



What is STEM?



Science, Technology, Engineering and Maths, or STEM, is the grouping of subjects concerned with science and technology. People who work in STEM collaborate on exciting research and projects to tackle some of the biggest challenges we face today. They find solutions through research, teamwork and innovation.

These challenges impact on everyday life:

- Renewable energy
- Sustainable transport
- Recycling
- Non-invasive healthcare treatments eg, microbots
- Cybersecurity
- Building homes and infrastructure for the growing population
- Food shortage...



...and the list doesn't end there. The impact of STEM can be seen in everything we do. If you're interested in making sure we can solve problems ready for the future, then STEM could be your passion.





What skills do you develop with STEM?

- **Problem-solving** – STEM workers solve real-life problems every day.
- **Creativity** – finding solutions to problems requires creativity and ‘thinking outside of the box’.
- **Design thinking** – when solving problems, you need to design a solution that can be tested and evaluated.
- **Critical thinking** – don’t be afraid to analyse and critique your ideas or the ideas of others so that you can improve the outcome.
- **Collaboration** – STEM problems often need input from many individuals, so being able to collaborate effectively is crucial.
- **Eye for detail** – STEM projects have many components that have to work together to meet their aim. When designing something like a bridge or a software program, it’s important to understand and check all of the finer details before rolling the project out.
- **Adaptability** – when a project isn’t going as planned or a client changes their requests it’s important to be flexible and adapt your approach.
- **Decision-making** – a large part of STEM is gathering data and then using it to make an informed decision about the next step in a project.
- **Learning from mistakes** – in STEM it’s important to understand why things go wrong, and use mistakes as an opportunity for deeper learning.



*www.thecompleteuniversityguide.co.uk/careers/what-do-graduates-do-and-earn#Graduatesearn



STEM careers

Did you know, there’s a shortage of STEM skills across the world right now? Skills and qualifications in STEM are in high demand, and with a wide range of careers to choose from, now is the perfect time to study STEM!

STEM jobs also tend to be highly paid. The starting salary for a STEM graduate is well above the average graduate salary, coming second to only medicine and dentistry*.

What’s your favourite thing about STEM?

STEM subjects often produce an outcome which will directly benefit society, whether it be through the construction of a new product, technological innovation, or a new theory. It’s extremely satisfying to be part of a community which uses innovation to, at times, literally shape the world we live in.

Naomi, Civil Engineering Year 4



What is university?

A university is where you continue your education after school, and will work towards an academic degree. Studying for your first ('undergraduate') degree can take three or four years, and you will gain in-depth knowledge of one or two specific subjects. Some students go on to further postgraduate study, for a Masters or PhD, to deepen their knowledge of their subject, and even be involved in academic research. A student who successfully finishes their degree is called a graduate.

Why go to university?

- Getting a degree usually qualifies you for a higher paying and more rewarding career
- You have three or four years to study a subject that really interests you
- In some degrees, you can do a year in industry to get job experience or study abroad in another country to experience different cultures
- You will meet new people, make new friends and expand your horizons

How do I get into university?

Each university has different requirements so it's good to do some research. At Birmingham, most of our degrees require three good A levels and at least a C (numerical grade 4) in Maths and English GCSE. To find out about the requirements for any degree subject, it's best to visit our website at www.birmingham.ac.uk

It's recommended to take time thinking about which subject you wish to study as you need to be prepared to study it for three or four years. If it's too hard to choose one subject you can do a joint honours degree, which allows you to study two or more subjects.

So that you can make a fully informed decision it's best to do some research:

- Speak to your teacher
- Check many university websites to compare
- Look at the UCAS website, which has an extensive list of degree subjects you can study across the country
- Attend a university open day to speak to academics and students



Why come to the University of Birmingham?

When picking a university, there are lots of things to consider and it can be quite overwhelming. A good place to start is to look into some of the key features of universities that offer the course you are interested in. At Birmingham, we pride ourselves on:

Excellent teaching and research

We are part of the Russell Group, which is a collection of research-intensive universities across the UK, so you will be taught by academics involved in cutting-edge research and experts in their fields.

Beautiful campus environment

Birmingham is a campus university, with facilities such as a library, lecture theatres and sports centre together on our main Edgbaston site, yet only an eight-minute train journey away from Birmingham, a diverse, modern and exciting city.

Fantastic job prospects

Birmingham is ranked in the top ten UK universities for graduate employability according to the Global University Employability Ranking 2019.

Student support

We are committed to providing the best possible support to all our students so that you can make the most of your time at university.

I chose to go to university because I wanted to try something new and I loved the idea of meeting new friends and becoming more independent. At first it wasn't easy, but I became more independent through trial and error (I have burnt toast quite badly a few times...). My favourite thing is joining new societies at university! I love engineering but I also love playing the piano, so I joined the Music Society.

Kelly, Mechanical Engineering Year 4



Degree apprenticeships

If you are considering going to university but would like to earn money and work experience at the same time, then a degree apprenticeship may be a good option for you.

Degree apprenticeships are similar to higher apprenticeships but they also provide you with an opportunity to gain a degree. During your course you will spend part of your time at university and the rest with your employer. The benefits of choosing a degree apprenticeship are:

- You will be employed and paid a wage throughout your course
- You won't need to pay student fees for your degree
- You will have a head start in your chosen profession as you have been gaining work experience whilst studying

See page 11 to find out about degree apprenticeships at the University of Birmingham.



I chose a degree apprenticeship because I mainly wanted to go to university to give myself access to work opportunities and I highly value the importance of work experience. When I found out that the programme I applied for offered two summer placements and a year in industry, I knew this would be immensely helpful to figure out which areas I would like to work in and would be exposed to a great network of people.

Lauren, Computer Science Degree Apprenticeship with PwC, Year 2

Engineering and Physical Sciences

At Birmingham, we offer many STEM degrees with high-calibre teaching and development opportunities. In order to study these you will need a Maths A level, so it's worth considering this when choosing your options. We will take a look at some of these degree subjects and where they could take you...



Chemical engineering

Chemical engineering involves the conversion of raw materials into useful products such as food, pharmaceutical drugs, renewable energy sources and personal care products. Finding an item that has not been chemically engineered is a challenge.

Chemical engineers are involved in selecting the most suitable materials for an application, designing the process to ensure it is safe and economically viable, as well as ensuring that the whole process from materials selection to recycling is efficient and sustainable.

There is a demand for chemical engineers to improve already well-developed products such as mayonnaise by reducing the fat content in order to fight obesity, or to develop alternative fuels such as hydrogen fuel cells to ensure future sustainability. Chemical engineering also includes healthcare technology, where there is a drive to develop smart materials such as wound healing dressings and cancer diagnostic tests.

Did you know?

Pure cotton is considered a natural product, but the soil it's grown in often contains fertilisers which are chemically engineered.



You should like...

- Problem-solving
- Group work
- Thinking creatively
- Learning new skills

A levels required to study Chemical Engineering at Birmingham

Three A levels including an A in Chemistry and Maths

Careers

Chemical engineering graduates have the knowledge and expertise to work in a variety of exciting sectors at a range of high-profile companies. Here are some roles you could find yourself in with a chemical engineering degree:

- process engineer
- analytical scientist
- project manager
- design engineer
- patent attorney
- investment banker

Companies hiring chemical engineering graduates: Shell, Procter & Gamble and Mondelez



Chemistry

Chemistry deals with elements of the periodic table and the compounds they make. Chemists study their composition, structure, properties and reactivity. Chemistry is a rapidly changing subject that is constantly responding to global issues, to the energy crisis, formulation of green plastics and even designing batteries to power electric cars.

Studying chemistry is very different at university. Chemistry students tend to spend much longer in the lab, and for some experiments they will spend a whole day or even a week working in a laboratory. They will learn about how to handle chemicals and analytical equipment safely but also learn about new areas of chemistry including some of the research that happens in Birmingham labs.

You should like...

- Solving problems
- Investigating
- Learning about the world around you
- Teamwork

A levels required to study Chemistry at Birmingham

Three A levels including an A in Chemistry

Did you know?

The first person to make Vitamin C in a lab was a chemist at the University of Birmingham!

Careers

A chemistry graduate has many options when choosing a new career. Some work in labs in the chemical industry, where they design new medicines, materials and commercial products, or explore analytical and forensic applications. Others go on to work outside the lab in a wide variety of jobs, such as:

- science journalist
- patent attorney
- data scientist
- consultant
- accountant
- teaching

For more information, visit the Royal Society of Chemistry careers page
www.edu.rsc.org/future-in-chemistry

Companies hiring chemistry graduates:
 AstraZeneca, Nestlé and GlaxoSmithKline



Civil engineering

Did you know?

The Great Wall of China is the longest structure built by humans measuring 21,196 km, which is almost five times the width of USA.

Civil engineering is the key to many of the issues affecting our lives today. Civil engineers design, build and maintain our living and working spaces, and solve problems along the way. They might design a new stadium, work on a local by-pass or railway line, assess a damaged structure, provide immediate and safe drinking water to a refugee camp, or manage a multi-million-pound construction project.



As a civil engineer, you could work on multi-million-pound projects in the UK or around the world.

As engineering isn't a subject you can commonly take at school, it's a good chance to put together subjects and knowledge you have already built on such as maths, physics and design and technology.

You should like...

- Solving problems
- Working as a team
- Designing concepts
- Managing and considering different priorities

A levels required to study Civil Engineering at Birmingham

Three A levels including a B in Maths



Careers

Civil engineering graduates are very employable. It's important to check that the degree you choose is accredited so if you go on to become a chartered engineer you have the correct educational base.

The Civil Engineering degree at Birmingham is fully accredited. As well as being a chartered engineer there are many other roles a civil engineering degree can take you to:

- environmental engineer
- urban planner
- structural engineer
- sustainability consultant
- construction manager

Getting a civil engineering degree doesn't mean that you have to go into a job related to engineering, many graduates go on to work in finance, law and teaching.

Companies hiring civil engineering graduates: Amey, BP and InBev





Computer science



Computer scientists study the theory, design, development and application of computers and computational systems. They are employed in almost every modern industry in a wide range of roles. They are responsible for creating and developing huge internet-based programs such as Google and Facebook.

Some computer scientists work in finance and business, whereas others are involved in the design and development of new computer games, or create software for medical imaging systems. Some work in cyber security looking at how to make data secure and others work in artificial intelligence, programming robots or other smart devices such as Alexa or Siri.



Studying computer science is very different from ICT at school as the focus is on designing and developing new programmes rather than learning existing ones.

You should like...

- Working with computer systems
- Programming
- Problem-solving
- Maths

A levels required to study Computer Science at Birmingham

Three A levels including an A in Maths



I have always known that I wanted to study a computing-related subject at university. Having studied Computer Science (CS) at GCSE and A level, I enjoyed the concept of creating computer programs and the theory behind how they work, so I knew that a computer science degree was for me. I am looking forward to a career working in the technology industry and having a CS degree opens so many doors. I can see myself working as a software engineer or as a network engineer in a few years.



Likkan, Computer Science Year 3



Careers

Knowledge of computer science is useful in many different sectors. Tech companies such as Google are an obvious choice but computer scientists also help keep aeroplanes from falling out of the sky, help surgeons increase the accuracy of their work and help automate aspects of manufacturing. Therefore, the job opportunities are vast and exciting as a computer science graduate. Here are some potential job roles:

- cyber security analyst
- game designer
- software engineer
- web developer
- nanotechnologist
- computer network architect

Companies hiring computer science graduates: IBM, Goldman Sachs and HP



Degree Apprenticeships in Computer Science

At Birmingham, we offer a Degree Apprenticeship in Computer Science with either PwC or Vodafone. Both courses last four years with placements and studying integrated throughout. You will be paid a salary by PwC or Vodafone and upon graduation, you will be offered a job with them provided you meet their performance criteria.

This is a good option if you would like to earn whilst you study and you know exactly what sort of job and industry you would like to go into. Please visit the website for more information at www.birmingham.ac.uk/level-6-apprenticeships

Hi, I'm John, a current Computer Science Degree Apprentice with Vodafone.

I stumbled across this

course by chance, but I'm glad I did! The programme is very competitive, as alongside learning about computer science it gives you the opportunity to work at a multinational telecommunications company over a summer, and as part of an industrial year, the opportunity to network, and get support from the company. My tuition fees are covered by my employer and I'm paid a salary while I study. I'm very happy with my choice as I am studying Computer Science at Birmingham, but with some extra perks!



John, Computer Science Degree Apprenticeship with Vodafone, Year 1



Electronic and electrical engineering

Electronic and electrical engineering deals with the technology of electricity. Electrical engineers deal with power on a large scale, such as generating and delivering electricity to homes and businesses. Electronic engineers work on specific components and systems, for example, in computers, TVs, mobile phones and cars. These areas overlap so it's useful for engineers ✕ to have a good understanding of both and be able to work in a larger team to collaborate on projects.

You should like...

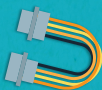
- Understanding how technology works
- Programming
- Problem-solving

A levels required to study Electronic and Electrical Engineering at Birmingham

Three A levels including a B in Maths

Did you know?

Steve Wozniak, the co-founder of Apple has a degree in electrical engineering. Together, Wozniak and Steve Jobs built the first Apple computer from parts they got for free from their employers.



Careers



As electronics and electrical systems surround us, there will never be too many engineers to work on them and the demand for electrical engineers continues to grow. Whilst studying your degree, you can prepare yourself to help meet the technological challenges we currently face, such as creating autonomous cars, electric cars, improving communication and more. As with other engineering degrees it's important to check that it's accredited so that employers know that you have the qualities they seek. Here are some roles that an Electronic and Electrical Engineering degree can take you:

- aerospace engineer
- CAD technician
- network engineer
- machine learning engineer
- special effects technician

Companies hiring electronic and electrical engineering graduates: National Grid, Ministry of Defence and Jaguar Land Rover



Material Science and engineering

Materials science and engineering (MSE) is concerned with understanding how materials behave based on factors such as the arrangement of their building blocks (eg, atoms and molecules), how they are processed and their operational environment.

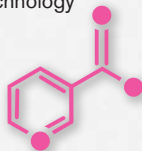
A fundamental understanding of such factors allows materials scientists and engineers to make new materials for new and advanced applications (such as making new materials for space exploration and medical devices) and to help tackle global issues such as recycling of materials, renewable energy sources and new ways of using the limited resources on the planet.

You should like...

- Learning how materials behave
- Understanding why things are made from certain materials
- The application of theory to the real world
- Being creative

A levels required to study Material Science and Engineering at Birmingham

Three A levels including Maths and at least 1 from Physics, Chemistry and Design Technology



Did you know?

Turbine blades, used in aeroplanes, are made from materials that operate above their melting temperature during flight.

Careers

A materials science and engineering graduate gains many useful skills throughout their degree that are highly employable. Here are some examples of the careers of some recent graduates from MSE courses in the UK:

- materials and processes engineer
- flight test development engineer
- scientific editor
- business development manager
- management consultant

There are many other career paths with an MSE degree, you can find more on the Institute of Materials, Minerals and Mining (IOM3) website (www.iom3.org) and the Discover Materials website (www.discovermaterials.uk).

Companies hiring materials science and engineering graduates: Tata, Rolls-Royce and BP





Mathematics



Maths is the science that deals with the logic of shape, quantity and arrangement. It is all around us and in everything we do. Maths is the building block of everything in our daily lives such as mobile devices, engineering, finances, healthcare, climate change and social media. Maths is the thread that runs through every STEM subject as it provides the foundation for learning and research.



Studying maths changes a lot at university so instead of doing calculations using given formulae, you are taught how to solve the problem yourself, creating your own reasoning and models. Being able to think mathematically to solve problems is a highly transferable skill.



You should like...

- Spotting patterns
- Solving problems
- Reasoning your answers
- Investigating and creating strategies

A levels required to study Mathematics at Birmingham

Three A levels including an A in Maths

I chose to study maths because it's a test of understanding and practice, not a test of memory and, of course, we don't really write essays in Maths. There's quite often 'a right answer', or at least a prescribed method to follow, whereas in other subjects your tasks are often more open-ended, which of course, suits some people, but I'd rather not depend too much on my creativity! People tell us all the time that Mathematics is a strong subject that opens up lots of doors. It may be a cliché, but it's also true. I've heard of students in the years above me going into all sorts of jobs after graduating and I think it's true that a degree in Mathematics sets you up for careers in many different sectors, and not least for real life.



Matt, Mathematics Year 2

Careers



A maths degree is very popular with employers due to the transferable skills you will develop. This means a maths graduate has many options when choosing a career. Having a solid understanding of maths can take you into many areas of STEM and even beyond that so it's a good degree to choose if you aren't sure what you want to do as a career. Here are some examples of jobs that a maths degree can help with:

- accountant
- data scientist
- financial manager/trader
- game designer
- meteorologist
- software engineer

Companies hiring maths graduates:
Civil Service, Deloitte and NHS

Did you know?

In a room of 23 people, there's a 50% chance that two people have the same birthday.





Mechanical engineering



Mechanical engineering deals with anything that moves, from machines to satellites, power plants to pacemakers, seismographs to robots. Mechanical engineers apply maths and science to design and model efficient solutions to real problems. This could be creating a prosthetic limb, building an engine for a racing car or improving a robotic arm used in food production. You can develop a diverse range of skills when studying a mechanical engineering degree that will make you very employable.



You should like...

- Finding solutions to real-life problems
- Learning new skills
- Being inquisitive
- Being creative with ideas

A levels required to study Mechanical Engineering at Birmingham

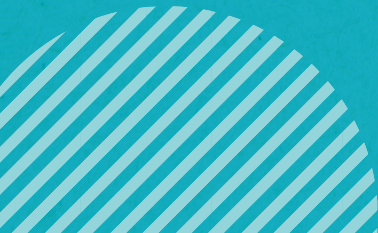
Three A levels including a B in Maths



“ Mechanical engineering was the perfect subject for me. I really enjoy being able to use the knowledge that I have learnt in class and apply it to real-life problems, for example, knowing how to maximise the efficiency of an aeroplane or car engine! Mechanical engineering (or any other STEM subject) opens so many doors to various career opportunities, such as becoming an engineer, teaching, finance etc. Once I have graduated, I would like to work towards becoming a Chartered Engineer, who is a person who is professionally registered with the Engineering Council and this shows that they are competent as an engineer. This could open doors to work internationally! ”



Kelly, Mechanical Engineering Year 4

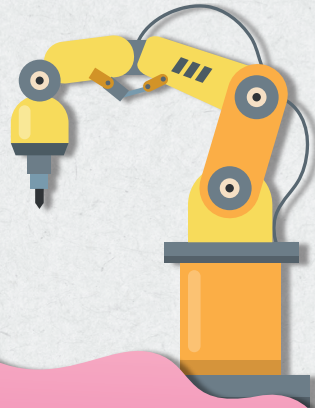
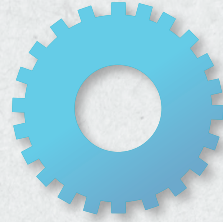


Careers

Mechanical engineering is thought to be one of the most diverse of all engineering disciplines, so there are plenty of employment opportunities as a graduate. As with other engineering degrees, you should still check that the degree is accredited so that you can make sure your degree is the most attractive to employers. As a mechanical engineer, you can work on all stages of a product from research and design to manufacture, installation and final commissioning. The graduate prospects are high and here are some examples of what you can do:

- automotive engineer
- aerospace engineer
- robotics engineer
- biomedical engineer
- CAD technician
- production manager

Companies hiring mechanical engineering graduates: Formula 1, JCB and Aston Martin





Nuclear engineering



Nuclear engineers aim to harness energy released from nuclear reactions to be used to supply homes and businesses. The UK government wants to solve the energy problem by using nuclear and renewable power so nuclear engineers are very important. Furthermore, we need nuclear engineers to decommission power plants and work out a way to safely store nuclear waste for hundreds of years.



When studying a nuclear engineering degree, you'll learn about the physics at the core of nuclear reactors and gain knowledge of the engineering and societal challenges facing the sector. The skills you gain can help ensure that we reduce our dependency on fossil fuels.



You should have...

- Interest in the energy sector and awareness of fossil fuel reliance
- Problem-solving skills
- Passion for maths and physics

A levels required to study Nuclear Engineering at Birmingham

Three A levels including an A in Maths and Physics



Careers



There is a high and increasing demand for the next generation of nuclear engineers and scientists. It's important to check that your degree is accredited so that employers can see that you have the skills that they require. Whilst becoming a nuclear engineer is a good career route, a nuclear engineering degree will provide you with skills that are useful across a variety of sectors. Here are some of many roles available with a nuclear engineering degree:

- reactor operator
- health and safety specialist
- project manager
- drilling engineer
- site engineer

Companies hiring nuclear engineering

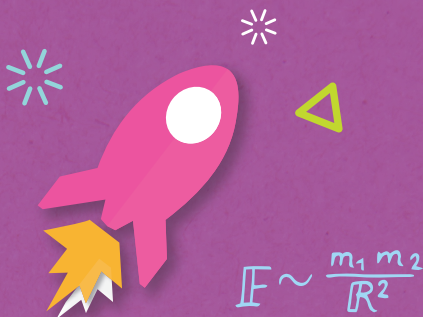
graduates: National Nuclear Lab, EDF Energy and KPMG

Did you know?

Around 11% of the world's electricity is produced by nuclear power and this is due to increase.



Physics and astronomy



Physics can be described as the study of matter and energy and how they affect each other over time and through space. Physicists address deep questions about the universe, such as when it began, what it's made of and what rules govern its behaviour. Physicists also research particles smaller than an atom and lots of experiments into this take place at the CERN Large Hadron Collider. Studying physics allows you to explore answers to many fundamental questions and has many branches for you to keep researching so that the exploration goes on and on.



You should like...

- Finding out how things work
- Being naturally curious
- Thinking logically
- Applying mathematics in real-world situations

A levels required to study Physics and Astronomy at Birmingham

Three A levels including an A*A in Maths and Physics OR four A levels to include Maths and Physics at A

When I was in school, I was constantly impressed by the new achievements that physics was accomplishing, and wanted to learn more about the universe from these discoveries. I also love the encouragement of critical thinking and problem-solving in daily life.



I hope to work on accelerator design for the next generation of radiotherapy machines. I enjoy learning from CERN scientists who helped build the Large Hadron Collider, and applying the similar technologies to medical developments, in return advancing the field for future particle physics experiments. I also enjoy the project management element of coordinating a huge engineering task.

Rebecca, Physics Year 4



Careers



Having a physics degree opens doors to a wide variety of careers as the skills you develop can be used in a diverse range of roles. Some physics graduates apply their knowledge directly in a scientific environment but many also work in other non-scientific areas. Many physicists go into further study, so they stay at university to complete research in a specialist area. Whichever route you choose, there are many options and job roles available:

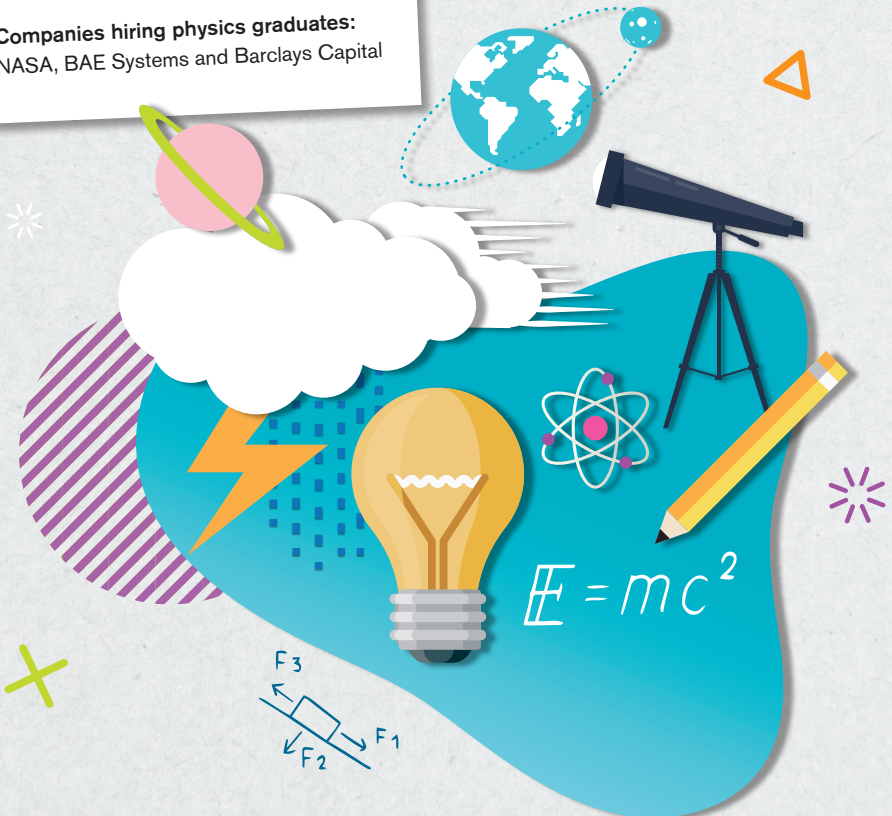
- astronomer
- academic researcher
- meteorologist
- patent attorney
- civil servant
- clinical scientist

Companies hiring physics graduates:
NASA, BAE Systems and Barclays Capital

Hi! I'm Jin and I do a Masters in physics with a year of international study. I chose to do physics because I love astrophysics, so the chance to do that whilst living in Sydney was too good to miss. Doing the year abroad was always something I wanted to do, and I'm so glad I took the opportunity! I've learnt how to live independently (even more so than in England), and it has helped me to grow into a more social and conscious person. It also helped to broaden my degree, allowing me to study subjects that weren't options in Birmingham. I also picked up a love of surfing!



Jinal, Physics Year 3

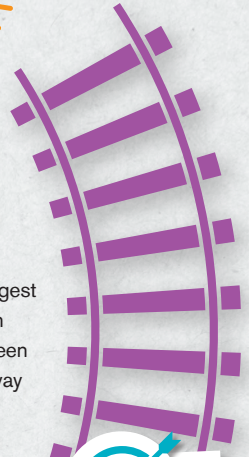




Railway engineering

Railway engineering deals with railway infrastructure, traction and energy, railway management, timetabling and control to meet the demands of a growing industry.

Engineers who understand railway infrastructure and systems are in high demand as the industry expands around the world. The University of Birmingham hosts the Birmingham Centre for Railway Research and Education (BCRRE) and it's the largest university-based railway research group in Europe. We have our own full-size train simulator, built by staff and students at the University – you can drive a train between Birmingham New Street to Selly Oak stations! At Birmingham, you can study railway engineering alongside a civil or electrical engineering degree.



You should have...

- Passion for working in the railway industry
- Interest in transport
- An enjoyment of maths and design

A levels required to study Railway Engineering at Birmingham

Three A levels including a B in Maths

Did you know?

The BCRRE built the world's first retro-fitted hydrogen train and is the UK's first train powered this way. The train is called HydroFLEX and is paving the way for decarbonisation of railway in the UK.

Careers



Around the world, the railway industry is expanding and this is most notable in the UK where the government launched the biggest rail investment since the Victorian era. Having a good understanding of the complex railway system means you will be in demand by engineering companies, vehicle and communications systems manufacturers, network operators and non-engineering organisations alike. Here are some jobs available after graduating with this degree:

- transport planner
- design engineer
- railway engineer
- analyst
- automotive reader manager

Companies hiring railway engineering graduates: Network Rail, The British Army and British Transport Police

Where to look next...



Now you've had a small taste of the subjects you can study in STEM it's up to you to do further research to find out more.

Online

You can find out more about specific courses and universities on the UCAS website www.ucas.com

To learn more about studying STEM at the University of Birmingham and the perfect course for you, you can visit www.birmingham.ac.uk/undergraduate. This website also has an offer calculator so you can see what grades you need to aim for in order to study your preferred course at Birmingham.

Students who have graduated from Birmingham with a STEM degree have gone on to have fantastic careers and some of those graduates, also known as alumni, have shared their experiences on our website at www.birmingham.ac.uk/eps/alumniprofiles

Visit us

Throughout the year, we offer opportunities for young people to come onto campus to attend STEM experience days which include lectures, interactive workshops and opportunities to speak to current students and academics. To find out more, please visit our website www.birmingham.ac.uk/epsOutreach and see if there's an event you'd like to attend.

Further questions

If you have any questions on taking part in our STEM activity experiences you can get in touch with the team at epsoutreach@contacts.bham.ac.uk





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