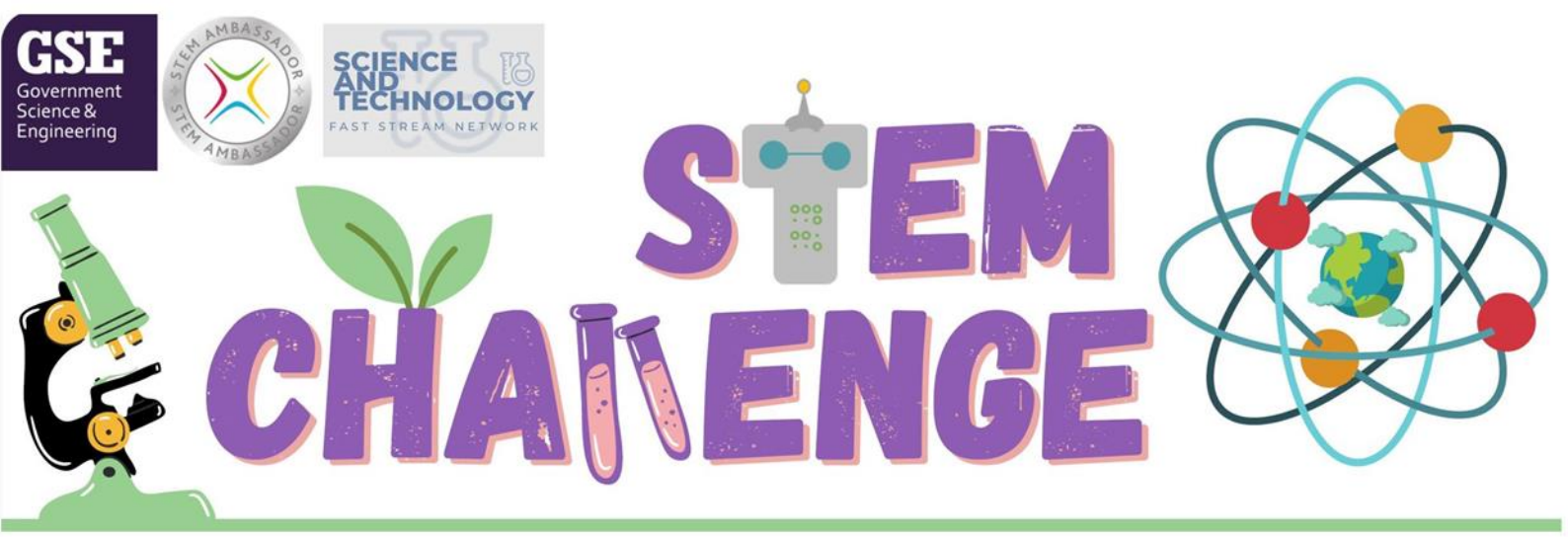


Student Pack

2022 Challenge

Civil Service Fast Stream

Royal Astronomical Society

SEB

BRITISH ECOLOGICAL SOCIETY

Who are we?

We are Civil Service Fast Streamers from a diverse range of science and engineering academia backgrounds. Our aim is to promote Science, Technology, Engineering and Mathematics (STEM) interest in schools. We are passionate about promoting STEM and encouraging diversity, social mobility and inclusion within the field. Fast Streamers work across the Civil Service, using their STEM skills to help shape government policy and decision making, whilst developing into future leaders.

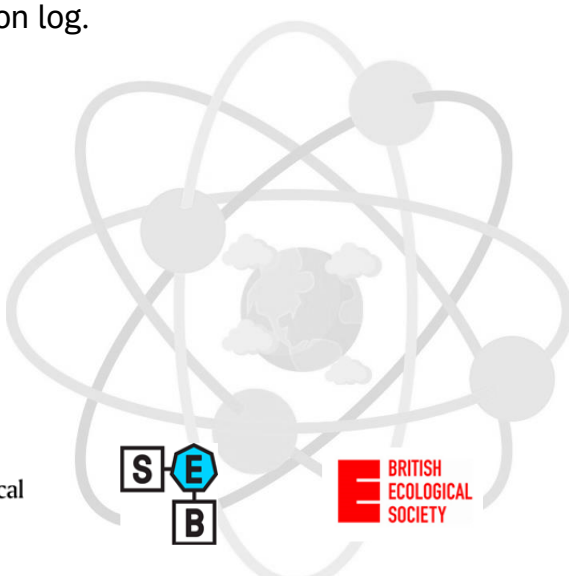
What is the Challenge?

We believe that an engaging and effective way to communicate the real-world relevance of STEM can be delivered through a competition-based STEM Challenge. The Challenge involves a hypothetical but realistic scenario that students will address in a creative and scientific manner. Aimed at years 9 and 10, students are Challenged to work in groups of 4-6 students and with a degree of autonomy. The Challenge will be reflective of the school curriculum. This will be open-ended to permit a range of approaches, and entries will be judged by a panel of policy experts with prizes being awarded to the best entries. We're also offering a talk by a government scientist for everyone taking part! Prizes will include STEM experience sessions for the winning teams with thanks to learned societies including the Society for Experimental Biology, Royal Astronomical Society and British Ecological Society.

2022's Challenge will be 'a vision of a carbon neutral day in 2050': imagine yourself as a scientist and policy maker in 2050 responsible for ensuring that resources are managed in a sustainable and carbon neutral way. 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. Choose one of the three exciting and innovative topics provided to explore and build your carbon neutral world:

1. Sustainable food production
2. Sustainable transport
3. Humans in space

Teams will submit their ideas in the worksheet. Each team member will also be expected to complete a reflection log.



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A vision of a day in 2050

This year's Challenge looks into the future and imagines how technological progress could overcome the sustainability challenge that we face today.

Please look at the problem statements below and choose **one** problem statement for your team to tackle.

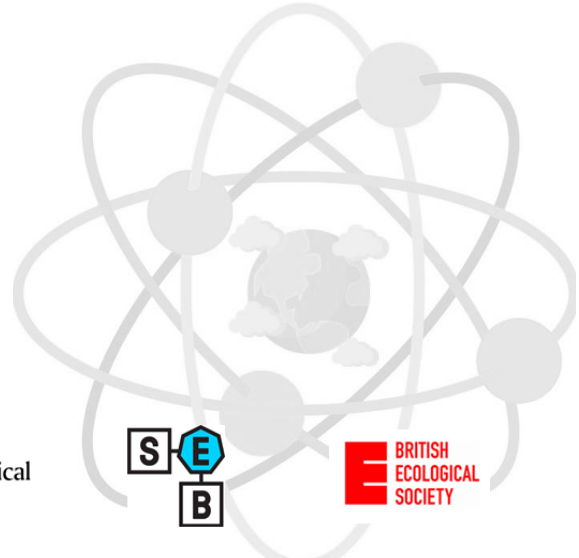
Your team will need to complete a worksheet outlining three potential ideas that address the issues outlined in your chosen problem statement.

You will need to explain the science and engineering behind these ideas and compare the pros and cons of each solution.

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!

We know that it may be tempting to write about more than three ideas, or write about fewer ideas in more detail. However, you need to write about three ideas or you will be marked down.



#1 Sustainable food production

The global population is estimated to reach 9.9 billion people by 2050. To feed the growing population, food production will need to be more efficient and sustainable. Sustainable food production involves producing food whilst protecting the land for future generations.

Imagine that you are overseeing food production in the UK. **How will you make UK food production more sustainable?**

As a team, pick your **top three** ideas to write about in the Challenge.

Topics to get you started

Biology and Ecology

- Genetic modification of crops
- Sustainable aquaculture and smart fishing
- Land use – land sharing or land sparing (extensive/intensive

Chemistry

- Alternatives to farming chemicals
- Soil Science (such as soil carbon)
- Fertilisers and crop nutrition

Engineering and Physics

- Emerging agricultural technology
- Water resource and reuse
- Reduce food waste during production or storage

Science in Society

- Changing diets (insect consumption)
- Reduce distance food travels
- Lab Grown “meats”




Helpful links

- BBC Bitesize - www.bbc.co.uk/bitesize/topics/zjsc87h/articles/z88nhcw
- Food and Agriculture Organisation (FAO) - www.fao.org/home/en
- Sustainable Food Trust - www.sustainablefoodtrust.org/

#2 Humans in Space

Space activities benefit people on Earth, such as using satellites for communication and monitoring the weather. Advancing space technologies could create scientific knowledge that improves sustainability on Earth. As the space industry grows, we must make sure that space activities are sustainable. Sustainable space activities must meet the needs of the current population whilst protecting space for future generations.

Imagine that you are overseeing the UK's space strategy. **How will you improve the sustainability of space activities? Or, how can you use space technology to improve sustainability on Earth?**

As a team, pick your **top three** ideas to write about in the Challenge.

Topics to get you started

Biology and Ecology

- Sustainable food production in space
- Impacts of rocket launch on wildlife
- Impacts of zero gravity on human physiology

Chemistry

- Rocket launch climate impacts
- Recycling resources on the International Space Station
- Sustainable rocket fuels

Engineering and Physics

- Sustainable removal of space debris
- Reusable rockets
- In space manufacturing or printing

Science in Society

- Space tourism and space elevators
- Space technology applications on earth
- Sustainable satellite applications




Helpful links

- UK Space Agency - www.gov.uk/government/organisations/uk-space-agency
- European Space Agency (ESA) - www.esa.int
- SpaceX - www.spacex.com/

#3 Sustainable Transport

Transport connects people to work, education, and healthcare, and enables the trade of goods. However, the transport sector produced 27% of the UK's greenhouse gas emissions in 2019, more than any other sector. The UK government has committed to achieving net zero emissions by 2050. To reach this target, we need to improve the sustainability of our transport. Sustainable transport involves moving people and goods without creating negative impacts that threaten future generations.

Imagine that you are overseeing the UK's transport system. **How will you make the UK's transport system more sustainable?**

As a team, pick your **top three** ideas to write about in the Challenge.

Topics to get you started

Biology and Ecology

- Green Cities
- Using biofuels
- Effects of air/noise/light pollution of wildlife

Chemistry

- Reducing air and water pollution in transport
- Alternative fuels for aviation
- Sustainable shipping

Engineering and Physics

- Future modes of transport (hyperloop, drones, hovercraft..)
- Renewable energy for transport
- Hydrogen powered vehicles

Science in Society

- Active travel and micro-mobility (cycling, walking)
- Planning sustainable cities
- Cyber security of smart transport systems




Helpful links

- BBC Bitesize - www.bbc.co.uk/bitesize/guides/zqvxdmn/revision/4
- Campaign for Better Transport - www.bettertransport.org.uk
- Virgin Hyperloop - www.virginhyperloop.com

Worksheet Guidance

What is the purpose of the STEM Challenge worksheet?

The STEM Challenge worksheet should provide the background information to your chosen problem statement and evaluate your top three ideas. You should reference the sources that were used to inform your arguments. This is your opportunity to showcase your scientific knowledge and ability to evaluate different ideas.

What should be included in the worksheet?

A guide for what to include in the worksheet is provided below. We are more interested in the quality of your arguments than in the number of points that you make. It will not be possible to address every issue in the problem statement so you will need to narrow down your focus. You can use the example topics in the problem statements to give you some ideas, but we encourage you to pick a topic that interests you. In the worksheet, you should evaluate your top three ideas to tackle the issues facing the narrowed topic within your chosen problem statement. You will need to draw a conclusion from your evaluations.

How should the worksheet be organised?

- Word counts for each section have been provided to guide how to structure your response.
- The total word limit for the worksheet is 2,300 words. Be careful! - You will lose marks if your worksheet is 10% above the total word limit.
- The title, tables/graphs and reference list will not count towards the word limit.
- Pages should be A4 and fonts may not be smaller than size 10.
- You must write about **three** solutions or ideas to tackle the issue raised in the problem statement. Solutions included after the first three will not be marked.
- Make sure that your graphs and tables have suitable headings and axis labels. Graphs/tables should be able to be understood on their own.
- Please submit your worksheet as a PDF document.
- All sources used should be included in the reference list at the end of the worksheet.
- **Please note that plagiarism (copying) will result in immediate disqualification from the STEM Challenge.**

Worksheet Layout

Abstract - 250 words

The abstract is a short summary, informing the reader of what you did and what you found out.

Introduction - 400 words

The introduction should provide background information to the problem statement that you have chosen. You should begin the introduction by thinking about the broader context for the problem and why it is important to address the issues raised by 2050. You should provide an overview of the relevant research and scientific thinking that has taken place on this problem.

Narrowing the scope - 150 words

It will not be possible to address every issue in the problem statement so you will need to narrow down your focus. You will need to provide more specific information on the chosen topic that your worksheet will be focusing on and explain why it is an important topic.

Proposed Solutions - 600 words

Explain your top three ideas or solutions to address the issues outlined in your chosen problem statement. Explain how each solution will help solve the issues using scientific evidence. Reference the sources you have used to explain your ideas.

Discussion - 600 words

Compare the benefits, drawbacks and risks of each of your proposed ideas or solutions to address the issues outlined in your chosen problem statement. Compare the potential costs and practical issues of putting each solution into practice in the UK. Explain where there is evidence missing or knowledge gaps that need to be addressed before the solution can be successfully implemented.

Conclusion - 300 words

Summarise the main points from your worksheet. You should recommend one of the solutions or ideas that you evaluated to address the problem statement issues. You should briefly summarise why this is the best option and suggest future research that could help the solution or idea to succeed.

References

Whenever someone else's work or idea, you should include the source as a reference. Please include all sources used in the reference list at the end of the worksheet. This includes websites, videos, articles, scientific papers, etc. When using a source to support your ideas, write a number in brackets at the end of the sentence that corresponds to the source in the reference list. In the reference list, sources should be written as a link or title, author and date published.

Example:

Main body of the worksheet:: 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

Success Statements

A good entry will...

Problem solving

1. Introduce the chosen problem statement, setting the scene and providing background information.
2. Present three relevant solutions and explain how each of these will help to solve the chosen problem.

Evaluation

3. Evaluate the proposed solutions in an unbiased manner by suggesting how effective they would be at tackling the problem and identifying any potential drawbacks.
4. Compare practicality (including acknowledging the cost) of putting each of the solutions into practice.
5. Consider whether there are any uncertainties and what other research may need to be carried out to address these.

Scientific evidence

6. Selectively use relevant information from reliable sources, recognising bias where present.
7. Present evidence from a wide range of sources and clearly reference all sources of information.

Presentation & communication

8. Prepare a well-structured worksheet, written clearly, concisely and persuasively.

Creativity

9. Present own ideas and interpretations using evidence from research. This also includes producing original graphs, tables and diagrams to display information.

Reflection Log

Each member of the team is required to answer the questions in the Reflection Log document. This contributes 5% to the overall STEM Challenge mark. We want you to reflect on how well you worked together as a team, what skills you have developed and what you would do differently if you were to do the project again.

Privacy Notice – STEM Challenge 2022

Entries must NOT include any personal information, including names of team members or schools to ensure anonymity in the judging process is maintained.

This statement covers the services provided by the STEM Challenge. The Data Controller for submissions and general enquires submitted through the STEM Challenge mailbox (stemchallenge@faststream.civilservice.gov.uk) is the Cabinet Office. The purpose of this statement is to inform users of the inbox, which is managed by the STEM Challenge team, about what information is collected about them when they contact this inbox, how this information is used, if it is disclosed and the ways in which we protect users' privacy. This privacy statement only covers the STEM Challenge. The information collected is voluntarily provided by the user when they contact the STEM Challenge mailbox.

Purpose

The purpose for which we are processing your personal data is to respond to email enquiries and receive STEM Challenge submissions from members of the public, in this case specifically the teachers of the schools participating in the STEM Challenge.

The data

We will process the following personal data:

• your name

• email address

We will also:

• collect details of any enquiries raised in your correspondence

• process any other information you volunteer about yourself

We are only collecting this information to allow the judging of the STEM Challenge entries and for queries related to this to be responded to.

Lawful basis

The legal basis for processing your personal data is that processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the data controller. In this case that is promoting STEM engagement and attainment. This is achieved through demonstrating how STEM is relevant to real world policy in the STEM Challenge.

Winning teams will be approached to gain consent prior to collecting any personal data (name and school) which will be used to distribute prizes and publish the winning entries on the Government Science and Engineering blog page. If students consent, the winning entry will be shared with the Government Chief Scientific

Advisor, the GSE team, the STEM Ambassador Programme, learned societies providing prizes and published on the GSE blog page.

If students are not happy to provide this information they can still take part in the competition but the prize will be given directly by the school and not the STEM Challenge. Any prizes that involve the passing on of names (for example to the Government Chief Scientific Officer) won't take place.

If you are not comfortable with the use of data in this way, you can contact the STEM Challenge mailbox with the subject line “STEM Challenge Enquiries”. You can choose not to take part in the challenge at any point. Any correspondence will usually be deleted 1 calendar year after the correspondence is closed.

This challenge is organised by civil servants on the Fast Stream and will be used to count towards their corporate objective.

Recipients

Your information will be shared with the STEM Challenge team to allow enquiries to be responded to.

As personal data will be stored on our IT infrastructure it will also be shared with our data processors who provide email, and document management and storage services.

Retention

Personal information in correspondence will usually be deleted 1 calendar year after the correspondence or case is closed or concluded.

Your rights

You have the right to:

• request information about how your personal data are processed, and to request a copy of that personal data

• request that any inaccuracies in your personal data are rectified without delay

• request that any incomplete personal data are completed, including by means of a supplementary statement

• request that your personal data are erased if there is no longer a justification for them to be processed

• in certain circumstances (for example, where accuracy is contested) to request that the processing of your personal data is restricted

• object to the processing of your personal data

• A full list of your rights under the General Data Protection Regulation (GDPR) is available on the ICO website.

International transfers

As your personal data is stored on our IT infrastructure, and shared with our data processors, it may be transferred and stored securely outside the UK. Where that is the case it will be subject to equivalent legal protection through an adequacy decision, or the use of Standard Contractual Clauses.

The right to withdraw consent

You have the right to withdraw your consent at any time where the Cabinet Office is relying on consent to process your personal data.

We will collect data from winning students in order to distribute prizes. We will approach winning students of the STEM Challenge to achieve consent prior to the collection of their personal data. Winning entries will be published on the GSE blog page and shared with the Government Chief Scientific Advisor, the GSE team, the STEM Ambassador Programme and learned societies providing prizes. All other data and entries will only be shared with the team of Civil Service Fast Streamers who are running this challenge. We will not release data to anyone who is unauthorised. All data will be deleted after 1 year.

Process for contacting students of winning entries and giving prizes:

• The teacher from the school the winning entry came from will be contacted using the email they used to submit entries. They will be contacted from the STEM Challenge mailbox.

• We will inform you which entry has been designated the winning entry.

• We will request that teachers seek consent from the students who put together the winning entry via parental consent forms. We request that teachers explain the following to students, and make it very clear that consent is optional.

We will request teachers seek student consent from the winning team for each of the following (consent can be given for all or some):

• Their names to be shared with the Fast Stream team, the GSE team and the Government Chief Scientific Adviser.

• Their entry to be shared with the Government Chief Scientific Advisor, the GSE team, the STEM Ambassador Programme and learned societies providing prizes.

• The entry will be published anonymously on the GSE blog.

• We will request that teachers reply to the STEM Challenge mailbox confirming that consent is given by providing the parental consent forms and provide student names.

• The Government Chief Scientific Adviser will sign certificates for the winning team.

If consent is not given for all parts of the above, prizes that can be given directly by the school and not the STEM Challenge will be distributed and any prizes that involve the passing on of names (for example to the Government Chief Scientific Officer) won't take place.

Contact us

If you have any questions about this, please contact stemchallenge@faststream.civilservice.gov.uk