facts that we have learned while working at the science centre. What is your favourite memory or fact that you have learned while visiting?

Best wishes,
Glasgow Science Centre



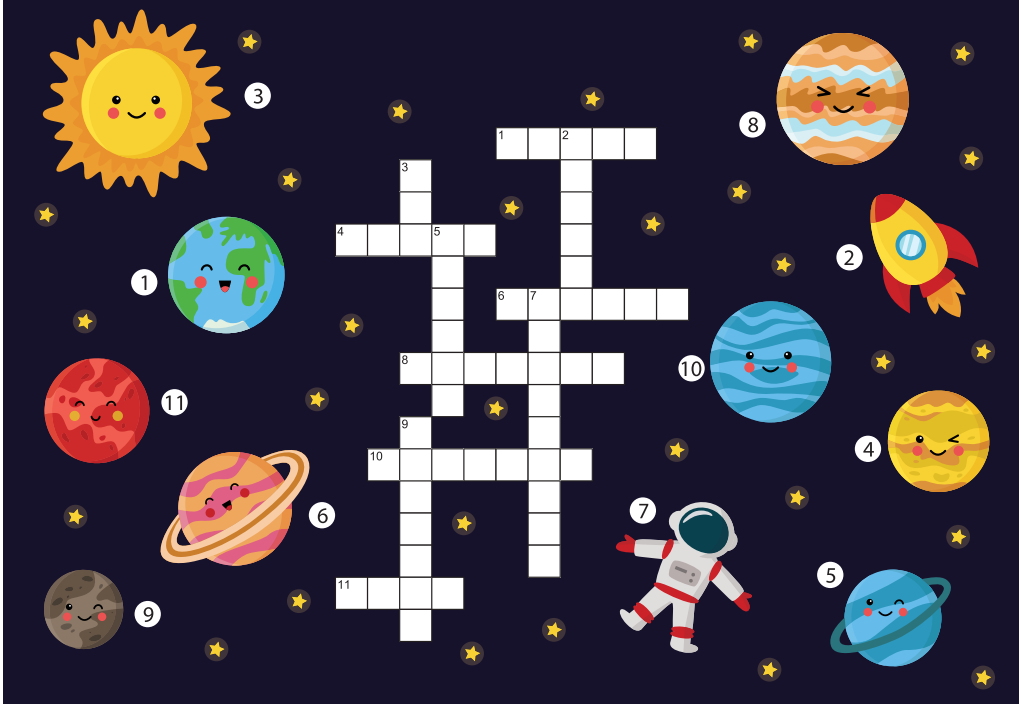
SHARE YOUR PICS WITH US

If you try any of our activities, please show us how they turned out! Send your favourite pictures to CLDteam@gsc.org.uk or share with us @TheBothyGSC on Twitter.

MINI GAME

Space Crossword

Identify the planets and space objects to fill in the crossword. Check out pages 4 and 5 for hints.





Page 12

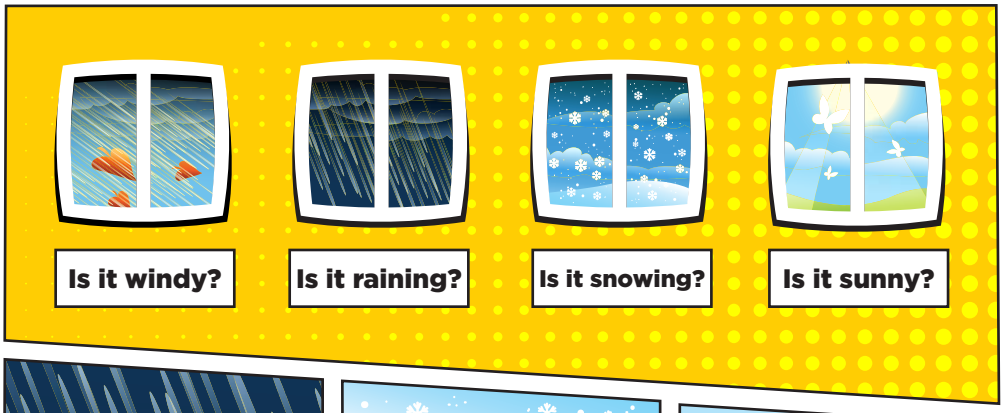
Meet a mechanical engineer

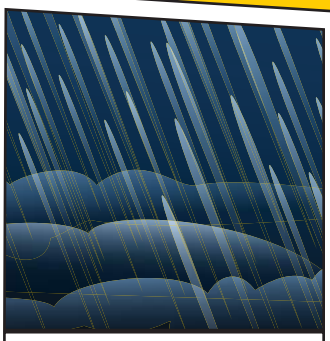
Meet one of the team members in charge of the world's most powerful floating tidal turbine, on page 12.



Chris's Climate Conundrum



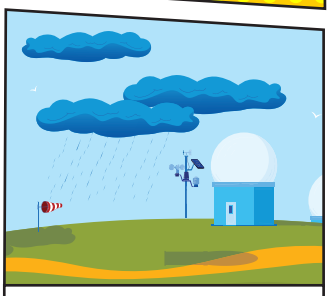




Weather is temporary.



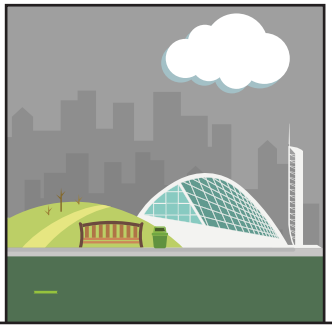
We can have snow one day and rain or sunshine the next.



Monitoring the weather allows us to determine our climate.

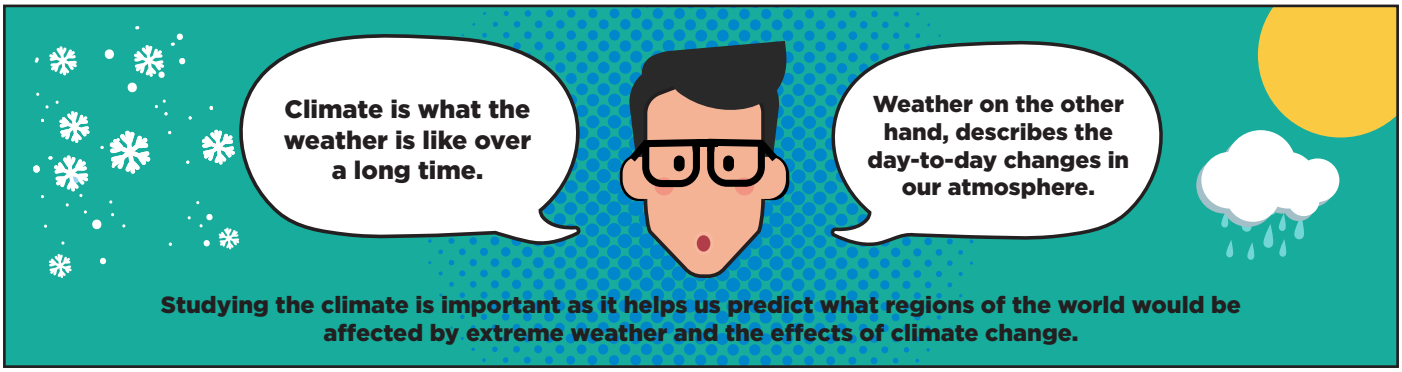
We would call Scotland's climate 'temperate'. We have distinct seasons and widely varying temperatures.







We have cool summers, mild winters and it can rain throughout the year.

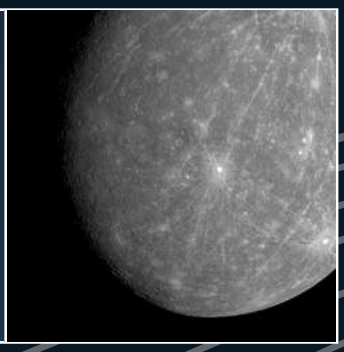


Studying the climate is important as it helps us predict what regions of the world would be affected by extreme weather and the effects of climate change.

Climate on other planets

Mercury

Mercury is the closest planet to the Sun. During the daytime, temperatures can be as high as 425°C. Then at night, because there is no atmosphere to trap the heat, the temperature can drop as low as –184°C.



Mars

On Mars, daytime temperatures are similar to Earth's winter, a chilly 0°C.

The rovers that have been exploring Mars discovered that it may once have had a lot of water. However, there isn't enough water left to make rain or clouds. The desert on Mars is also home to massive storms that can blanket the planet in dust for weeks.



Saturn

Saturn is about 900 million miles away from the Sun, and has an average temperature of –176°C.

Titan is Saturn's largest moon and it has the most recognisable weather in the solar system. Like Earth, it is thought to have seasons, raining clouds, and a nitrogen-rich atmosphere.

Unlike Earth, Titan cycles a chemical called methane rather than water. Methane rain falls from the sky and is collected in lakes, rivers, and oceans. Titan is also far too cold for human visitors.



Venus

Venus has a dense layer of carbon dioxide and sulphuric acid clouds which create a greenhouse effect, trapping heat and warming the globe. Venus has an astounding average temperature of 450°C!



Jupiter

Jupiter is a gas giant, because it is made almost entirely from gases and has no solid ground to stand on. Jupiter's big red spot is a gigantic storm that has been going on for hundreds of years.

The entire planet is covered in bands of swirling cold clouds high in the atmosphere made from ammonia and water.



Earth

Uranus

Uranus is very far away, a single orbit around the sun takes around 84 Earth years, and each of its seasons lasts 21 Earth years.

During its summer and winter seasons, parts of the planet experience only daytime or night-time for 21 years.



Neptune

The very cold ice giant Neptune is a long way from the Sun, at an average distance of 2.8 billion miles. Neptune's average temperature is around -217°C.

Neptune has a dense atmosphere, covered with changing clouds that swirl around the planet. Winds blow at 2,000 kilometres per hour on Neptune, making them the fastest winds in the solar system!



Greenhouse Gases



Are they good or bad?

Gases that trap heat are known as greenhouse gases. They get their name from garden greenhouses. A greenhouse has many windows that allow light to enter. Heat is produced by the sunlight. Greenhouses are good at preventing that warmth from escaping, which is good for the plants that grow there.

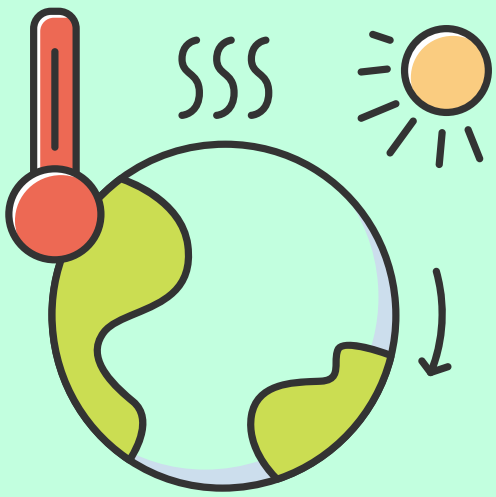
This is how greenhouse gases behave too. They allow sunlight to travel through the atmosphere, but prevent the heat created by the sunlight from escaping.



The Greenhouse Effect

ACTIVITY

See the effects of increased greenhouse gases and increased heat in these experiments.



What will you need?

- Two identical glass jars or plastic containers with lids.
- Cold water.
- Ice cubes.
- One clear plastic bag.
- Thermometer.

What to do

Step 1. Take your two containers and fill them halfway with water.

Step 2. Add three ice cubes to each container and put the lid on securely.

Step 3. Wrap one of your containers in a plastic bag, this will act as our greenhouse model.

Step 4. Leave both containers in sunlight or under a lamp for one hour.

Step 5. After an hour measure the temperature of the water in each container. What do you notice?

The air inside our plastic bag greenhouse model has warmed up in the sunlight. The greenhouse allows some of the Sun's light and heat to pass through, heating up the water inside. The greenhouse holds on to this heat and will get warmer and warmer. You have just demonstrated the greenhouse effect!

Greenhouse gases are a good thing, our planet would be too cold without them, and life as we know it wouldn't exist.

Without these gases, our planet would be a lot like Mars.

However, too much of a good thing can be bad. Scientists agree that human activities are causing an increase in the greenhouse gases in our atmosphere, which is causing Earth's temperatures to rise.



ACTIVITY

Greenhouse Gases Experiment

What will you need?

- Two identical glass jars with lids.
- Bicarbonate of soda.
- Vinegar.
- Thermometer.

DID YOU KNOW?

The chemical reaction between bicarbonate of soda and vinegar is an endothermic reaction, which means it becomes colder during the reaction.

What to do

Step 1. Take one of your jars and add a tablespoon of bicarbonate of soda.

Step 2. Add 50ml of vinegar to your bicarbonate of soda jar. It will immediately start reacting! Quickly put the lid on securely to trap the gas that is released during this chemical reaction.

Step 3. Put the lid on the empty jar. This will be our 'control' jar.

Step 4. Put both jars on a radiator or on a sunny windowsill.

Step 5. After an hour measure the temperature of the air in each jar with your thermometer. What do you notice?

The reaction between the bicarbonate of soda and the vinegar creates carbon dioxide (CO_2) gas, which is one of the greenhouse gases in our atmosphere. The jar which contains the carbon dioxide gas will get much warmer than our control jar with just air inside. This is because the greenhouse gas stores this heat more easily than the jar with air.

A 'control' in an experiment is the part that remains unchanged. This allows us to see differences between conditions and make comparisons. Having a control lets us know if our experiment has worked. For example, in this experiment, we can compare the jar which contains carbon dioxide to the jar which contains just air (the 'control'). If the experiment has worked, we should notice a difference in temperature between the two jars.

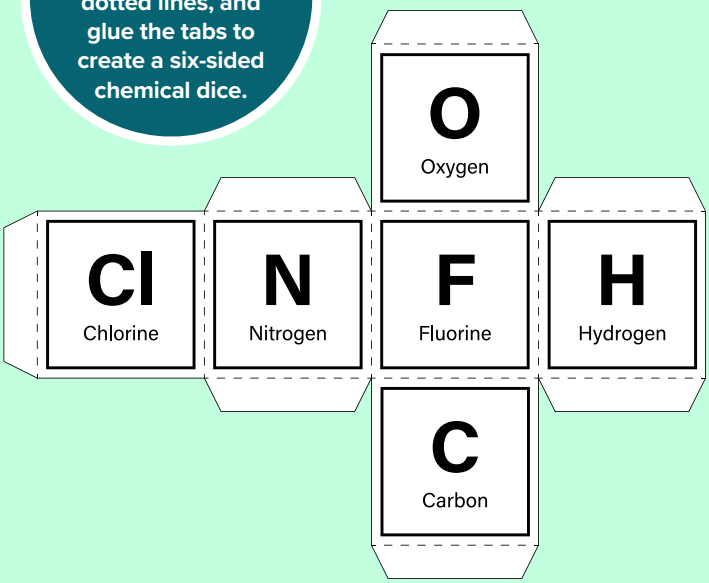
Greenhouse Gas Capture Game

There are six main greenhouse gases in our atmosphere. Together these help to keep our planet warm, but too much of them would be bad news for life on planet Earth. Can you capture the gases before they heat up our planet?

Cut out and assemble the dice and grab a coloured pen or pencil to play. Each player will need to copy the chemical diagram below onto their own piece of paper.

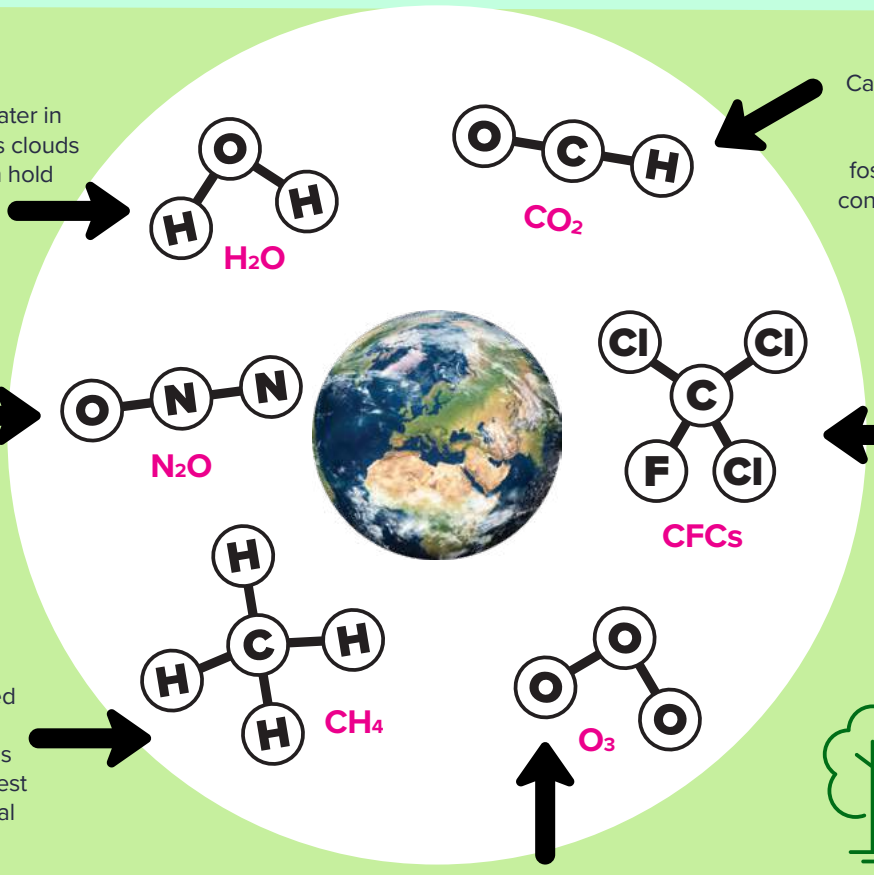
What other games could you make with your chemical dice? Let us know on twitter @GSC1

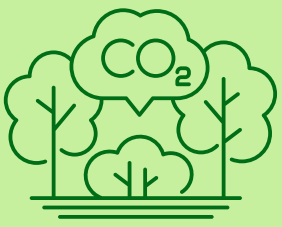
Cut out the solid lines, fold the dotted lines, and glue the tabs to create a six-sided chemical dice.



HOW TO PLAY

Take it in turns to roll the dice and colour in the chemicals that match your dice roll. Use a different colour for each element. The first player to colour in all their gases is the winner!





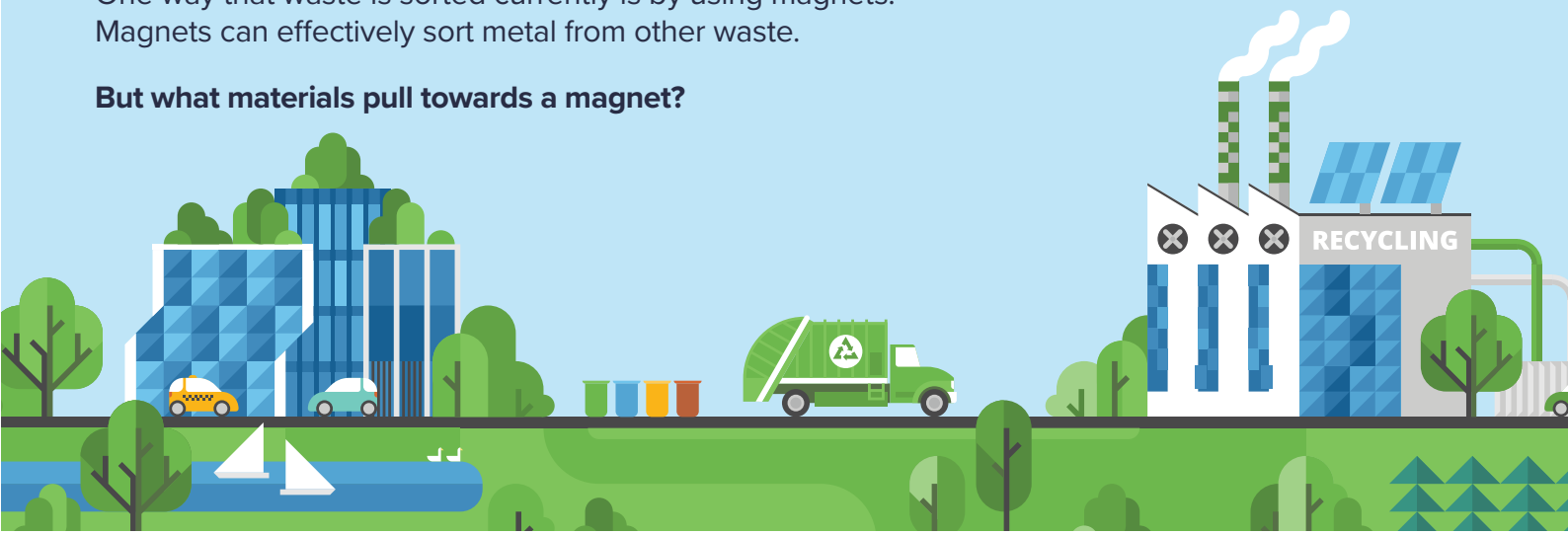
Waste Sorting

In the UK the average household recycles around **45%** of its waste.

As part of the recycling process the materials must first be sorted and cleaned before they can be reused.

One way that waste is sorted currently is by using magnets. Magnets can effectively sort metal from other waste.

But what materials pull towards a magnet?



ACTIVITY

Sort the waste without using your hands!

What will you need?

- Large container - for mixed recycling.
- Small containers - for sorting.
- Various recycling materials (e.g. metal tins, plastic bottle tops).
- Glass marbles.
- Strong magnet or magnet wand.

Step 1. Put the recycling materials and marbles in the large container.

Step 2. Use the table to record which things pull towards your magnet (magnetic) and which don't (non-magnetic).

Object	Magnetic	Non magnetic
Plastic bottle cap		
Metal bottle cap		
Drinks can		

Try timing yourself to see how efficient your waste sorting is. Try separating your remaining plastic and glass waste. How might using water help?

Q

What kinds of things are pulled towards your magnet? Are there any left behind? Why might that be?

How it works

Metal objects are pulled towards your magnet but not all metal things are magnetic. Only ferrous metals (metals containing iron) can be sorted this way.

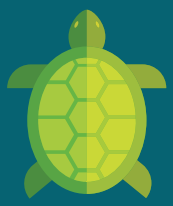
Glasgow Science Centre is 21

It's our 21st birthday, and to celebrate we have asked our staff to share their favourite facts they have learned while working at GSC.

GLASGOW SCIENCE CENTRE
Celebrating **21 years**

Abi

While working on **GSCAtHome**, I learned that the temperature of a turtle's nest determines whether hatchlings are female or male. **A warm nest results in female turtles, and a cool nest results in male turtles.**



Peter



While working at the 2019 summer **Moon50** party, I learned that the Apollo 11 astronauts described the moon smelling like 'burnt gunpowder' after they accidentally brought some of the moon dust back into their shuttle.

Fiona

From watching **'Our Changing Climate'** science show, I learned that lightning may have helped to start life on Earth. Scientists think that billions of lightning strikes, billions of years ago, unlocked vital phosphorous that was needed for life to begin!



Caitlin

Did you know that the majority of the neurons in an octopus are found in its arms? So they are able to 'think' without using their brains!

Cat

My favourite fact from our **DNA Extraction** workshop: if you took out the DNA from one of your cells in your body and stretched it out, it would measure ~2 metres long!





Graham

You fart a balloon's worth of gas a day!



Patrick

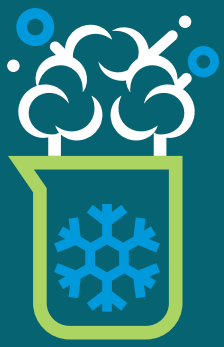
The T-Rex is closer in time to the iPhone than it is to the Stegosaurus. These two dinosaurs were not alive at the same time.

Yvonne

A non-Newtonian substance, like custard or quicksand, feels like a solid when you hit it hard or run across it, but will slip through your fingers like a liquid if you try to slowly pick it up - a fact best experienced by trying it!

Jess

My favourite fact is that dry ice, which is a solid, sublimates directly into a gas without changing into a liquid first.





Tara

Glasgow Tower holds the Guinness World Record for the tallest fully rotating freestanding structure in the world.

Nina

The rings of Saturn are so thin, that if you made a model of the planet the size of a basketball, and made the rings out of paper, the paper would be 10,000 times too thick.

Sharon

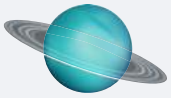
When I first started at Glasgow Science Centre I remember sitting in the Planetarium and learning that we are all made of star dust. How cool is that!

The planet Jupiter would float if you had a big enough bathtub for it.

Zayneb

Lorna

I learned during one of our GSC@ Home videos that the planet Uranus was almost called 'Planet George'.



Amy



An earthworm has five 'hearts' that pump blood through its body.

On its 5th Birthday, the Curiosity Rover on Mars sang "Happy Birthday" to itself in a Martian crater millions of miles from home.

Emma

Jennifer

Humans share 99.9% of their DNA with every other human on the planet. For all the diversity on Earth, we are actually more alike than we are different.

Derek

Glasgow Science Centre was built on the site of an old shipyard and was designed to look like the hull of a ship.



Chris

If you were to break a magnet in half you would end up with two magnets, each with their very own north and south pole.





Jennifer

Unborn babies pee in the uterus. Then they drink it. Then they pee again. Then they drink it. So amniotic fluid is mostly baby pee.

Sam

In 2018 I learned that a teacake can survive a trip into space!



Is that a spaceship or a tidal turbine?



In 90 seconds, O2 can generate enough low carbon electricity to meet the demand of the average UK home for a week!

Orbital Marine Power is an innovative Scottish engineering company, on a mission to help turn the tide on climate change.

In April 2021, Orbital launched the O2, the world's most powerful floating tidal turbine.

The O2 is the same size as a 747 Jumbo Jet. When the blades rotate, they cover the same area as three whole tennis courts!

The O2 is now generating power from the tides surrounding the Orkney islands, where it will operate for the next 15 years, providing 2,000 UK homes with clean, predictable power while offsetting approximately 2,200 tonnes of carbon dioxide production per year.



In less than a single turn of O2's rotors, it is able to generate enough low carbon electricity to drive an electronic vehicle the distance of an average UK car journey 13.5 km (8.4 miles).

I'M A... MECHANICAL ENGINEER

Meet John Bowman

I design mechanical systems for the world's most powerful floating tidal turbine, the Orbital O2. My job involves solving problems that arise during the design and build of the turbine.

I had quite an imagination growing up and spent lots of time building LEGO models to see if I could create something better, so becoming an engineer made the most sense. I also knew that I wanted to work in the renewable energy industry, as I wanted to help find sustainable ways for people to live their lives in a normal way.

Literally everything has engineering input at some level. For example, the shoes you wear have materials which have been engineered to provide grip and durability; the house you live in has been planned to keep the heat in and last for a long time, and even your desk at school has been optimised to find the best way to manufacture thousands of them as efficiently as possible.

So, in summary, it isn't just towering bridges, skyscrapers and other impressive mega-projects like you see on the TV, at its core, engineering focuses on designing the world we live in.



Build a Water Turbine Model

Hydroelectric power is a renewable source of energy and uses large bodies of water which spin turbines that generate electricity. Try the experiment below to see how it works.



What will you need?

- A large bowl
- Two paper plates
- A straw
- Six plastic bottle caps
- Two plastic rulers
- A wooden skewer
- Sticky tack
- A jug of water
- Sellotape
- Strong glue



What to do

Step 1. Glue the bottle caps around the edge of one of the paper plates so that they stand up and the bottom of the caps point outwards.

Step 2. Then glue the other plate onto the other side to sandwich the bottle caps between the plates.

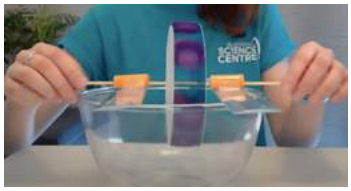
Step 3. Use a skewer to pierce the plates through the middle.

Step 4. Cut two pieces of your straw so it is the same width as your rulers and thread these pieces over your skewer. This will allow your water wheel to spin.

Step 5. Place the two rulers across the bowl and fix in place with sticky tack.

Step 6. Rest the two straws on the rulers and tape them down, so your water wheel is in the middle of your bowl.

Step 7. Pour water gently over the wheel and you should start to see it turn.





What's happening in the water wheel?

Potential energy is stored in the water in the jug. It has the potential to go somewhere and do something.

When the water is poured from the jug over the water wheel, the movement of the water turns the wheel. The potential energy of the water is transformed into movement energy which we call kinetic energy, just like in a hydroelectric power station where the spinning turbine would generate electricity.

TOP TIP

Try pouring the water more slowly and then more quickly. What do you notice?

Scan to watch our 'Make your own water wheel' video on Youtube.

BRIGHT SPARKS!

Are you a bright spark? Test your knowledge with our tricky questions! Check your answers on the back page.

1 A chemical reaction which becomes cold is known as what?

- A) Exothermic
- B) Endothermic
- C) Elsathermic

2 Kinetic energy is more commonly known as what type of energy?

- A) Movement
- B) Chemical
- C) Thermal

3 How many main types of greenhouse gasses are there?

- A) Two
- B) Four
- C) Six

4 How many planets are there in our solar system?

- A) Five
- B) Eight
- C) Nine

5 Which of these are magnetic?

- A) All metals
- B) Ferrous metals
- C) Plastics

6 Which planet in our solar system is the hottest?

- A) Mercury
- B) Mars
- C) Venus

7 Which of these planets in our solar system does not have rings?

- A) Uranus
- B) Mars
- C) Saturn

8 The reaction between bicarbonate of soda and vinegar creates what gas?

- A) Carbon dioxide
- B) Nitrogen
- C) Oxygen

9 Methane is created naturally by which of these processes?

- A) Farming cattle
- B) Humans breathing
- C) Photosynthesis

10 Which of these chemicals is not found in chlorofluorocarbons?

- A) Chlorine
- B) Hydrogen
- C) Fluorine

11 When did Glasgow Science Centre first open for visitors?

- A) 1999
- B) 2000
- C) 2001

12 How many 'hearts' does an earthworm have?

- A) 3
- B) 5
- C) 7

13 Planet George was nearly the name of what planet?

- A) Uranus
- B) Earth
- C) Pluto

14 Hydroelectric power is a form of renewable electricity?

- True
- False

15 A banana shares how much of its DNA with a human?

- A) 25%
- B) 50%
- C) 75%

16 Which one of these is not the name of a Rover on Mars?

- A) Curiosity
- B) Perseverance
- C) Determination

17 How many kilometres above Earth is Space?

- A) 10 km
- B) 100 km
- C) 1,000 km

18 What is the name of the gaseous form of water?

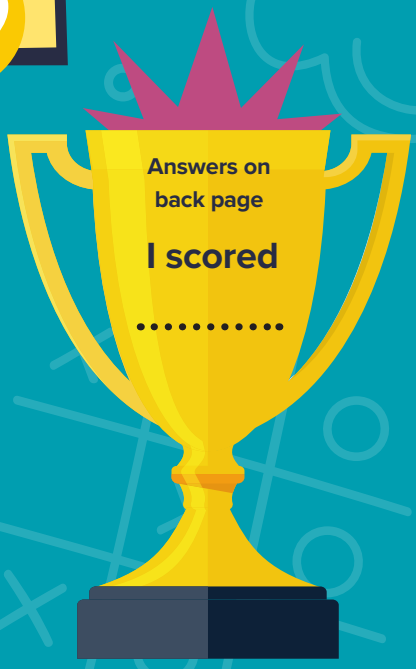
- A) Steam
- B) Condensation
- C) Water vapour

19 How many homes will the O2 turbine power every year?

- A) 1,000
- B) 2,000
- C) 3,000

20 What is the average UK car journey?

- A) 13.5 km
- B) 15.5 km
- C) 18.5 km



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.

Glasgow Science Centre is a registered Scottish charity SC030809.

For more information and bookings, visit: glasgowsciencecentre.org

PUZZLE SOLUTIONS

Space Crossword



Bright Spark QUIZ ANSWERS

Q1 – B. An endothermic reaction is the name of a reaction that becomes cold.

Q2 – A. Kinetic energy is also known as movement energy.

Q3 – C. There are six main greenhouse gases.

Q4 – B. There are eight planets in total in our solar system.

Q5 – B. An earthworm has 5 structures that act as 'hearts'.

Q6 – C. Venus is the hottest planet reaching 450°C.

Q7 – B. Mars doesn't have rings, Saturn and Uranus do.

Q8 – A. Mixing vinegar and bicarbonate of soda makes carbon dioxide gas.

Q9 – A. Cattle farming creates lots of methane.

Q10 – B. Hydrogen is not found in chlorofluorocarbons.

Q11 – C. Glasgow Science Centre opened in the summer of 2001.

Q12 – B. Purple doesn't appear on the visual spectrum.

Q13 – A. King George wanted the planet Uranus named after him upon its discovery.

Q14 – True. It is a form of renewable energy.

Q15 – B. 50% of a human's DNA is the same as a banana's DNA.

Q16 – C. Sojourner, Spirit and Opportunity are names of the other Rovers on Mars that have been sent by NASA.

Q17 – B. Space is 100 km (62 miles) above the Earth.

Q18 – C. Water vapour is the name of the gaseous form of water.

Q19 – B. The turbine will create enough energy for 2,000 homes every year.

Q20 – A. The average car journey is 13.5 km (8.4 miles).

There's more to learn!

Curious to know more about Climate Change? Then check our Curious About: Our Planet website, which focuses on climate change and how you can get involved in building a more sustainable future. Explore the website now: **curiousabout.glasgowsciencecentre.org**

Summer Birthday Party: Friday 22 July, 2022

Glasgow Science Centre turns 21 this year and we want you to come and celebrate with us! We'll be throwing a Summer Birthday Party with live music, arts and crafts, outdoor activities, food and drink and of course: live science demonstrations and the opportunity to meet Scotland's researchers showcasing their latest work!



KEEP IN TOUCH

0141 420 5000 | glasgowsciencecentre.org
50 Pacific Quay, Glasgow G51 1EA

GLASGOW SCIENCE CENTRE
Celebrating 21 years

Glasgow Science Centre is a registered Scottish charity SC030809