Friends in STEM

Activity Pad

Ages 5-8

Hi Everyone!

My name is Stella! My friends and
I are going to teach you all about STEM.

Have you heard of STEM? It stands for Science, Technology, Engineering and Maths! These subjects help our world develop and make new things for you and me.

I love learning all about STEM, especially the people in STEM who have helped our world become what we know today. I would like to share some of their stories with you, so you too can see the brilliant things that these people have created. These people were just kids like you and me once, they loved STEM and went on to do amazing things!

Come and join us on an adventure into the world of STEM. But first, my friends are going to introduce themselves!

Hi, my name is Leo and I'm an astronaut!

As an astronaut, it is my job to explore space! This means I am launched from Earth in a space rocket, I then get to board the International Space Station. We can do lots of cool science experiments in space since things float due to weightlessness.

Space is my favourite thing about science, whats yours?

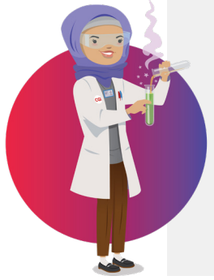
'Leo' is a constellation of stars in space. The stars in Leo make the shape of a lion.

Hi guys! I'm Aurora and I'm an engineer.

It's an engineer's job to design and make things. Being an engineer is a great job if you're curious about how things work and like to work with your hands.

What would you build if you were an engineer?

An 'aurora' is a beautiful natural light display which is sometimes visible at night. The coloured lights are usually only visible near the north and south pole!



Hey everybody! I'm Elara and I'm a scientist.

Being a scientist is super cool because I get to do experiments all day – sometimes I'm even allowed to blow things up!

At school I loved science classes because they help us understand the world around us. What's your favourite thing to learn at school?

'Elara' is the name of one of Jupiter's moons. Jupiter actually has 80 moons in total!

Hello! My name is Samson and I'm a mathematician.

Being a mathematician means I'm good with numbers, but that's only part of it. The best mathematicians are also creative, and great problem solvers too.

What's your favourite way to be creative?

'Samson' is the Hebrew word for Sun.

Science

Science helps us to understand how the world works, through things such as experiments and observations. One of my favourite things about science is space! The scientists who study space are called astronomers or astrophysicists, they can teach us loads of cool stuff about our solar system and beyond!

What is our Solar System?

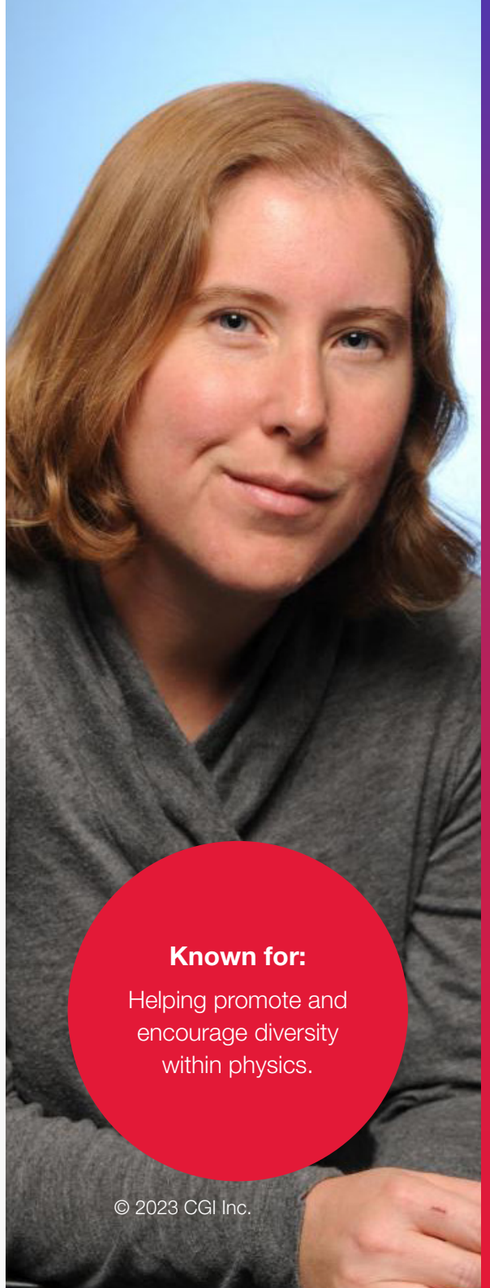
The Solar System is made up of the Sun and everything that circles, or orbits, around it. This includes the planets and their moons, asteroids, comets and meteoroids.

Pluto is a dwarf planet, which means it's a lot smaller than the other planets, but it still orbits, the Sun. Since Pluto is so small, it has not managed to clear its surrounding area of other space debris. (debris is loose natural material – mostly broken up rocks!)

A mnemonic (nuh·mo·nuhk) is an easy way to remember the order of the planets. The first letter of each word gives you the first letter of the planets, in order:

The planets are
(in order of their distance from the Sun):

Mercury →	**M**y
Venus →	**V**ery
Earth (you live here!) →	**E**nthusiastic
Mars →	**M**other
Jupiter →	**J**ust
Saturn →	**S**erved
Uranus →	**U**s
Neptune →	**N**oodle
Pluto (Dwarf Planet) →	**P**ots



Known for:

Helping promote and encourage diversity within physics.

Dr. Jane Rigby

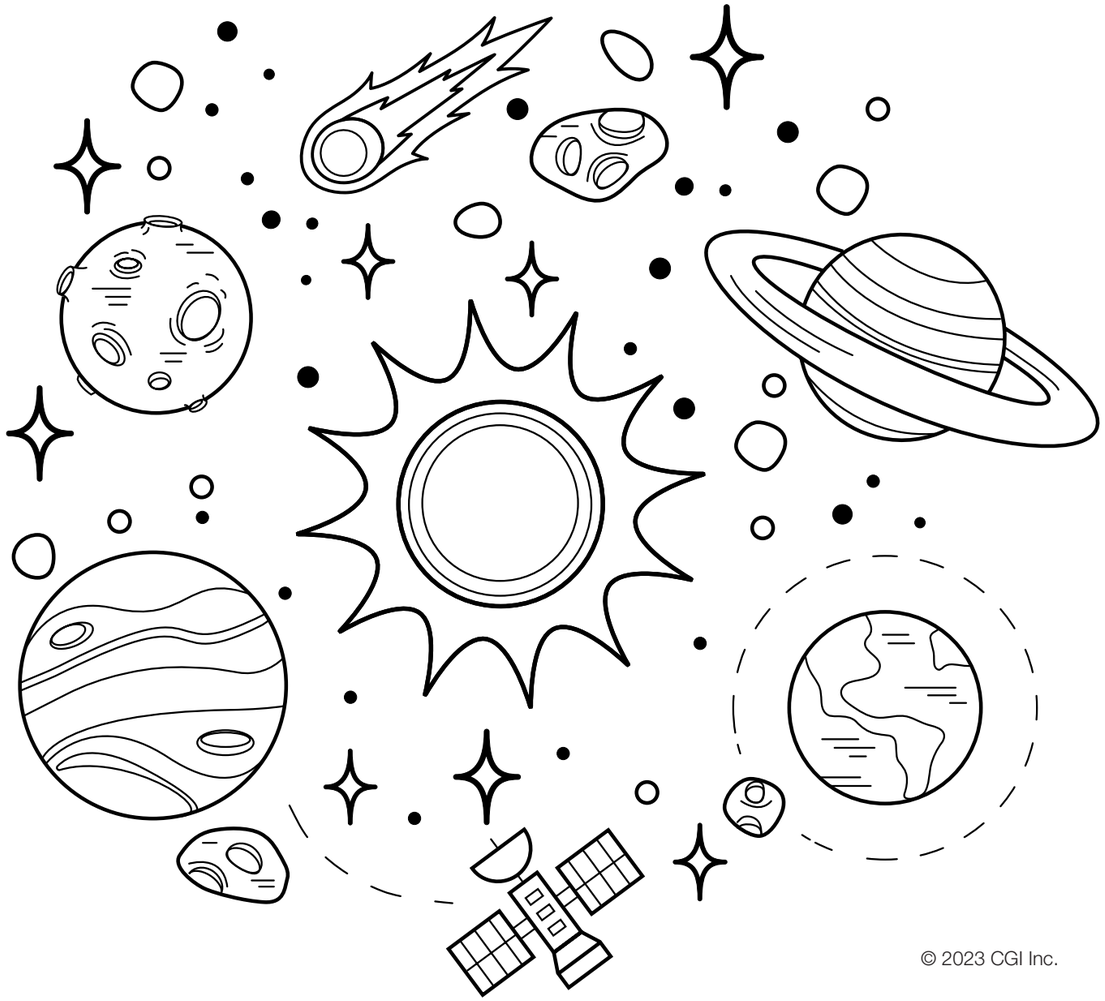
Astrophysicist at NASA

Dr. Rigby is an astrophysicist for NASA. Astrophysicists are people who study space – including stars, planets, and galaxies. Dr. Rigby has also won awards for her amazing work encouraging diversity in physics!

As part of her job, Jane got the opportunity to work on the James Webb Space telescope. The James Webb telescope is the biggest and most powerful space telescope ever engineered, which means it can show us parts of the universe we couldn't see before! It is much bigger than a telescope that you can keep in your house – in fact it is as tall as a building and as wide as a tennis court!

Science

Colour in the picture and circle the items that are planets...



Known for:

Being the first black woman in space!

Dr. Mae Jemison

Engineer, Doctor, Professor, and Astronaut

Mae Jemison has had lots of jobs, she has been a doctor, a teacher, a businesswoman, and even an astronaut!

Mae studied engineering and medicine at university and went on to work as a doctor. However, it was always Mae's dream to be an astronaut, so in 1985 she applied to the NASA astronaut training program. She was so excited to be accepted as this would make her the first black women ever to train to be a NASA astronaut!

After training really hard, Mae and six other astronauts went to space for eight days! During this time Mae orbited the Earth 126 times. Her job on the space shuttle was to test the crew for motion sickness due to weightlessness. She also studied how tadpoles develop in zero gravity!

Science

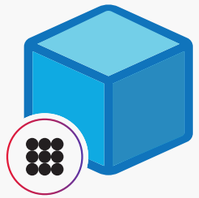
Scientists also study very small particles called atoms and molecules. These particles come together to form something called matter. Matter can take three different forms. I bet you know them already!

Gases do not have a fixed shape. They spread out and change shape and volume to fill up the container they are in!

States of Matter

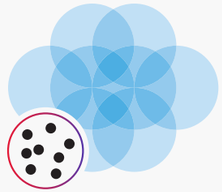
Solid, liquid and gas are the three states of matter.

Matter is made up of particles and can change state when energy is added or removed from it. This energy can take the form of heat or pressure.



A **solid** contains particles that have no room to move around. Lots of materials are solid, such as paper, bricks, wood, metal, and ice.

A **liquid** contains particles that can move around but still stay connected to each other. There are many different liquids such as water, oil, fruit, juice, and many others.



A **gas** contains particles that can move freely and usually bump into each other. There are lots of different gases, such as the air we breathe, or the helium we use to fill balloons.

How about the chairs in your classroom, or the water in your bottle?

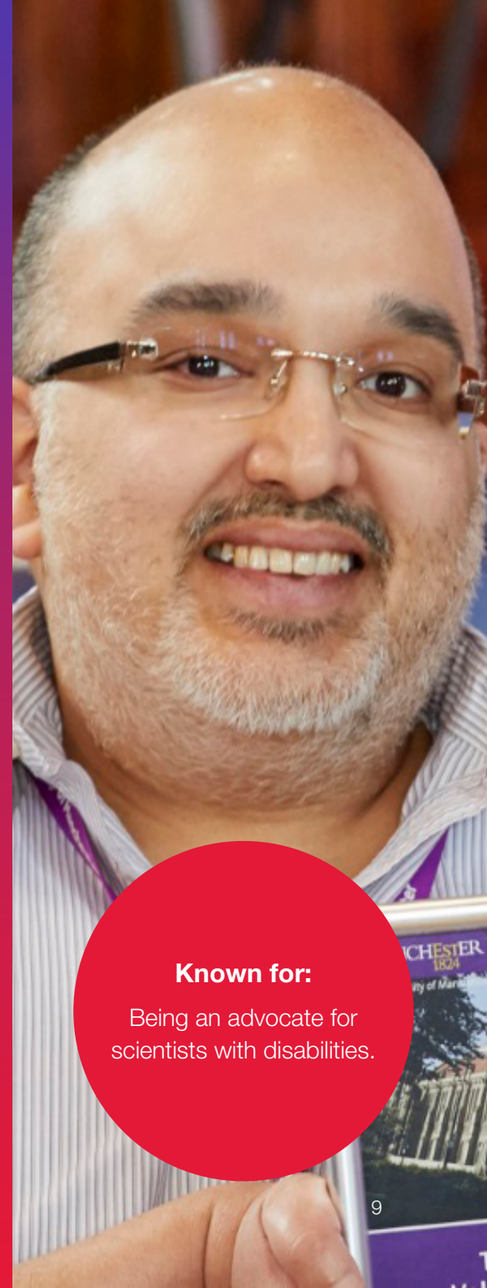
Dr. Hamied Haroon

Biomedical Scientist at the University of Manchester

Dr. Hamied Haroon is a biomedical scientist, this means he works in a lab to create more effective medicine and medical devices.

When Hamied was young he loved science and maths and dreamed of becoming a doctor. He really wanted to make life better for people using his knowledge of science. However, Hamied has a disability which meant it was difficult for him to use his hands, and because of this he was told becoming a doctor would be impossible. Hamied was determined to overcome this, and when he spotted a book called ‘Medical Physics’ he realised there were plenty of ways to work in medicine without being a doctor.

He then went on to study the science behind medicine and used that to help hundreds of people. Right now, he is helping develop technology which can be used to scan people’s brains! How cool is that?



Known for:

Being an advocate for scientists with disabilities.

Science

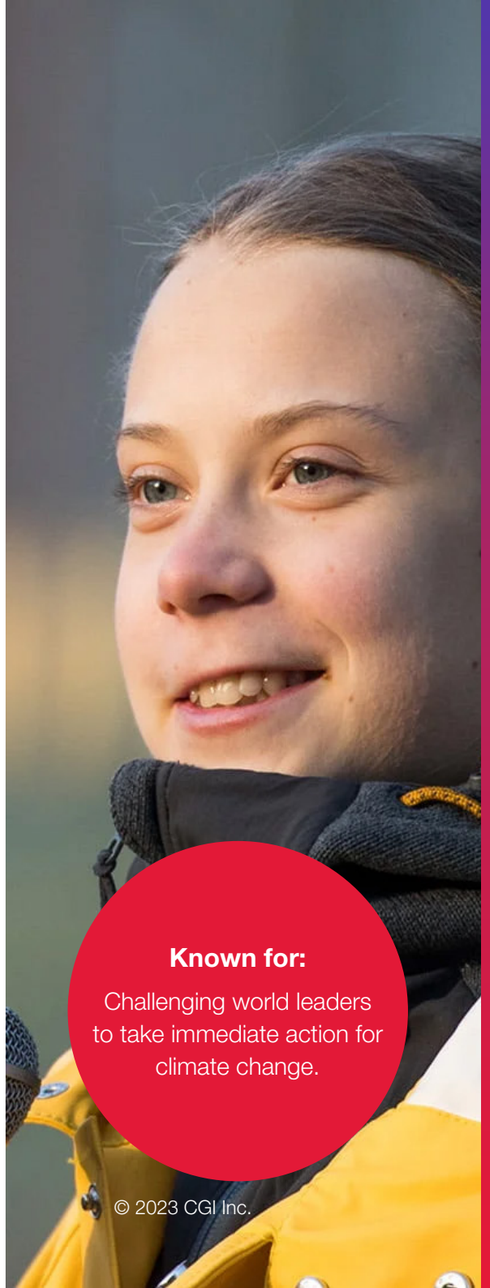
States of Matter

These items are all different states of matter.

Draw each of the items in the correct box. Is it a solid, a liquid or a gas?

Items: Teddy bear • Air in a balloon • Cake • Honey • Clouds • Milk • Apple • Apple juice

Solid	Liquid	Gas



Known for:

Challenging world leaders to take immediate action for climate change.

Greta Thunberg

Environmental Activist

Greta Thunberg is a Swedish environmental activist. This means she does everything she can to slow down climate change.

Climate change is caused by human activities like driving cars, cutting down trees, and creating non-renewable electricity. These actions release harmful greenhouse gases into the air. They create a blanket layer over the Earth which traps all the heat inside – this is called global warming. The extreme change in climate as a result of this is very dangerous for people, animals, and plants everywhere, this is why we must slow it down.

We can all do our bit to slow climate change by:

- Remembering to turn off lights when you leave a room.
- Choose to walk or cycle to school instead of getting a lift.
- Reduce the amount of waste we produce, and recycle it when we can.

Technology

Technology can be anything that is created by humans to help solve problems and make our lives easier!

Computers are a great example of how technology has done just this. Can you think of a way in which a computer helps to make your life easier?

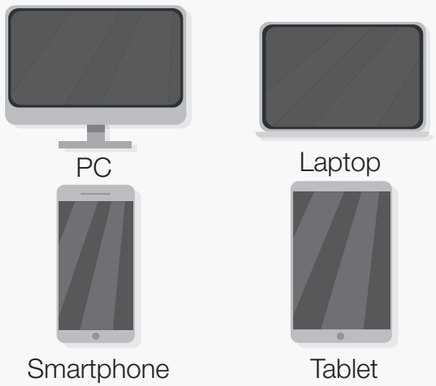
What is a computer?

Computers work by following instructions called code. The instructions tell the computer what to do, and they are written by people called programmers.

Computers are used to write books, create videos, make games, play music, and many more things!

Not all computers look alike.

Here are some examples of different types of computer:



Kimberly Bryant

Engineer and Founder of ‘Black Girls CODE’

Kimberly Bryant is an electrical engineer from the USA. Electrical engineers create and improve electronic devices and equipment.

A lot of engineers work with computers, so it is important for engineers like Kimberly to know how to program them using code.

Kimberly’s daughter wanted to learn to code so she could pursue a career in STEM like her mum, of course Kimberly was thrilled. When they were looking for places to learn code, they noticed a lot of the courses were aimed at boys. Kimberly wanted everyone to have the opportunity to learn to code so she created her own organisation which aims specifically at teaching programming to black schoolgirls – and so Black Girls Code was born!

By creating a safe space for black women and girls to learn code, Kimberly helped encourage loads of people to try STEM who never would have considered it before. She is a STEM outreach superstar!

Known for:

Founding ‘Black Girls CODE’.

Technology

Let's programme a cake!

Coding is a lot like making a cake. We need a list of instructions to tell us how to make the cake, and the instructions must all be in the right order.

My instructions have become muddled.
Can you help me to figure out the correct order by numbering the list of instructions from 1 to 8?

	Pour the mixture into the cake tin
	Put all the equipment on the counter
	Put the cake tin into the oven and bake the cake
	Mix the icing in a bowl
	Take the cake tin out of the oven and place it on the counter to cool
	Mix flour, eggs, milk and sugar in a bowl
	Put the icing on the cake
	Cut and eat the cake

Katie Bouman

Engineer and Computer Scientist

Katie is an American engineer and computer scientist. She helped to produce the first image of a black hole. A black hole is a place in space where the gravity is so strong that nothing can escape, not even light!

Katie studied electrical engineering at university in the USA. She then went on to earn a master's degree and a PhD in engineering and computer science – that takes a lot of work!

After graduating university Katie joined the Event Horizon Telescope project, in which her team developed the algorithm which produced the first image of a black hole. A photo of Katie celebrating this huge achievement went viral on the internet. She used her new internet fame to praise her team and their hard work.

Katie now works for the California Institute of Technology, here she studies a type of artificial intelligence called machine learning.

As a result of her many achievements, Katie has won lots of awards. She even has an asteroid named after her!

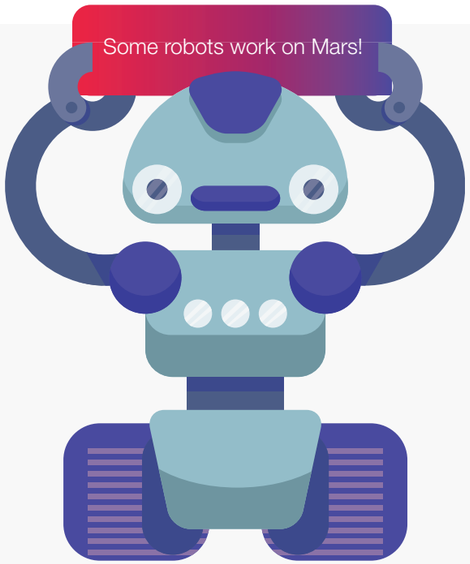
Known for:

Creating the first image of a black hole.

Engineering

Engineers solve problems with their inventions. They love figuring out how and why things work. But before things are built, they need to be planned out, this is called engineering.

Do you like engineering things? I do. One of my favourite activities is making a robot out of junk, like old material, metal, or paper, and imagining what jobs it might do.

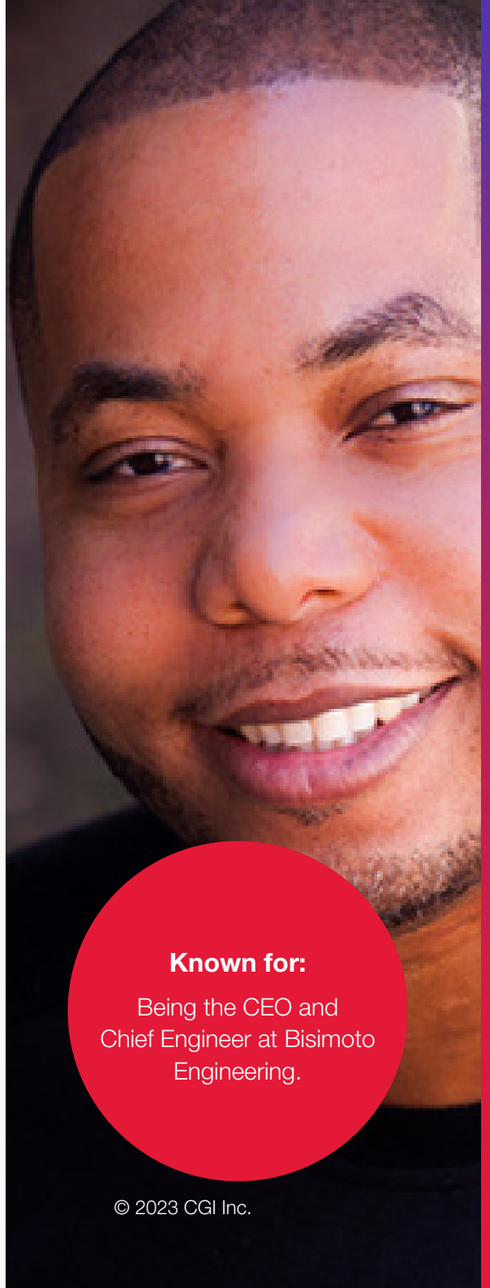


What are robots?

Robots are machines designed to follow instructions and do lots of different jobs – even the ones humans can't do. Robots only do the specific jobs that a person has built them to do.

Robots are used for lots of things – making cars, fixing things, cleaning, cooking, and even having them as friends.

What have you seen robots do before?
What would you have your robot do?



Known for:

Being the CEO and Chief Engineer at Bisimoto Engineering.

Bisi Ezerioha

Engineer and Racing Driver

Ndubuisi ('Bisi') Ezerioha is an engineer and a professional race car driver. While Bisi was young he developed an interested in science, specifically chemistry. He also loved cars and wanted to know how they were powered.

His curiosity led him to start university aged only 15, which is very young! Most people are much older when they go to university. At university he studied chemical engineering and went on to gain a master's degree.

Once he left university he started researching different types of medicine. However, his real passion was still motorsports, so not long after, Ezerioha started his own engine design company. During this time, he created extremely powerful engines and raced in some very fast cars. Over his 20 year drag racing career he won loads of races and awards for engine design.

It was his scientific skills which set him apart and helped him achieve his dreams!

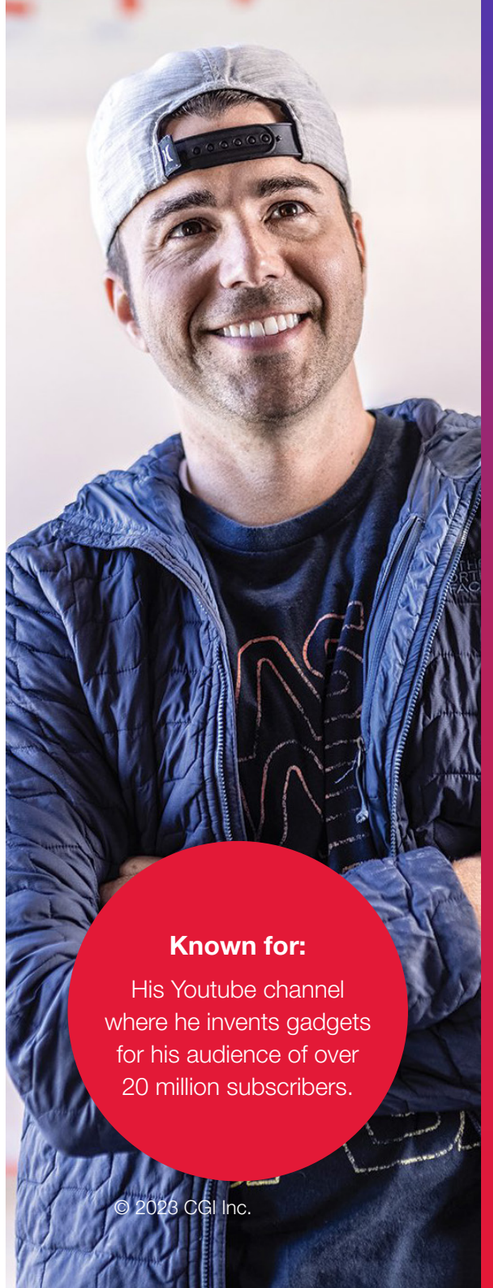
Engineering

Colour me in!

Colour each square of the robot using the colour-coded numbers.
For example, 3 should be coloured grey.

				3	3	3	3	3				
				3	1	3	1	3				
				3	3	3	3	3				
				3	6	6	6	3				
	4	4	3	3	3	3	3	3	3	4	4	
	4	4	3	5	5	5	5	5	3	4	4	
	3		3	5	2	2	2	5	3		3	
	3		3	5	2	2	2	5	3		3	
7	7	7	3	5	2	2	2	5	3	7	7	7
7		7	3	3	3	3	3	3	3	7		7
				3	3		3	3				
				3	3		3	3				
				3	3		3	3				
			7	7	7		7	7	7			

1	Yellow
2	Orange
3	Grey
4	Blue
5	Purple
6	Black
7	Red



Known for:

His Youtube channel where he invents gadgets for his audience of over 20 million subscribers.

Mark Rober

Ex-Nasa Engineer, Inventor, Educator and Youtuber

Mark Rober is a YouTuber from the United States. He makes videos on science and gadgets.

Before he started making videos on YouTube, Mark worked for NASA as an engineer. He helped to create the Curiosity rover, a robot designed to explore Mars!

Mark has always enjoyed inventing things. When he was young, he created a pair of goggles that stopped you from crying when you were cutting onions!

Maths

Maths is all around us. We use maths to tell the time, to play games, to build things, and do all sorts of different work.

I will even be using maths to help me divide up some pizzas later on. I'll be using fractions to do this and I'll need your help!

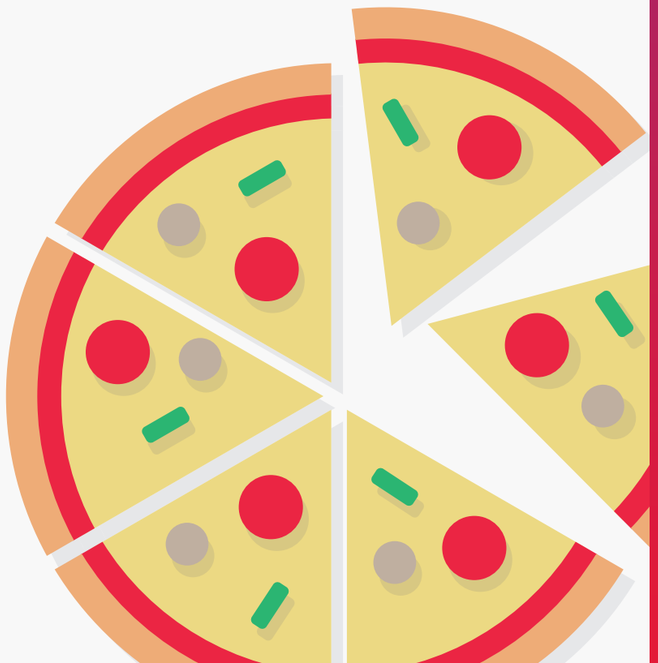
1/4 1/2 3/4

What are fractions?

Fractions are parts of a whole thing or number. Here is an example of a fraction : ¼ (one quarter).

The top number is called the numerator and the bottom number is called the denominator.

A simple way to think of fractions is by imagining them as slices of pizza. If you divide a pizza into 6 slices and someone takes 2 slices, then they have a fraction of 2/6.



Dr. Jess Wade

Physicist and Science Communicator

Jess Wade is a physicist from the UK. A physicist is someone who uses maths to study the way things move and interact with each other. Jess is so good at physics that she earned a British Empire Medal, which is an award given to her by the crown for her services to physics.

Jess works hard to make sure that women and girls have equal opportunities in STEM. She recently started a project where she writes about female scientists, mathematicians, and engineers who were overlooked throughout history. She details their achievements on Wikipedia so others can be inspired by them. So far, she has written 300 articles! Her work to encourage girls into science has earned her a Wikipedia article of her own!

"I don't want science to just be for the chosen few… I think that once we've got more diversity in science, it will become a better place." **Dr. Jess Wade**

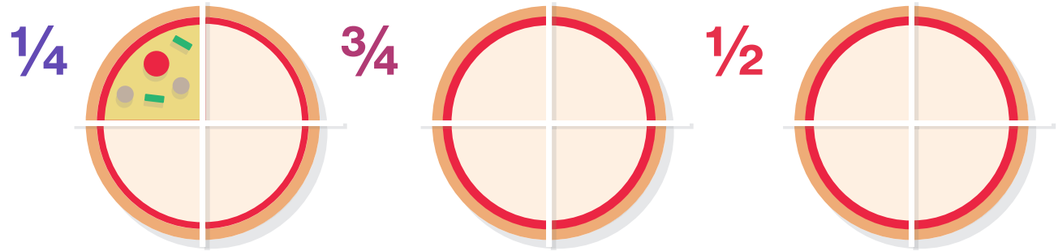
Known for:

Promoting equal opportunities for women and girls in science.

Maths

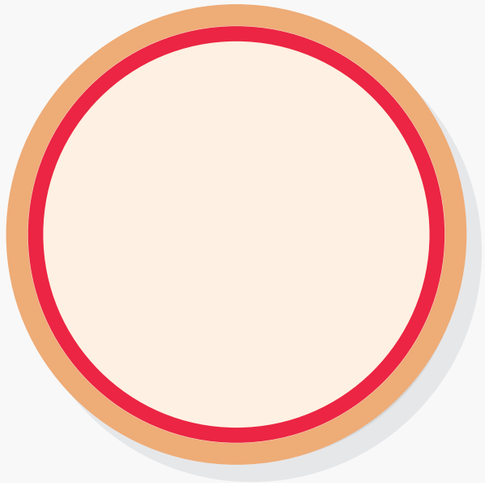
Can you help me get these pizzas ready for the party?

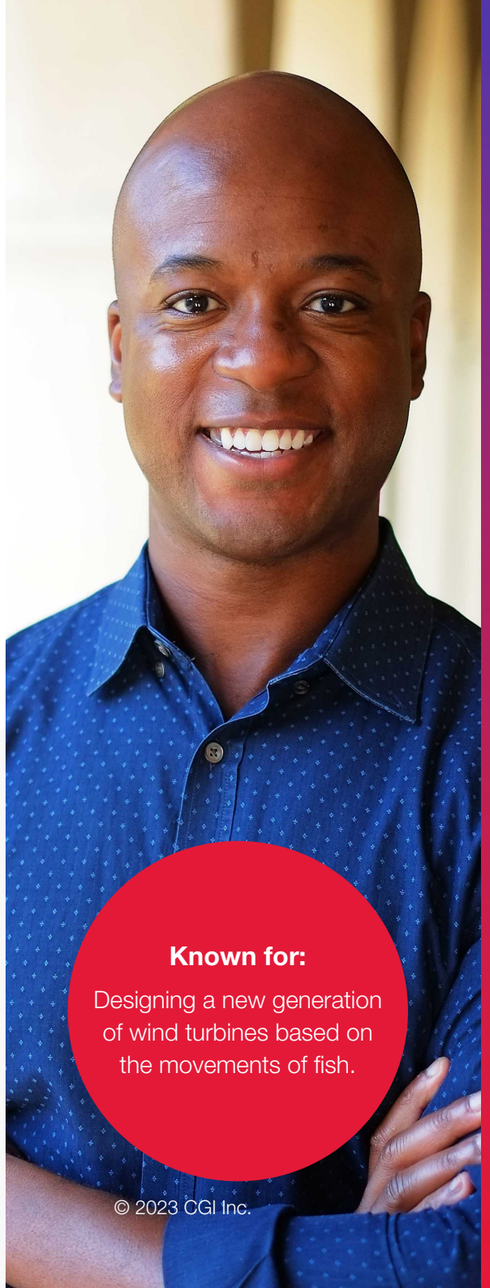
I have coloured in the first pizza fraction.
Can you do the rest? The fraction tells you how much of the pizza needs to be coloured in.



Pizza party!

Can you create your favourite pizza and then divide it into 6 equal slices for you and your friends?





Known for:

Designing a new generation of wind turbines based on the movements of fish.

John O. Dabiri

Engineer and Biophysicist

John O. Dabiri is a Nigerian-American engineer who studies fluids (liquids and gases). He has used his knowledge of fluids to study how jellyfish move in the ocean. Jellyfish swim by pushing themselves through the water with their tentacles, this is a very interesting process and modelling it requires a lot of complex maths. Liking maths is important to engineers and scientists as it is the language they use to solve problems.

While studying jellyfish in the ocean, John was inspired to design a new more efficient wind turbine. Wind turbines transform wind into electricity which is great for the environment. He was interested in how schools of fish move in the sea, and he designed a wind turbine which copied this action.

These new wind turbines can be placed closer together than traditional ones and this means more electricity can be produced in a smaller space. Traditional wind turbines are very tall which means they can interfere with birds and bats but John's new turbines solve this problem!

CGI

Well, it looks like we've reached the end of our journey through STEM. We had lots of fun – we hope you did too!

Remember that STEM is all around us; it makes the world go round and lets us do really cool things. Without STEM, we would not have lots of the things that are part of everyday life, like mobile phones, cars, medical equipment, and so much more.

If you're interested in learning more about STEM, there are loads of great books to read and things to learn about. Ask your teachers and parents about these, and see what else you can learn!

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Dr. Jane Rigby
https://aas.org/comms/sgma/sgma-interviews-jane-rigby

Dr. Mae Jemison
https://airandspace.si.edu/stories/editorial/she-had-dream-mae-c-jemison-first-african-american-woman-space

John O. Dabiri
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Greta Thunberg
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Kimberly Bryant
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Katie Bouman
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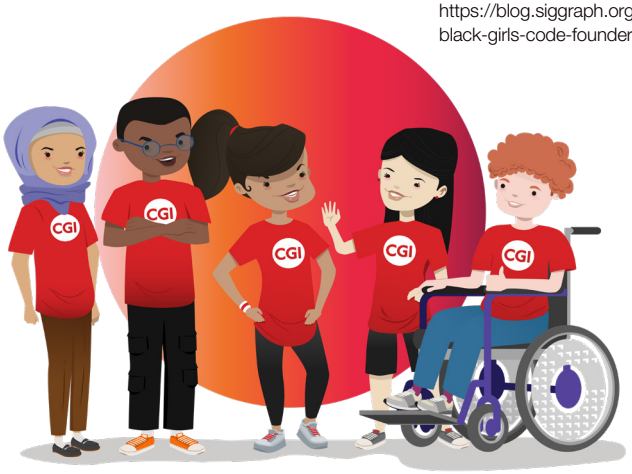
Bisi Ezerioha
https://www.speedsport.com/other-series/industry-news/ezerioha-to-be-featured-during-race-industry-week/

Mark Rober
https://magazine.byu.edu/article/mark-rober/

Dr. Hamied Haroon
https://royalsociety.org/topics-policy/diversity-in-science/scientists-with-disabilities/hamied-haroon/

Dr. Jess Wade
https://www.thefemalelead.com/post/jess-wade-we-rise-by-lifting-others



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