STEM Ambassadors in mathematics: from skyscrapers to freight trains

Michael Anderson

STEM Learning

https://youtu.be/cZQ2ycf8NuA

Welcome!

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www.stem.org.uk/STEM-Ambassadors-20

What's the plan?

In this session we will cover:

- What is STEM Learning?
- Who are STEM Ambassadors?
- Careers quiz!
- Booking a STEM Ambassador
- Case studies
- Q+A

20 years of the STEM Ambassador programme

Read more here:

www.stem.org.uk/STEM-Ambassadors-20

What is the maximum expected wind force acting on the top floor of the building?

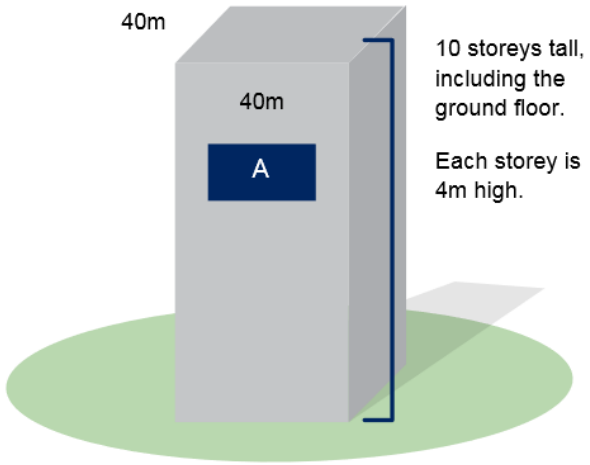
When architects design a new building they need to make sure it won't sway too much or be damaged in high winds. Structural engineers calculate the forces the wind will exert on the building. They help the architect design a structure that's strong, stiff and safe.

The wind force on any area of building is proportional to:

Half the square of the wind speed W

The area the wind is acting on A

This new building needs to stay steady in a storm:

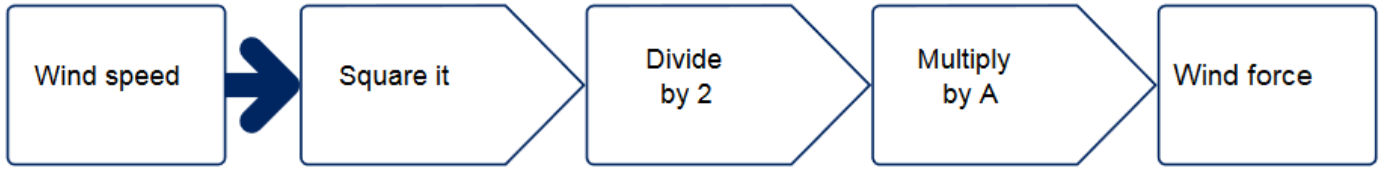


10 storeys tall, including the ground floor.

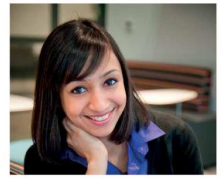
Each storey is 4m high.

Wind speed varies with height, it decreases closer to the ground, and increases as you get higher:

Height about ground (m)	Wind speed in a storm (m/s)
38	38.7
34	37.6
30	36.3
26	34.9
22	33.4
18	31.6
14	29.6
10	27.0
6	23.5
2	17.5



Wind force $F = 1/2\ w^2A$



STEM Ambassador Profile:

Name:
Roma Agrawal

Job title:
Associate Structural Engineer at WSP

Location:
London

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My job

Day-to-day role: I'm responsible for making buildings and bridges stand up. My day at work varies depending on what stage my project is at. We start with conceptual design – meeting architects and clients to turn ideas into something that will stand up once built. During the design phase we do calculations, running computer models to test our design. Finally, during construction, I visit site regularly to solve problems that occur as a building takes its physical form. There is a lot of team work involved which I really enjoy.

Favourite part of my job: My job is always challenging and creative, requiring quick thinking, communication and problem solving, and I find it extremely rewarding. The most exciting part is seeing your ideas turn into a real, usable object, something that people point to and admire every day.

Most challenging part of my job: I normally love going to site, but with my fear of heights and the cold, I don't always enjoy being high up in the winter!

Motivation: I love maths and physics and wanted to use those subjects in my job. Engineers can create and build anything they want, which I find inspirational.

What option for a new building would you recommend?

Option	Maximum Wind Force	Cost Per Storey
1	500,000	900,000
2	350,000	850,000
3	250,000	700,000
4	150,000	600,000

Height about ground (m)	Wind speed in a storm (m/s)
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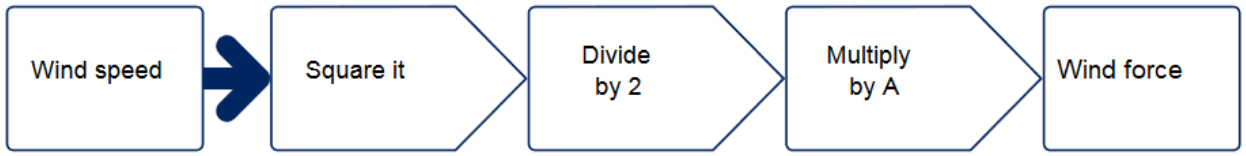

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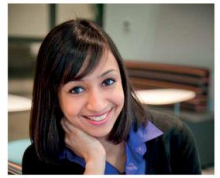

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About STEM Learning

At STEM Learning, our commitment to STEM education is part of everything we do.

Whether that's delivering teacher CPD (continuing professional development) in STEM subjects, bringing STEM role models into schools as part of the STEM Ambassador Programme or providing bespoke, long-term support for groups of schools in collaboration with companies through our ENTHUSE Partnerships, our aim is always the same –
to provide a world-leading STEM education for all young people across the UK.

We will have achieved our vision when:

- all young people are enthused about STEM from an early stage - an engagement which is built on and developed throughout their education
- there are more pupils from all backgrounds opting to study more STEM subjects, for longer, through vocational and/or academic routes
- there are greater numbers progressing to study STEM subject at HE, and entering the workforce

Our supporters

STEM AMBASSADORS

STEM Ambassador Hubs

A Network of 19 Hubs across the country supporting 47,000 volunteer STEM Ambassadors, of which:

- **50%** are under 35
- **50%** are female
- **16%** are from BAME backgrounds

STEM Ambassador Hubs

Find your local hub [here]

STEM Ambassadors make an impact by:

Supporting learning: help young people to understand the real world applications of their learning

Illuminating careers: showcase different roles and pathways into industry.

Raising aspirations: help young people meet a wide range of inspiring role models.

What can STEM Ambassadors do?

STEM AMBASSADORS

Classroom

STEM Club activities

Careers talks

Speed networking

Online mentoring

Site visits and hosting work experience

Large science festivals and fairs

Non-school group

Who are STEM Ambassadors?

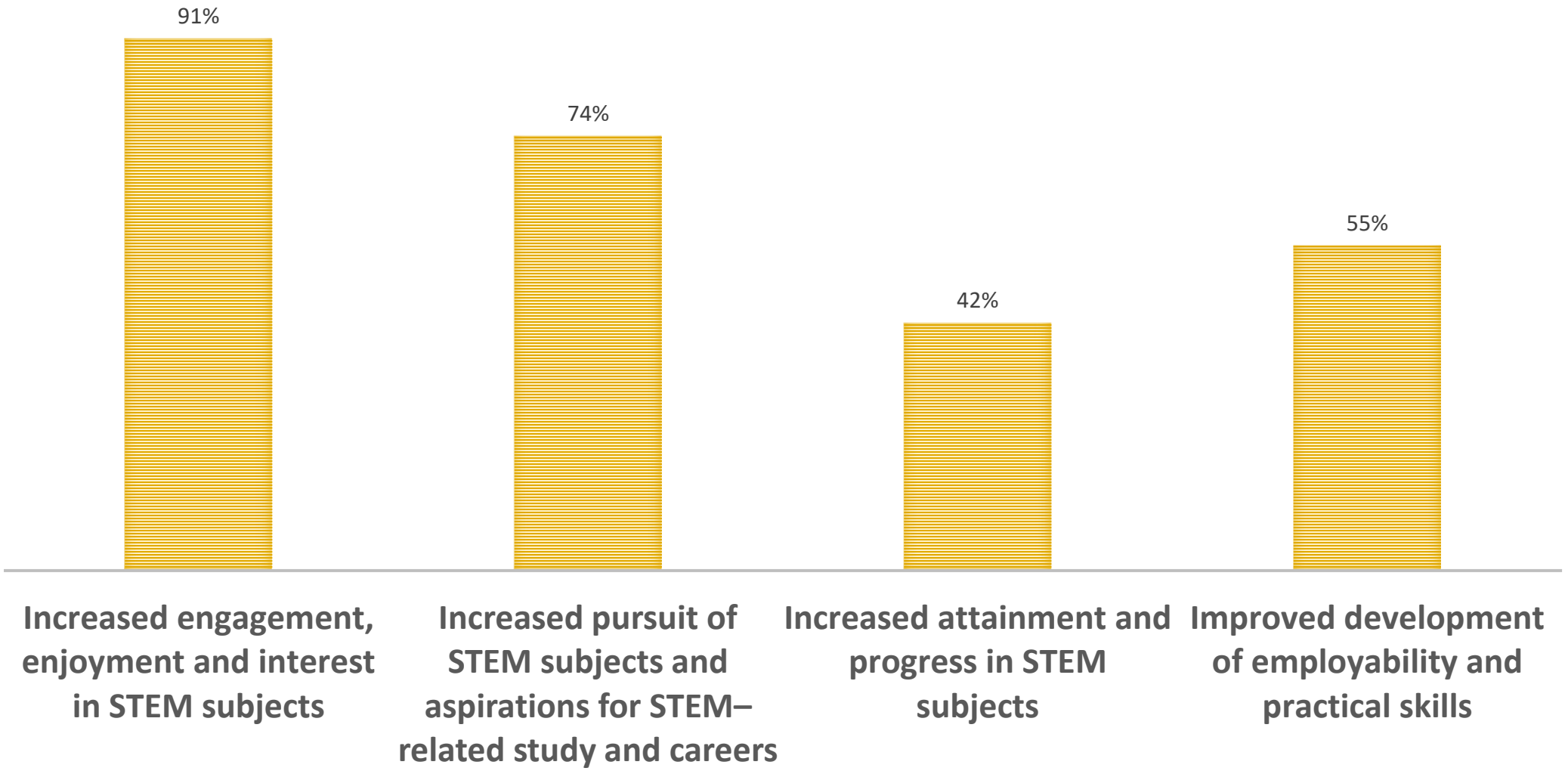
- Product Analyst
- Director of Government Affairs
- Neuromodulation clinical specialist
- Intelligence Coordinator
- Rail Automation Engineering Intern
- Graduate Engineer
- Lecturer
- Cardiographer
- Finance EID Intern
- Analytical Chemistry Graduate
- Air Quality Consultant
- Software developer
- Lab scientist apprentice
- Head of Marketing
- Early Careers Coordinator
- Scrum Master (IT)
- TV Presenter
- Economist
- Research Assistant
- Medical Director for Immunology and Inflammation
- Sales Assistant
- Chief Technology Officer
- Head of Laboratory Services
- Policy advisor, EU exit
- Met Office - Climate science communicator
- Polar Explorer
- Civil Engineering Apprentice
- Offshore Wind Turbine Installation Manager
- Biomedical Scientist
- HR Assistant
- Troop Sergeant

STEM Ambassadors introduce children to a world of science beyond the school gates and make it fun.

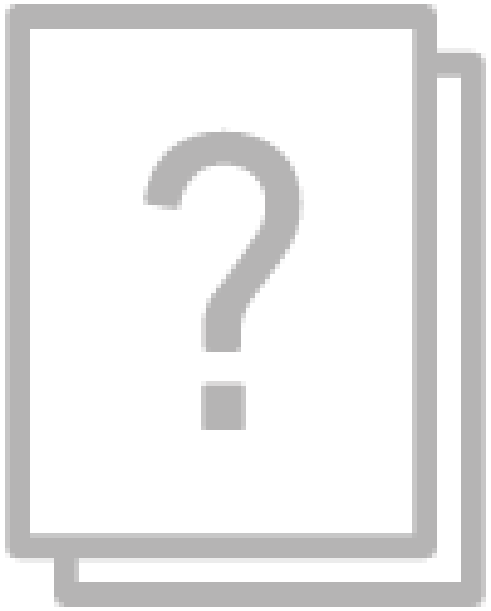
Children's Worker, Glasgow

STEM AMBASSADORS

What impact do STEM Ambassadors have?



Quiz time!!

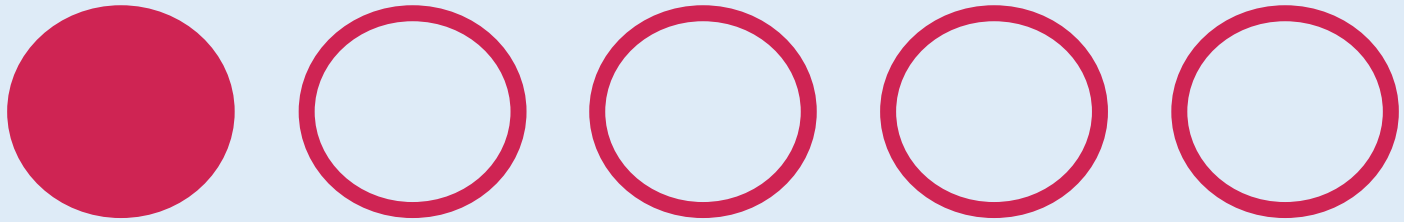


Question 1:

Ref *The UK STEM Education Landscape*
Royal Academy of Engineering: 2016

In 2016, the UK economy employed approximately 30 million people.

What % were involved in STEM related occupations?



Question 2:

What % of firms are reporting recruitment difficulties in engineering, science and hi-tech industries?

a) 24%

b) 44%

c) 84%

Ref Engineering UK 2016 The State of Engineering

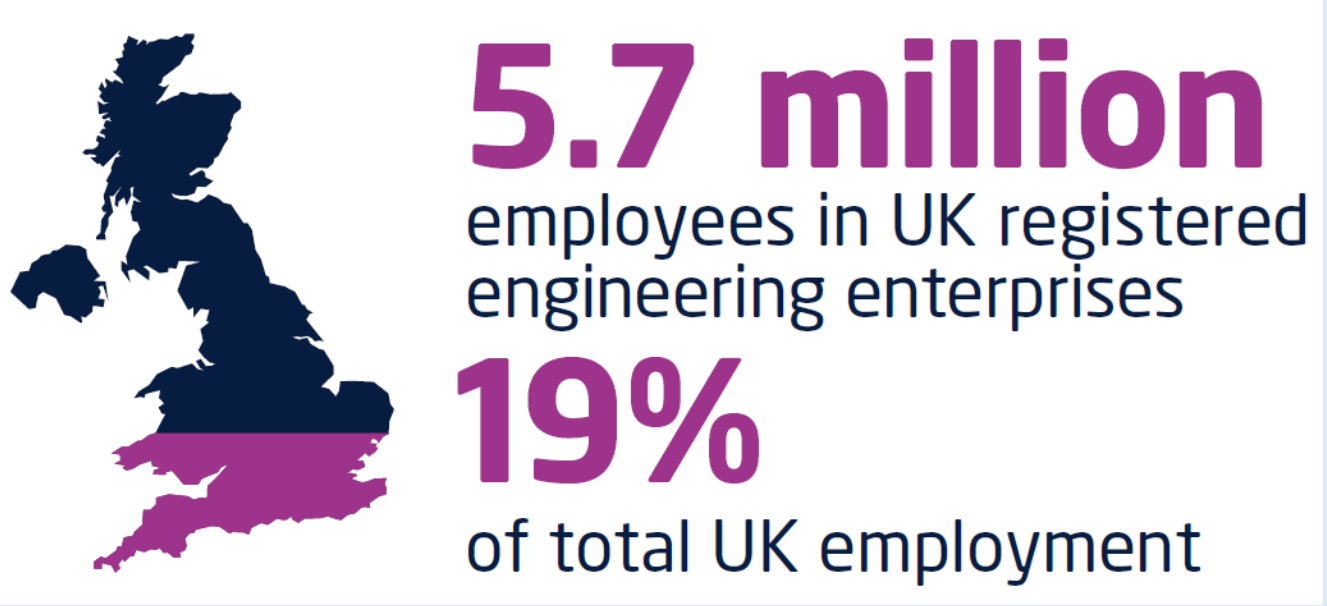
Question 3:

What % total UK employment is in engineering enterprises?

a) 2%

b) 9%

c) 19%



Ref Engineering UK 2017 The State of Engineering

Question 4:

Each year, how many new STEM graduates are needed to fill the STEM skills gap?

a) 54,000 graduates

b) 84,000 graduates

c) 104,400 graduates

Ref *www.yourlife.org.uk/stem-skills-gap*

Question 5:

In 2017, what percentage of engineers were Black and Minority Ethnic (BME)?

a) 8%

b) 18%

c) 38%

Ref Engineering UK 2018 The State of Engineering

Question 6:

Women make up 47% of the UK workforce.

What % of the UK's STEM workforce is female?

24%

Ref Women in STEM Workforce 2017

Question 7:

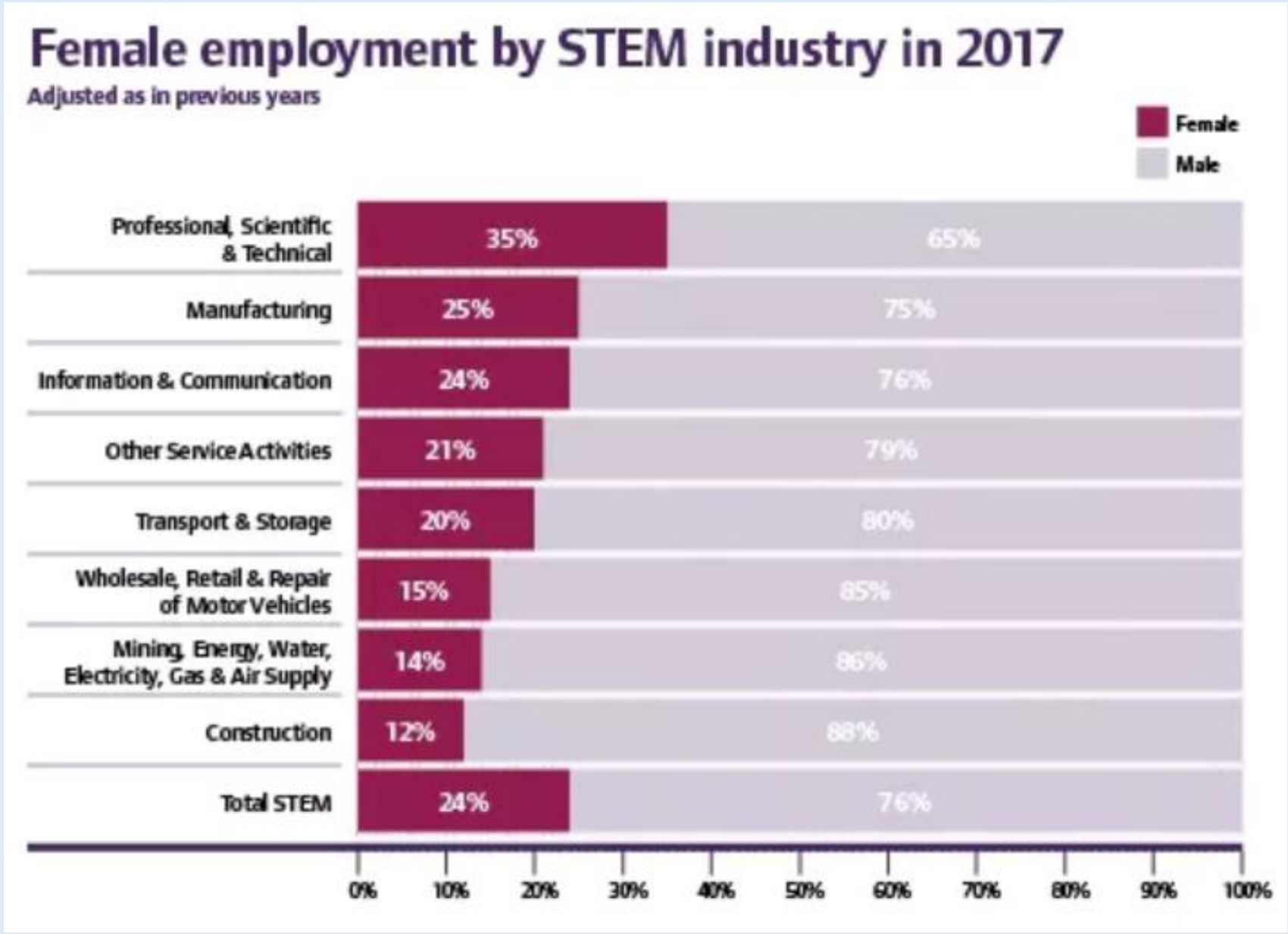
What % of engineering staff in the UK are female?

a) 11%

b) 29%

c) 49%

Ref Women in STEM Workforce 2017

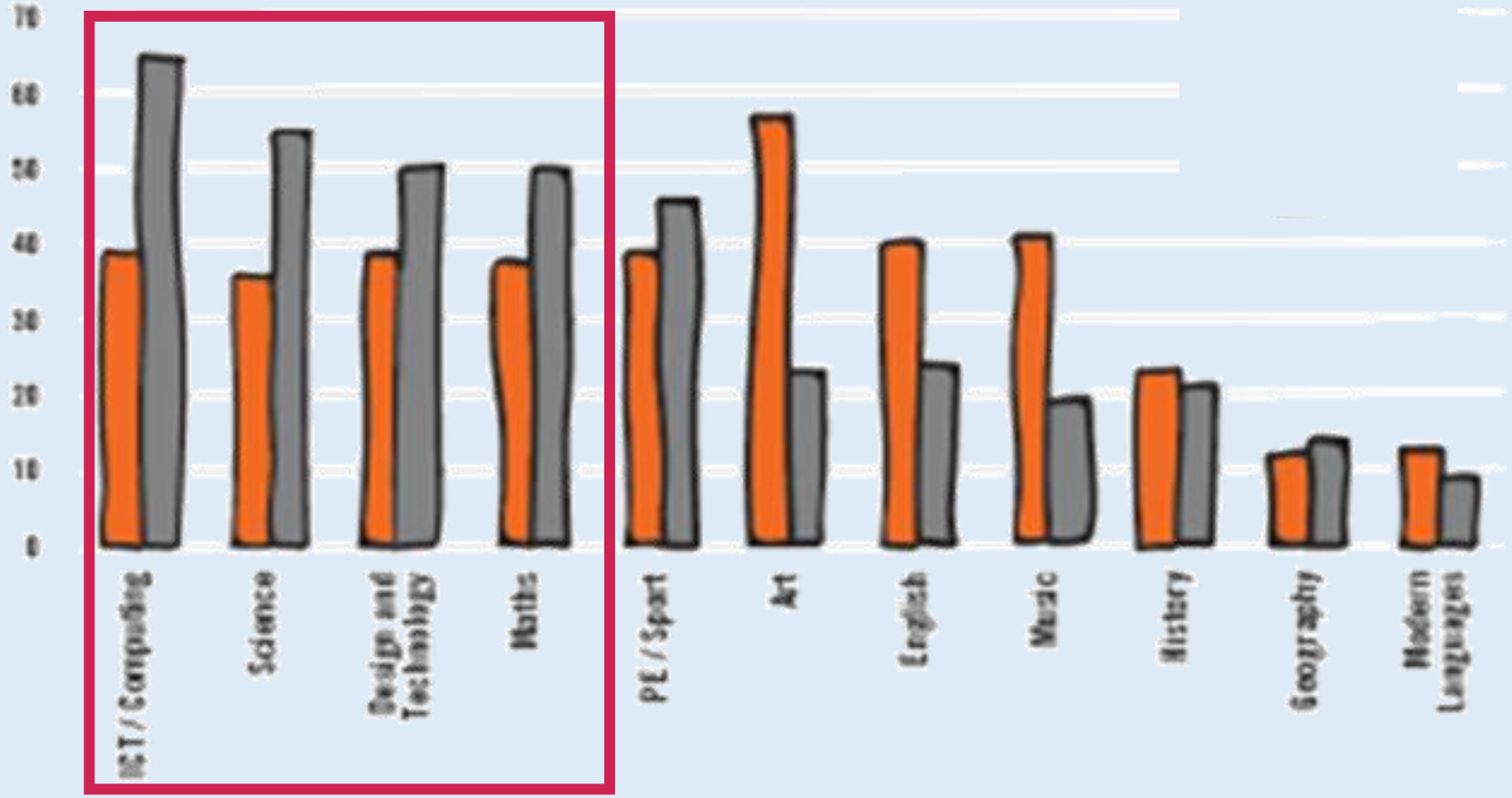


Ref Women in STEM Workforce 2017

Question 8:

Favourite subjects for boys and girls in England aged 9 – 12

Which colour on the graph is boys and which is girls?



Ref www.engineer-a-better-world.org 2015

Question 9:

When the British public were asked to name a famous female engineer or scientist, who did they name?

Ref www.sciencegrrl.co.uk 2014

68%

Image taken from Wikipedia

10%

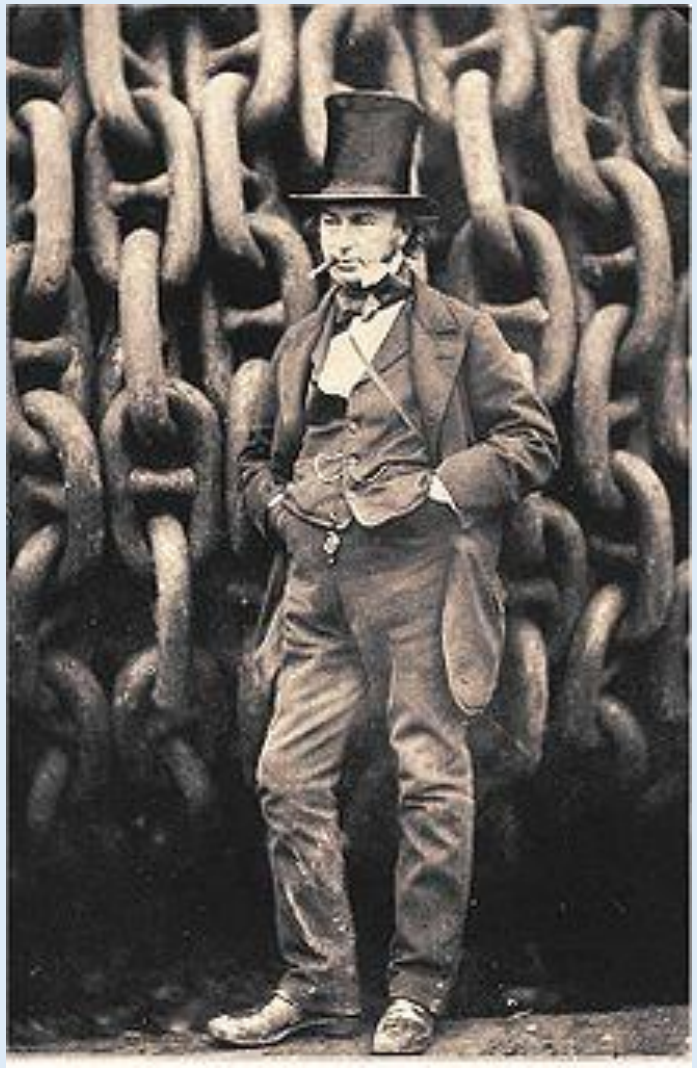
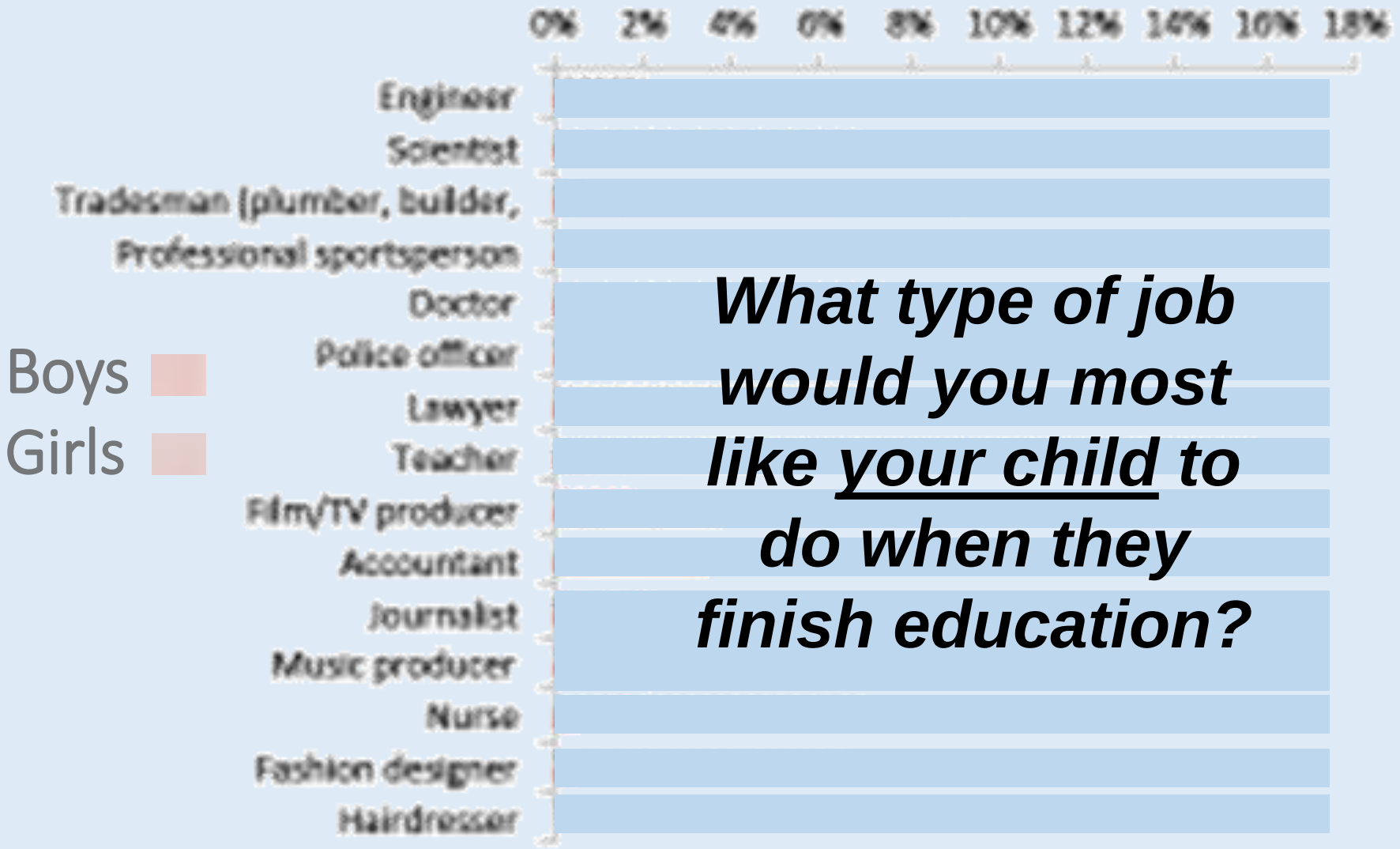


Image taken from Wikipedia

Question 10:



Ref CaSE: Improving Diversity in STEM 2014

Question 11:

What is the recommended <u>minimum</u> number of employer engagements that a student should have during their school life?

a) One every key stage

b) One a term

c) One a year

Ref Careers strategy: making the most of everyone's skills and talents, 2017

Question 12:

In 2017, what % of 11 to 14 year olds took part in a STEM careers activity?

a) 28%

b) 48%

c) 68%

Ref Engineering UK 2018 The State of Engineering

Question 13:

Ref AoC: Careers Guidance; Guaranteed 2014

Where do young people find careers advice? (Rank in order from most popular to least)

- **parents**
- **teachers**
- **friends**
- **relatives**
- **internet searches**
- **professional careers advisors**

Question 13:

Ref AoC: Careers Guidance; Guaranteed 2014

Where do young people find careers advice? (Rank in order from most popular to least)

- **parents 70%**
- **teachers 57%**
- **friends 48%**
- **relatives 42%**
- **internet searches 32%**
- **professional careers advisors 27%**

Booking a STEM Ambassador

How it works

STEP 1

Sign in at www.stem.org.uk/dashboard

STEP 2

Select 'Advertise an activity' in the menu on your online dashboard, fill in the details and publish your activity

STEP 3

STEM Ambassadors will express an interest in your activity and you can offer them a place

STEP 4

Once the STEM Ambassador has accepted, click confirm and communicate through the integrated messaging tool to arrange the details for your activity

STEP 5

Complete your activity

STEP 6

Give us feedback on your activity

Sign in to your dashboard or create an account now.

www.stem.org.uk/stem-ambassadors/schools-and-colleges

https://stemmobile.app/

STEM Ambassadors in action

Bring a STEM Ambassador into your primary school

Bring a STEM Ambassador into your secondary school

Bring a STEM Ambassador into your college

www.stem.org.uk/stem-ambassadors/schools-and-colleges

Sampling the River Itchen

A Toxicologist from Johnsons helped a home-education group over several weeks to sample different areas of the River Itchen.

The children then presented their data as part of the project.

STEM Ambassador activities

- STEM Ambassador Garry Packer from Highways England
- Fractal Workshops – Sierpinski Triangle
- Delivered to Teachers & STEM Ambassadors both in schools and online
- Masterclass session included contributions from the team at the National Numeracy – “Making Maths Fun for families outside the classroom” resource

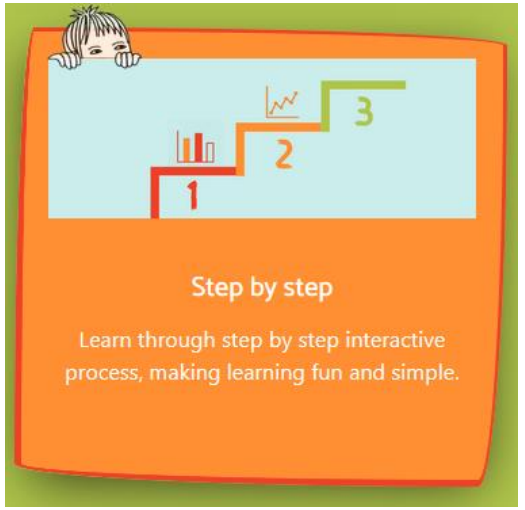
Maths Week – a STEM Ambassador presentation to primary pupils about the maths he uses as part of his job.

KS3 weekly after school Maths Puzzle Club. Activities included:

- *Solving maths/logic puzzles (7 bridges)*
- *Carrying out experiments (probability spinners)*
- *Craft activities (mobius strip, snowflakes)*

Kids in Data Workshop

- STEM Ambassador Kabir, a Solutions Architect
- Looks at what is data literacy
- Children use his website www.kidsindata.com to play a series of Space Invaders games
- Using league tables, he teaches how to create bar charts.

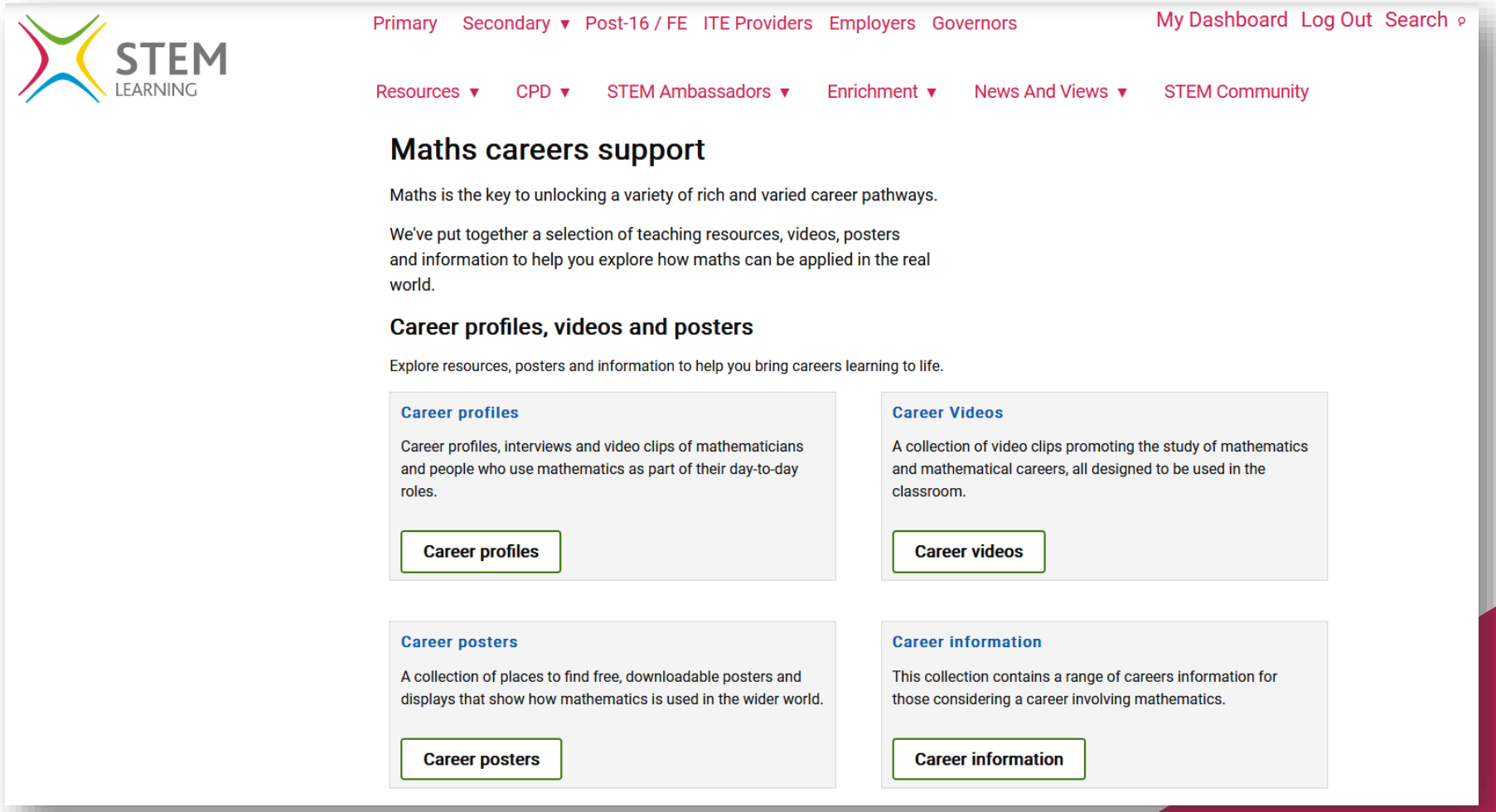


Masterclass with Operational Research Society

STEM Ambassadors work with OR on activities such as the Lego Furniture Factory – using Lego for a real-life scenarios.

“Can you help the production manager find out how many tables and chairs should be made in order to create the greatest profit?”

Mathematics careers resources



STEM Ambassador Profile:

Name:
Anna Fraszczyk

Job title:
Researcher

Location:
Newcastle University, NewRail

Education:
- A levels: Maths, English, Polish, Geography
- Degree: Master of Engineering in Geomatics, finishing PhD in Transport

My job

Day-to-day role: I support teaching and learning activities at NewRail by mentoring students, engaging with stakeholders (people who own or have invested in the company) and organising and coordinating rail education activities and events.

Favourite part of my job: Creativity and freedom! I like mentoring students, sharing my research or public engagement ideas with them and watching them grow in confidence, as well as upgrading their knowledge and skills when developing projects with me.

Most challenging part of my job: Sitting and writing reports or scientific publications (papers) when exciting hands-on projects are waiting for my attention.

Motivation: I like challenges and this job offers me a space where my ideas and creativity, supported by my knowledge and skills, can flourish. The university environment offers freedom and flexibility, which I love!

Network Map

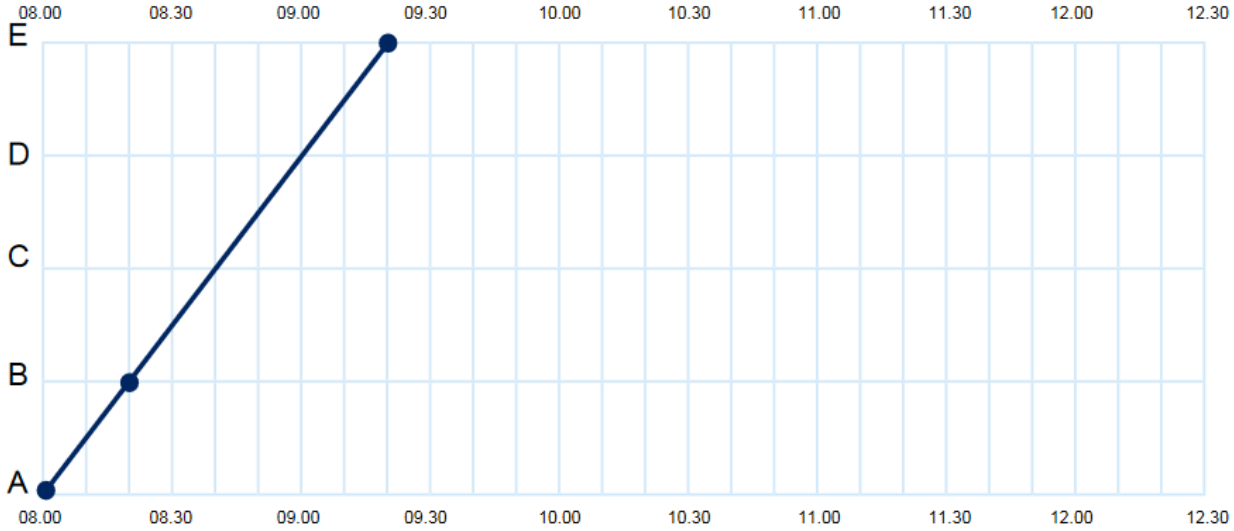
Trains can only overtake one another on the double track between stations B and D, including at stations B, C and D.

Trains wait 10 minutes in station they stop at.

Service	Express	Stopping	Express
A	08:00	**09:00**	10:00
B	08:20	09:20	**10:20**
C	-	09:50	-
D	-	10:50	-
E	**09:20**	11:10	11:20

Train times string graph

String graphs are a visual way to show train timetables. Each line shows a train's journey from station to station. The 08:00 express has been added:



Can you plot the other journeys?

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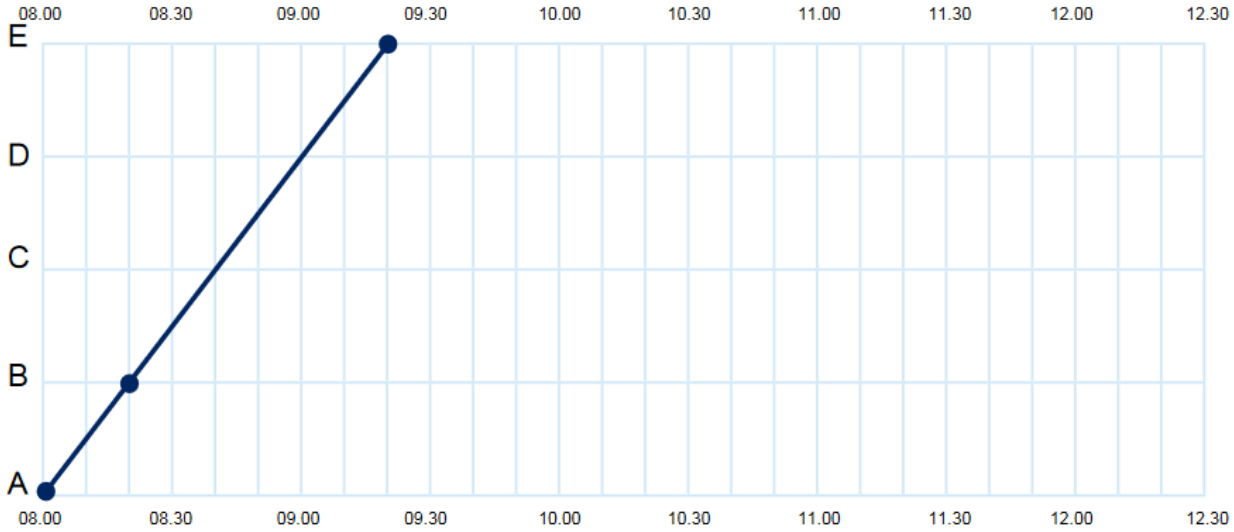

A freight train will take 3 hours and 15 minutes to travel from A to E. Can it safely travel departing at 8:30 or 8:55?

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STEM Ambassadors in mathematics: from skyscrapers to freight trains

Thank you!

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