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Government Science & Engineering

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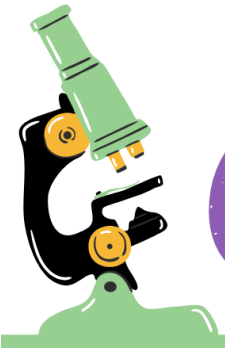
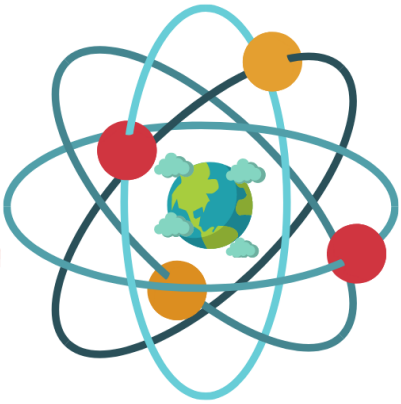


STEM CHALLENGE



Welcome to the STEM Challenge

Who we are?

We are a group of Civil Service Fast Streamers aiming to promote Science, Technology, Engineering and Mathematics (STEM) attainment in schools and encourage diversity, social mobility, and inclusion. Fast Streamers experience working in a range of different government departments to develop the skills required to become future leaders. We come from a wide range of fields, from anthropology to chemistry and engineering to human biology, and a diverse array of backgrounds but we all share a passion for science and communication.

The challenge.

We are launching the STEM challenge as a way to show students three real-world problems that STEM can tackle. The challenge involves a hypothetical, yet realistic, scenario that year 9-10 students will tackle in groups of 3-5. The students will need to justify and present their ideas in a creative and scientific way. Entries will be judged according to the success statements by a panel of policy experts. Prizes will include amazon vouchers and certificates signed by Government Chief Scientific Adviser Sir Patrick Vallance for the winning team. There will also be separate certificates for all participants commemorating their participation in the challenge.

2021's challenge will be 'a vision of a carbon neutral day in 2050'. This challenge will provide an opportunity for students to engage in discussion about the pressing issues of the environment and sustainability, while allowing scope for creative problem solving. Students will choose one of the three topics provided to explore and build your carbon neutral world: sustainable food production, sustainable homes, or humans in space. Challenge submissions should take the form of an A3 poster and a written statement explaining your team's vision for 2050 and focusing on your chosen topic. Each team member will also be expected to complete a reflection log. Further details on the challenge requirements and each topic can be found in the problem statements.

Problem Statements

A Vision of a day in 2050

Welcome to the Civil Service STEM Challenge. This year's challenge looks into the future, imagining how technological progress might overcome environmental problems we face today. For this challenge, please look at the problem statements below and choose **one** problem statement your team will tackle. Your team will need to produce a poster and report outlining an idea for a solution and the science and engineering behind that idea. We encourage you to think outside the box and do some wide research on your proposed solutions. Remember to consider the cost and practicality of implementing your ideas!

For completing this challenge all teams that take part will receive a certificate. The team that produces the best poster and report will have their certificates signed by the Head of Government Science and Engineering, Sir Patrick Vallance, to evidence their achievement! Amazon vouchers will also be awarded to the winning team!

#1 Sustainable food production

With the global population estimated to reach 9.1 billion people by 2050, food production will have to be more efficient than ever to provide a nutrient-rich diet while ensuring sustainable use of land and water resources. We want you to imagine that you are overseeing food production in the UK. **What three ideas does your team think will have the largest impact in making UK food production more sustainable?**

Consider ideas such as the following when evaluating your ideas:

1. How will you utilise the limited land, in the UK (e.g. Extensive vs Intensive agriculture)?

2. How does food production impact water resource usage? Could water be recycled or are there alternative low-water farming methods?
3. What the role will emerging technologies and innovative agricultural practices play in 2050?
4. How will increasing the scale of food production impact on key parts of the food chain? Will this impact biodiversity and resilience?
5. How will food production be impacted with changing diets in the UK?

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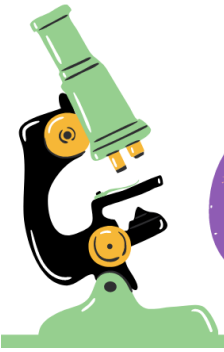

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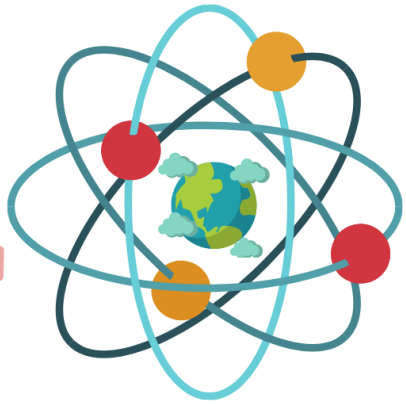

#2 Humans in Space

This year many people have been stuck indoors and not managed to travel very far. In the year 2050 we hope people can travel much further, explore off planet. We want you to look at some sustainability benefits they might find! **What three ideas does your team have which could have the biggest impact on improving sustainability?**

Consider ideas such as the following when evaluating your ideas:

1. How will we offset the negative impacts of space travel i.e. CO2 emissions? Perhaps, look historically at what technologies space travel has given us access to and then look to the future at what technologies could be developed.
2. What alternative energy sources or resources could human presence in space give us access too? Are they more powerful or sustainable than terrestrial alternatives? How would we get the energy/resources back to earth sustainably?
3. How could satellites and other space-based infrastructure be used in the future? For instance, autonomous vehicles may require low earth orbit satellites for navigation (see https://www.oneweb.world/, https://www.starlink.com/ for low earth orbit satellites)

#3 Sustainable Homes

The government has signalled the UK is to have zero carbon emissions by the year 2050. To achieve this our housing stock is going to need to be updated and modernised. **What three ideas can your team bring to the design of a futuristic housing community that will have the biggest impact on sustainability?**

Consider ideas such as the following when evaluating your ideas:

1. How will these homes reach the future homes standard? Will the energy be sustainably resourced or offset to be carbon neutral?
2. What materials will the houses be made from? How will these be sourced sustainably?
3. How will you cope with land pressures, where will the plot be? (E.g. on a brownfield site vs greenfield), how will you maximise the number of people housed on this plot?
4. How will you ensure that the houses are affordable?
5. When building housing it is important to consider the communities that go alongside homes. What infrastructure and social systems would encourage greener living

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Poster Guidance

What content needs to be included?

- The poster should be a visual display of your proposed response to your chosen problem statement.
- You do not need to include a background or methodology section, just a visual display of your ideas and proposed solutions, with a small explanation given for each one.
- Remember that you will be marked on your creativity!

How should your poster be organised?

- A3 size.
- Landscape or portrait.
- Minimum font size 12.
- Please submit your poster as a PDF document, but you can make your poster using software of your choice e.g. MS Word, PowerPoint etc.
- Your poster should have a balance between text, graphs/tables and images.
- Make sure that your graphs and tables have suitable headings and axes labels so we can understand what they are showing!
- There are no guidelines on how you should lay out the poster, but make sure you consider how much text you give to each section and the visual appeal of the poster.
- There is an example poster included in this pack to give you an idea of the balance between words and images/graphs/tables. This is only intended as an example and you do not have to use a layout like this – be as creative as you like!

Using Graphs and Images

- Your poster should include at least one graph and/or table and an explanation of what the graph/table shows. You can include more graphs and tables if you want to.

Checklist:

- Check your poster carefully for spelling mistakes.
- Show it to someone who hasn't seen it before and observe their reaction – Is it clear? Do they understand the points you are making?
- Check that when you've converted your poster to a PDF that all of the images and graphs are clear and not blurry.

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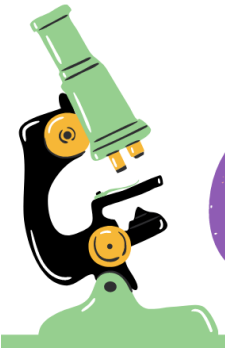

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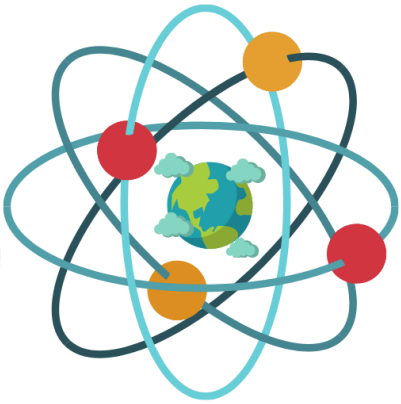

Report Guidance

What is the purpose of the STEM Challenge Report?

The STEM Challenge report is an accompanying document to the Scientific Poster. It should detail the scientific background information and sources that are included in the scientific poster. This is your opportunity to showcase your scientific knowledge and analytical thinking!

How long should the STEM Challenge report be?

The STEM Challenge report must be no longer than 5 pages. References and the title page will not count against the 5 page limit. Graphs and figures will count towards the 5 page limit. Annexes will not be accepted, pages should be A4 and fonts may not be smaller than size 10. All figures must be legible. Quality is advised over quantity as it will not be possible to address every issue in detail from the problem statements.

What style should the report be in?

The style of the report is left to the judgement of the team and will be dependent on the problem statement chosen and the way in which the team decides to address the problem. We encourage students to be creative in the style of report that they choose. A generic scientific report layout is set out below to help structure and aid in clear communication but does not need to be used.

What should be included in the report?

Please include all sources used in producing the report and poster. These sources can be videos, articles, scientific papers etc. and should simply be included as a link or title and author (don't waste your time with Nature style references!). Please also include the scientific evidence and background information used to produce your poster. Diagrams, graphs and figures are encouraged.

Please note that plagiarism (copying) will result in immediate disqualification from the STEM Challenge.

Generic Scientific Report Layout

Please note this is just for information and other report styles exist. This layout does not have to be used and we encourage students to be creative in their report layout and style.

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Abstract

The abstract is a short summary of the report, informing the reader of what you did and what you found out. Abstracts are usually between 150 and 250 words long including:

- Aims and scope
- A brief reference to the materials and methods
- A summary of the results and conclusions

Introduction

This provides a summary of the background information and should give the reader context of the scientific field of research.

The introduction generally does not include results or conclusions.

Main body of the report

Split into method, results, discussion or split according to common themes.

- A discussion of the method used.
- What results were found?
- What do these results mean in the context of the big picture?
- How did you evaluate your ideas against the evidence base?
- A discussion of what evidence is missing and where knowledge gaps may be.

Conclusion

This is the summing up of the argument and should relate back to the introduction. The conclusion should only consist of a few sentences, and should reiterate the findings of the report.

References

References should be used whenever someone else's work or idea is mentioned in your report or poster. Cite any references used including a number in-text which refers to where the reference is relevant to.

Example:
Main body of the report:
Agriculture contributed 0.53% to the UK economy in 2019 [1].
References section:
[1]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/884101/agricaccounts-tiffstatsnotice-07may20i.pdf

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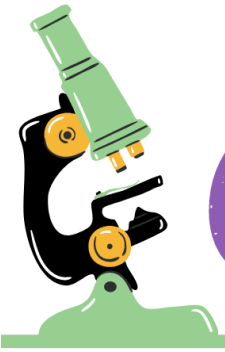

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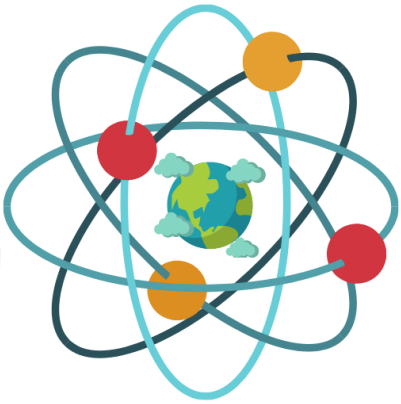

Success Statements

Entries will be marked against 5 criteria: problem solving, evaluation, scientific evidence, presentation & communication, and creativity. The 10 success statements below provide a description of what a good entry looks like.

A good entry will demonstrate:

Problem solving

1. Introduce the chosen problem, providing context and background information.
2. Present 3 solutions and explain how each of these will help to solve the chosen problem.

Evaluation

3. Evaluate the proposed solutions, suggesting why they would be the most effective ways to tackle the problem, and identify any potential drawbacks of the solutions.
4. Show consideration for the cost and practicality of implementing the proposed solutions.
5. Consider what evidence is missing and where knowledge gaps remain.

Scientific evidence

6. Selectively use relevant and the most up to date information available.
7. Include a range of evidence, such as facts, conclusions, and opinions, and clearly reference all sources of evidence.

Presentation & communication

8. Have a visually engaging poster with a logical layout and design.
9. Have a well-structured report, that is written clearly, concisely, and persuasively.

Creativity

10. Present, with evidence, the student's own ideas and interpretations of existing material. This also includes producing original graphs, charts, or other visual aids to display information.

Reflection log

Good entries will also include reflection logs from each member of the team. Providing comments on the communication and collaboration skills used with other team members, as well as the skills you feel you have developed during this project.

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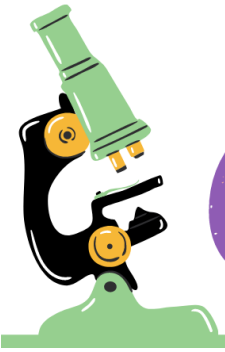

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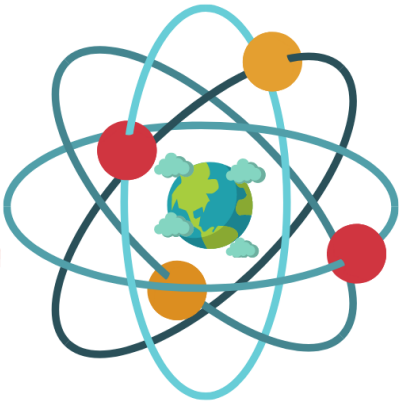

Frequently Asked Questions

1. **How do I enter?**
   Please send your final PDF submissions to your teacher/ school careers advisor.

2. **How do you recommend we start?**
   We recommend you start by looking at the problem statements and the relevant links included, using this information to guide your further searches. Exploring the general overview of your chosen topic, including current and future directions, should give you ideas for the specific information you should be looking for.

3. **Do you recommend any tools to help us create the poster?**
   There are many options for building posters, and we would encourage you to be creative in your building process. Some good poster-building tools include MS PowerPoint, Prezi, InDesign, and MS Publisher.

4. **Should the reflection log be completed by each student or the team as a whole?**
   Each individual team member should complete a reflection log and submit this along with the poster & report.

5. **What are the prizes?**
   For completing this challenge all teams that take part will receive a certificate. The team that produces the best poster and report will have their certificates signed by the Head of Government Science and Engineering, Sir Patrick Vallance, to evidence their achievement! Amazon vouchers will also be awarded to the winning team!

Timeline

1. **13th May** – Launch date of the STEM challenge.
2. **13th May** (4-5pm) – We will be hosting an online event where we will present the STEM challenge and host a Q&A session from 4-5pm. This session will also be recorded for any schools joining later. We look forward to meeting you all!
3. **20th May** (4-5pm) – Additional Q&A session.
4. **25th May** (4-5pm)- Additional Q&A session.
5. **11th June** (6pm) – All submissions for the STEM Challenge will have to be submitted by 6pm.
6. **Mid July** (TBC) – Winner to be selected
7. **Mid July** (TBC) – Prizes to be distributed