

# ENGINEERING

# MUM



## What is engineering?

It might sound tricky but engineering is all about solving problems. It means designing, testing and making useful things. Engineers have helped improve our lives in loads of ways and even helped change the world. Almost everything in your house will have been designed by an engineer - from the carpet on your floor to the toothpaste on your brush - the brush was invented too (by William Gibson, in case you were wondering!)

## What do engineers do?

- They identify a problem or new idea or something that could be improved
- They ask lots of questions to understand how best to solve the problem
- They have to be creative and think in lots of different ways to find solutions
- They make detailed designs of their best ideas
- They make models to test the designs
- When a final version is built that will need testing too!



## Could I be an engineer?

Of course! Often there will be many people involved in creating new things and solving problems and the chances are, whatever you like to do, you could be an engineer too!

### **If you like music and playing an instrument...**

You could test new instruments - maybe test the world's loudest trumpet!

### **If you love gadgets and video games...**

What could be better than becoming a software engineer? You could design the perfect multiplayer.

### **Maybe it's nature you love - you're all about pets and wildlife!**

Engineering new submarines could help us to understand more - or you could study the animals and come up with ways to help protect them

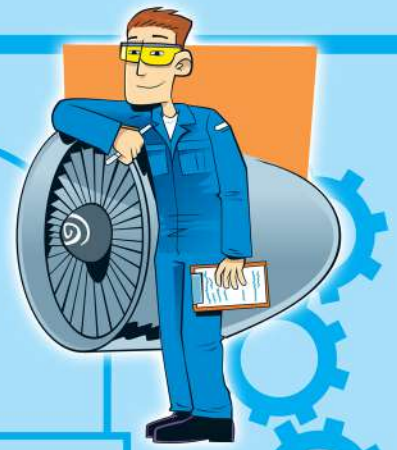
### **We'll find you on the football pitch or on the skatepark - as long as it's outside!**

There's masses of engineering in science - you could design the best football boot ever and get a goal every time!

### **Perhaps you just love getting lost in a good book and being taken to a fantasy land!**

Ideas come at the start of all new inventions and are really important for all areas of engineering - so if you've got a good imagination it could be just the thing for you!

**Aeronautical and aerospace engineers** work with things which can fly both inside the Earth's atmosphere - that's aeronautics, and out in space - or aerospace. They could be working on big stuff like double decker planes, or rockets and spacecraft to explore space. They also design test and build smaller things - like satellites the size of a table or drones that fit in one hand.



**Biomedical engineers** use the power of engineering to develop treatments and aids to help us stay in good health. Some work on new and with different materials - inventing and trialling super tough metals or mega flexible polymers to use in artificial joints to keep us moving for longer - especially in old age.



**Chemical engineers** create and develop the processes to produce, change or transport products and materials. They are involved in the design, modification and operation of processes to produce the things we rely on everyday - electricity, petrol, chocolate, cars, cosmetics, aspirin, the list is endless. Chemical engineers learn at university, they're employed across a huge range of sectors including energy, healthcare, food, water and many more.



**Civil and structural engineers** need to know how to design and build different kinds of structures in ways that make them safe, steady and energy efficient. It's like Lego and Minecraft but for real. Just like building games you need to know how building materials behave and then test out different designs to see what works best.



**Electrical engineers** design, develop and maintain electrical control systems and components to required specifications. They work across many sectors, including the building industry (such as lighting, heating and ventilation), transportation and transport networks, manufacturing and construction, as well as production and distribution of power.





**Energy engineers** are involved in the production of energy through natural resources, as well as from renewable or sustainable sources of energy. They look for efficient, clean and innovative ways to supply energy, which might involve designing and testing machinery, developing ways of improving existing processes, transmitting and supplying useful energy to meet our needs for electricity or researching ways to generate new energy.

**Mechanical engineers** design, produce and operate machinery to carry out many different jobs. They might invent some totally new machinery or help an inventor to create or improve their machines. Mechanical engineers understand the science behind movement and the properties of different materials. They also have to know how the environment around a machine will affect things.



**Marine engineers** design and build things which operate in water - that might mean at sea, in a river or reservoir, even in a swimming pool! One of the oldest types of marine engineering is naval architecture - designing boats! They figure out the best way for vessels to be propelled - which means thinking about power and engine design. Things can behave very differently at sea so they need to know the effects water has on machinery and materials.

**Material engineers** are experts at understanding the differences between different types of things. And they even create new materials - like smart fabrics.



**Software engineers** write programmes which contain the instructions to run games, applications and machinery. These programmes are everywhere - inside kitchen appliances like washing machines, our cars we drive, electronic toys and smart watches. And they are used in helping manufacture all sorts of things too - a car on a production line or a plastic drinking bottle.



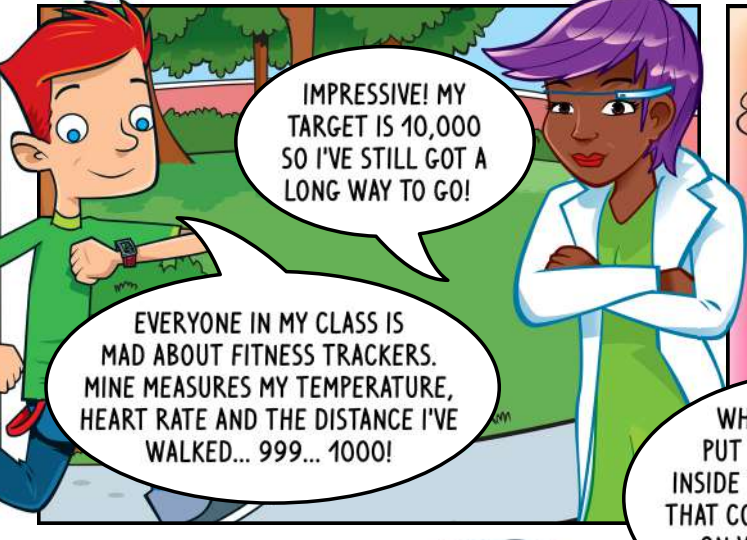
# Civil and structural engineers

What do they do?



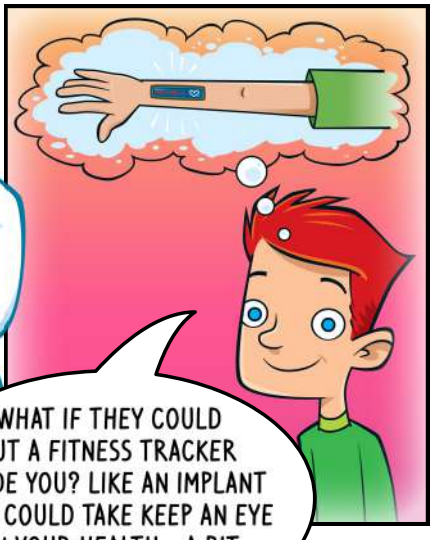
# Electrical engineers

What do they do?

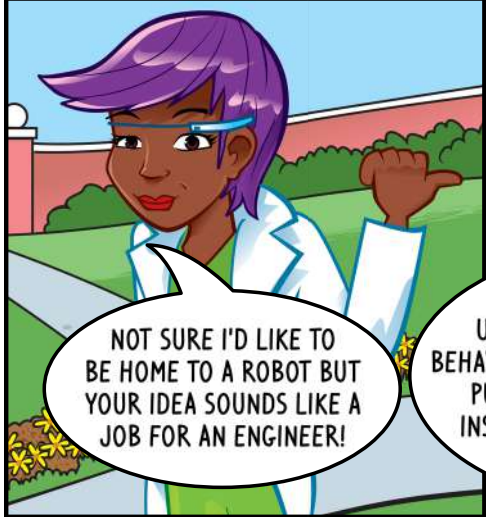


IMPRESSIVE! MY TARGET IS 10,000 SO I'VE STILL GOT A LONG WAY TO GO!

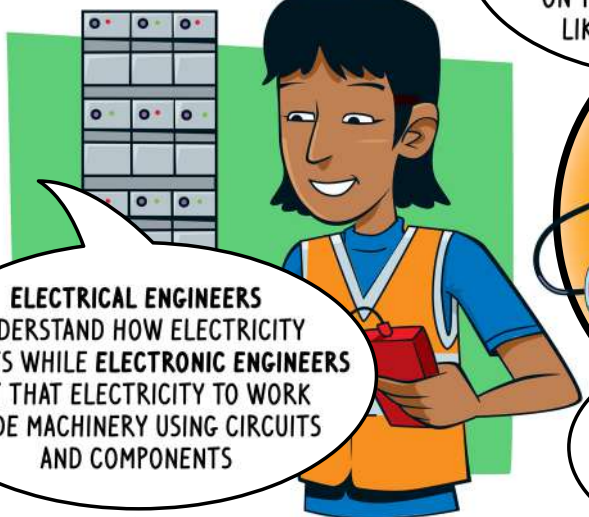
EVERYONE IN MY CLASS IS MAD ABOUT FITNESS TRACKERS. MINE MEASURES MY TEMPERATURE, HEART RATE AND THE DISTANCE I'VE WALKED... 999... 1000!



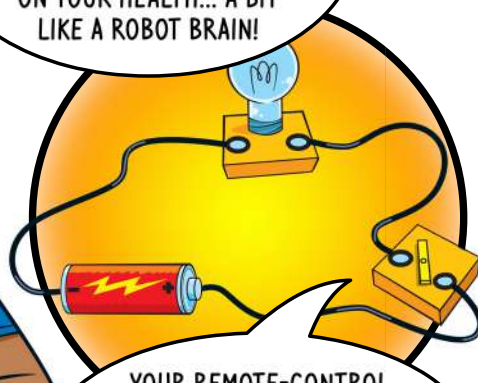
WHAT IF THEY COULD PUT A FITNESS TRACKER INSIDE YOU? LIKE AN IMPLANT THAT COULD TAKE KEEP AN EYE ON YOUR HEALTH... A BIT LIKE A ROBOT BRAIN!



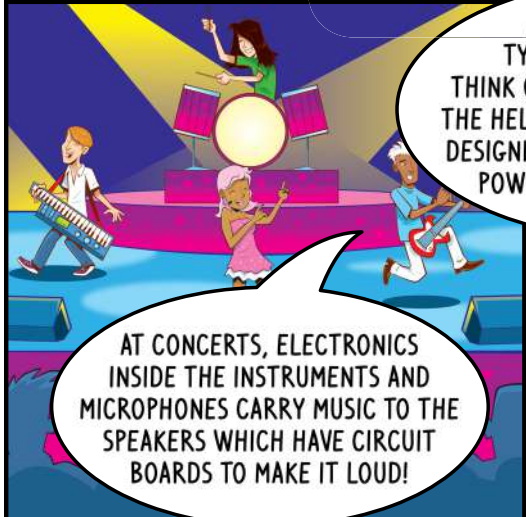
NOT SURE I'D LIKE TO BE HOME TO A ROBOT BUT YOUR IDEA SOUNDS LIKE A JOB FOR AN ENGINEER!



ELECTRICAL ENGINEERS UNDERSTAND HOW ELECTRICITY BEHAVES WHILE ELECTRONIC ENGINEERS PUT THAT ELECTRICITY TO WORK INSIDE MACHINERY USING CIRCUITS AND COMPONENTS



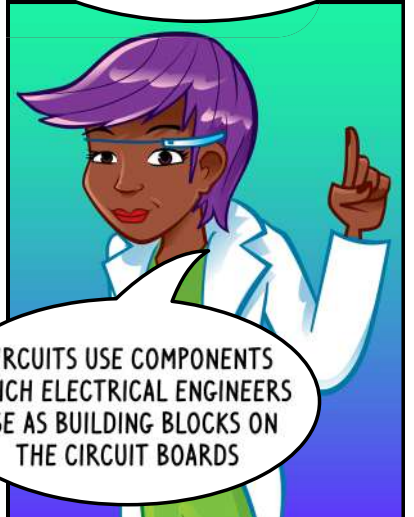
YOUR REMOTE-CONTROL CAR AND DRONE HAVE CIRCUIT BOARDS INSIDE THEM, DESIGNED BY ENGINEERS TO TAKE INSTRUCTIONS FROM A CONTROLLER



AT CONCERTS, ELECTRONICS INSIDE THE INSTRUMENTS AND MICROPHONES CARRY MUSIC TO THE SPEAKERS WHICH HAVE CIRCUIT BOARDS TO MAKE IT LOUD!



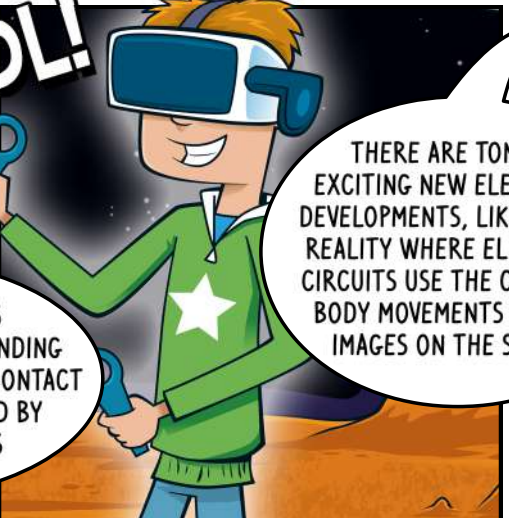
AND JUST ABOUT ANY TYPE OF VEHICLE YOU CAN THINK OF HAS BEEN DESIGNED WITH THE HELP OF ELECTRICAL ENGINEERS, DESIGNING THE CIRCUITS TO DELIVER POWER TO WHERE IT'S NEEDED



CIRCUITS USE COMPONENTS WHICH ELECTRICAL ENGINEERS USE AS BUILDING BLOCKS ON THE CIRCUIT BOARDS



ELECTRICITY BEHAVES IN A PARTICULAR WAY DEPENDING ON WHAT MATERIALS IT'S IN CONTACT WITH. IT'S ALSO AFFECTED BY THINGS LIKE MAGNETS



THERE ARE TONS OF EXCITING NEW ELECTRICAL DEVELOPMENTS, LIKE VIRTUAL REALITY WHERE ELECTRICAL CIRCUITS USE THE CHANGE IN BODY MOVEMENTS TO MOVE IMAGES ON THE SCREEN



VR GOGGLES COULD MAKE THIS PARK LOOK LIKE NEPTUNE - THAT WOULD MAKE IT MORE FUN TO EXERCISE!

# Interested in engineering? Why not be a...



## Formula 1 Engineer

Maybe you've got what it takes to make these supercars faster and lighter?



## Rollercoaster Engineer

There are plenty of highs and lows as a theme parks engineer. What will you design?



## NASA Curiosity Driver

Controlling the craft from Earth or maybe travelling to Mars and steering it yourself?



## Skatepark Engineer

If you skate, you'll know what makes the perfect half pipe - so why not come up with your own?



## Chocolate Engineer

If you like a sweet treat, you might be the best person to come up with new taste sensations



## Storm Tracker

You could chase storms around the world to gather data for meteorologists



## 3D Printing Engineer

Almost anything is possible with a 3D printer - maybe you could print a digital pet?



## Deep Sea Builder

Bored with life on dry land? Why not design a city under water - fish lover's welcome!



## LEGO Designer

Loads of us love LEGO. How cool would it be to come up with the latest LEGO creations?



## Cloud Chaser

Taking readings from the clouds can tell us about the chemicals in our environment

# Can you match the invention to the inventor?



Reflecting telescope



Toothbrush



Tin can



Thermos flask



Hovercraft



Chocolate bar



Aquarium



ATM



The World Wide Web



Paper bag



Dishwasher



Telephone



First cloned animal



Home security camera



Kevlar body armour

Jeanne Villepreux-Power / 1834

Isaac Newton / 1668

William Addis / 1780

Peter Durand / 1810

Sir James Dewar / 1982

Christopher Cockrell / 1953

JS Fry / 1847

Margaret E. Knight / 1879

John Shepard Baron / 1967

Stephanie Kwolek / 1965

Josephine Cochrane / 1886

Marie Van Brittan Brown / 1966

Alexander Graham Bell / 1876

Keith Campbell / 1991

Tim Berners Lee / 1989



## Famous British female engineers



**Delia Ann Derbyshire**

Electronic music engineer at the BBC who worked on creating sound effects and helped write the Doctor Who theme tune!



**Dame Caroline Haslett**

Electrical engineer who believed that electricity could change women's lives for the better and free them from exhausting housework, with electric appliances such as vacuum cleaners. Also encouraged all adults to know how to wire a plug safely.



**Beatrice Shilling**

Aeronautical engineer who corrected a serious fault in the Spitfire's engine during WWII. She also raced motorcycles!



**Victoria Drummond**

UK's first marine engineer who served at sea as an engineering officer in the British Merchant Navy during WWII



**Helen Sharman**

Respected chemical engineer who was the first British astronaut and the first woman to visit the Mir space station in 1991

## Skills for engineering

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

- Solving
- Design
- Computing
- Gaming
- Drawing
- Creativity
- Mathematics
- Thinking
- Checking
- Pattern
- Inventing
- Good Listener
- Reporting
- Explaining
- Analysing
- Researching
- Testing
- Experimenting

## All about engineering

- Energy
- Marine
- Electronic
- Nanotechnology
- Materials
- Civil
- Biomedical
- Structural
- Software
- Electrical
- Automotive
- Architectural
- Chemical
- Mechanical
- Aeronautical
- Aerospace
- Robotics
- Geological

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

## Techno Mum's fun engineering facts

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Download the podcast at [funkidslive.com](http://funkidslive.com)

### John Joseph Merlin



Merlin invented the roller skates. He demonstrated them for the first time by careering into a party while playing the violin... and crashing into a mirror!

### Edwin Beard Budding



Budding was the man who invented the lawnmower. He would only test it at night so his neighbours didn't think he was mad!

### Gunpei Yokoi



Yokoi invented the Game Boy. He was originally a caretaker at Nintendo!

## Inspirational women engineers



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Electronic music engineer at the BBC who worked on creating sound effects and helped write the Doctor Who theme tune!



**Dame Caroline Haslett**

Electrical engineer who believed that electricity could change women's lives for the better and free them from exhausting housework, with electric appliances such as vacuum cleaners. Also encouraged all adults to know how to wire a plug safely.



**Abbie Hutty**

Abbie works for Airbus Defence and Space where she started working in a number of different mechanical engineering groups, analysing and testing structures of various spacecraft before becoming a Spacecraft Structures Engineer on the ExoMars Rover - building Europe's first Rover mission to Mars!



**Patricia Bath**

Patricia was the first black person to serve as an ophthalmology (medicine that looks at the anatomy and diseases of the eye) resident at New York University and the first woman on staff at the Jules Stein Eye Institute. She invented a way to use lasers to treat cataracts.



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**Anna Stork + Andrea Sreshta**

After the devastating 2010 Haiti earthquake, the pair created an inflatable, waterproof, solar-powered light, the LuminAID Solar Light. Their design can be packed flat, charges in 6 hours to provide light for 16, and features a handle to make it easy to carry.



**Ayla Hutchinson**

After teenager Ayla saw her mother cut her finger while splitting kindling with a hatchet, she thought there had to be a better way to do the job. She invented the Kindling Cracker - a device that makes it easier and safer to cut kindling. It uses a built-in axe blade in a safety cage: the cage holds the wood while you hit it with a hammer, easily splitting the log in pieces.

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**Forces**

Gravity is a force which pulls an object

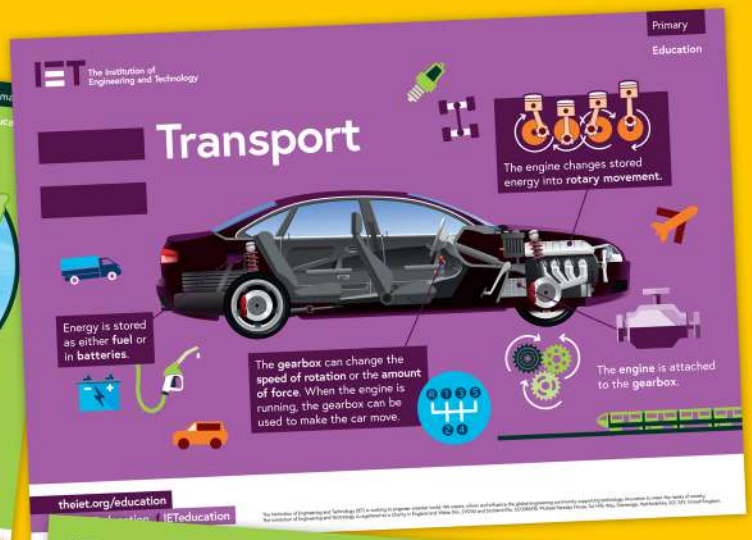
Gravity pulls objects towards Earth.

This is why when something is dropped it falls to the ground.

Different shapes fall at different speeds. This is because of air resistance.

How fast the object falls depends upon what it is falling through. Air and water create different levels of resistance.

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**Transport**


Energy is stored as either fuel or in batteries.

The gearbox can change the speed of rotation or the amount of force. When the engine is running, the gearbox can be used to make the car move.

The engine changes stored energy into rotary movement.

The engine is attached to the gearbox.

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**The International Space Station**

Astronaut living quarters

The International Space Station orbits the Earth more than 15 times a day. This means it travels a distance equal to the length of the United Kingdom every two minutes!

When something travels in a circle around another object, this is called 'orbiting'.

The moon takes about 27 days to orbit the Earth.

The Earth takes a year to orbit the sun.

Docking bay to deliver supplies

Solar panels for power

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**Radio waves**

Connecting the wireless world

Antennas are used to send and receive radio waves. These are a type of electromagnetic radiation and are used to:

- connect our mobile phones
- receive pictures on our TVs

Antenna design is a big engineering challenge - antennas range from:

- a 10cm radio telescope to...
- a metal pattern on a tiny circuit board in your phone

Mobile phones use radio waves to connect with their network.

- Radio waves are a type of electromagnetic radiation.
- Just like ripples in water, radio waves bend (diffract) around objects.

Bringing learning alive

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We are one of the world's largest engineering institutions, passionate about inspiring students with STEM studies and helping them develop valuable skills. Our education programme offers a range of free STEM teaching resources. [theiet.org/education](http://theiet.org/education)