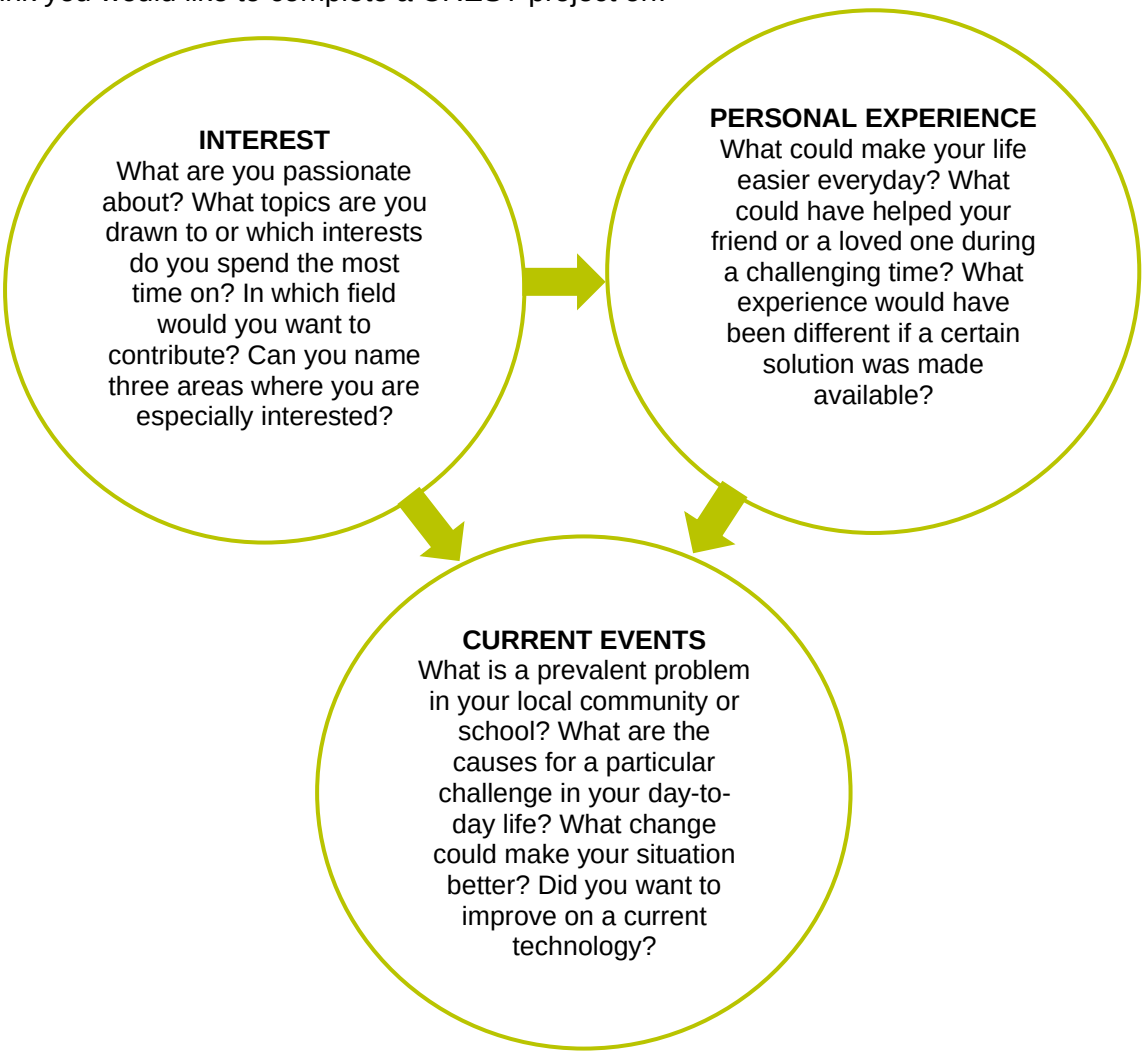
Generating questions for CREST

This document is intended to help CREST students who may be struggling to come up with a project idea and to help them generate a question that is relevant to them and their daily lives. Using this document you'll be able to narrow down areas and topics that interest you, coming up with a question that is relevant to both the world around you, and your everyday life. CREST is all about tackling an issue that interests you, so use this document to find something that inspires you to learn more!

> "The most exciting phrase to hear in science, the one that heralds new discoveries, is not *"Eureka!"* but rather*, "hmm… that's funny…"* – Isaac Asimov

The problem

A scientific problem always starts with a question, but sometimes it can be difficult to figure out how to ask an effective question. To help you generate questions for a CREST project, start with something that is relevant to you – it can be something of interest, something that is happening around you, or an activity or experience closer to home. These factors are in no particular order and can be applied separately or linked together if it works for you. Take a look at the diagram below and use it to come up with a broad problem that you think you would like to complete a CREST project on.

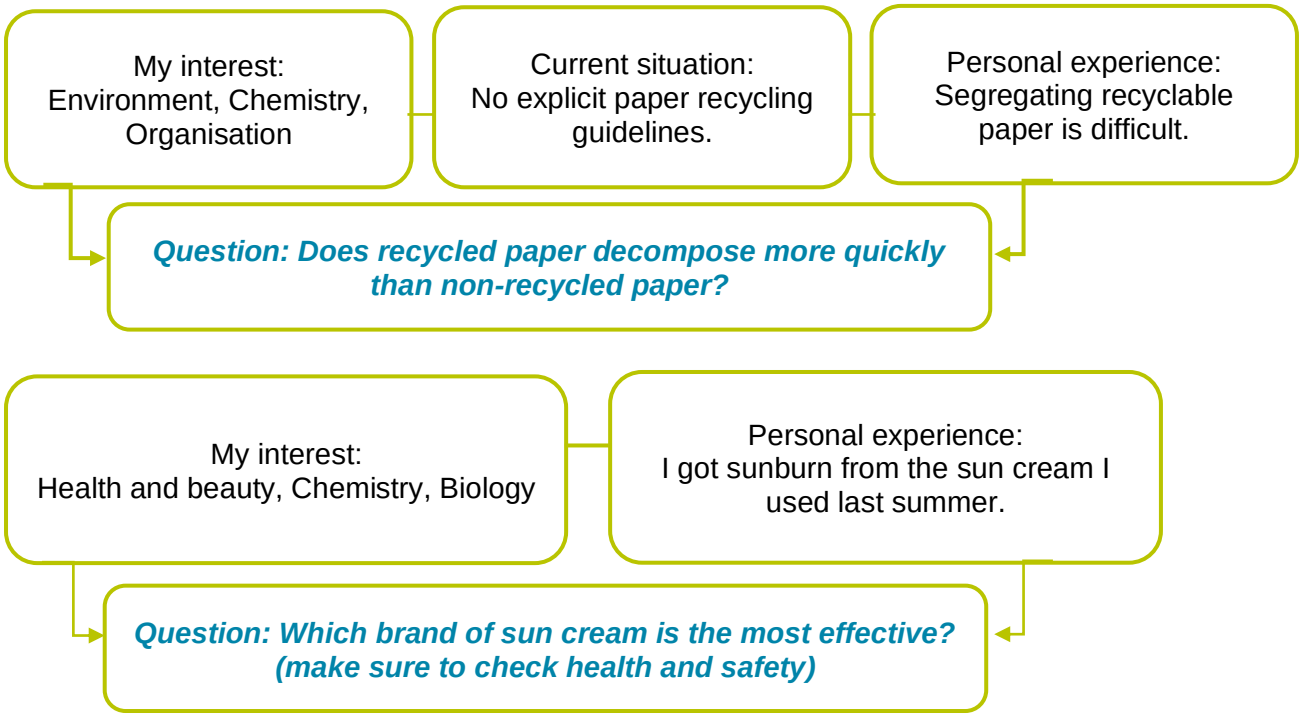


The question

After identifying a broad problem, you can start generating questions and narrowing down your problem into something that is measurable or testable. There is a good chance that your problem will be testable if you ask yourself good questions using the 5W1H (Who, What, Why, When, Where, How) method:

- **WHO:** Who will benefit more from an existing technology? Who has more potential when it comes to doing a certain activity?
- **WHAT:** What can be changed? Replaced? Improved? What is the most effective solution? What is the most productive way to do an activity? What features do they have in common? What factors influence an event?
- **WHERE:** Where else could a product be used effectively? Where in the world does a solution have a bigger impact?
- **WHEN:** When is the best time to perform an activity ('best' can be measured in productivity, ease, comfort, etc.)? When I change the course of the process, what happens? When tested for something, how do two groups compare?
- **WHY:** Why is something like this?
- **HOW:** How does one thing affect another? How does one part of a product affect the function of another if modified? How could it be simplified? How effective is that product?

For example:



Here are question examples applied in different fields:

- Biology: What fertiliser works best?
- Chemistry: What natural oil works best in repelling flies?
- Engineering: What is the most ideal design of a toothbrush?
- Fashion: Which metals are suitable for making jewellery?
- Food: What are the health benefits of tea?
- Geology: What type of soil holds the most water?[1]
- Health: Which foods are best for someone with a nutritional disorder?
- Physics: How does aerodynamics affect sails?
- Thermodynamics: What inside window covering is best in blocking outside heat?

Now that you have chosen your question, the next thing to do is to determine how measurable your problem is. You should be able to answer all these questions[2] with a yes:

1. Is the topic interesting enough to read about and still relevant to work on for the next couple of months?
2. Are there at least **three** sources of written information on the subject? Reliable, recent and relevant literature gives you a context of history about your problem.
3. Is there another way of thinking about the problem? Can you simplify it? The broader the problem, the more difficult it can be to test it.
4. Is it measurable? Your question should be answered using measurable data in units such as count, percentage, weight, volume, length, width, speed, time, velocity, energy, etc.
5. Do you have a clear timetable? A clear plan steers you to achieving your goal more than when you do not have one.
6. If your problem requires an experiment or making a model, is it safe?

If you have considered all of the above points, and can answer yes to them – fantastic! You now have your question! The next step is to figure out what process you should use to help you find your answer.

Health and Safety

You should create a plan for your project and a risk assessment before you begin any practical activity. You can use the CLEAPSS student safety sheets to help you. Make sure you check any practical work and risk assessments with a responsible adult.

[1] https://sciencefaircentral.com/students/scientific-projects

[2] https://www.sciencebuddies.org/science-fair-projects/science-fair/science-fair-project-question

The method

To arrive at the answer to your measurable question, you must choose one of the below as the best method to test your solution. The below are the four types of CREST project – the way you'd like to run your project will likely fall into one of these. By deciding this in advance you can prepare for what elements you'll need to complete your project.

	Practical Investigation	**Design and Build**	**Research**	**Communication**
What is it?	Aim to answer a question, hypothesis or problem.	Aim to design and create a product that meets a specific aim. Design and Make enterprises can start with a broad scope, which is then narrowed down to something more specific.	Aim to provide a fresh perspective or strengthen an argument for a disputed STEM topic through data gathering and analysis. These are ideal for young people who are learning at home, and want to complete something on a topic of interest. They also fit well with the Extended Project Qualification.	Aim to inform a specific audience about a topic or raise their awareness and interest in STEM. If you have younger siblings, you could consider creating something that communicates a STEM topic to them in a way that makes it easy to understand.
Typical elements	• A question, hypothesis or problem • Project aims • Planning • Evidence • Analysis • Conclusion	• A brief • Project aims • Designing of a solution to a specific problem • Testing, analysis, improvement and retesting of solution (multiple cycles) • Analysis of final solution • Conclusion	• A project brief or area to investigate • Project aims • Plans for how data will be gathered and analysed • Critical analysis of existing data • Conclusion	• A target audience • Background research of the topic and the audience • Design of a form of communication • Reflection and explanation of how the communication is fit for purpose, including being pitched at the correct age and level of understanding • Evaluation of their communication using appropriate measures • Conclusion

Questions to ask	• What will you test? • Is there an experiment you can conduct that supports your solution? • What results are you aiming for?[3]	• Do you want to build a model to support or visualise your solution?	• What trends are you looking to find? • How will you collect your data?	• Did you want to explore a topic to a specific audience? Did you want to raise awareness on a certain area of interest? • How are you going to address it to your audience?
Example brief in the CREST library	**Bronze:** What makes bread rise?	**Bronze:** Bath Bomb Challenge	**Bronze:** Grand Challenges – Future Jobs	**Bronze:** Grand Challenges – How can you create a trustworthy machine?
	Silver: How does cooking change pasta?	**Silver:** Make your own tea bag	**Silver:** Climate science – Drought Detectives	**Silver:** Grand Challenges – Accessible Messenger
	Gold: The properties of saucepans	**Gold:** Build a pinhole camera	**Gold:** Grand Challenges – Are we ready for driverless cars?	**Gold:** Fruit juice or fizzy drinks?

Once you have an idea and a plan for your project, you're ready to begin. Take a look in the CREST Help Centre, our teacher guide, and Silver and Gold student guides if you have any questions. You can also check out the support in the CREST Resource Library.

[3] https://drive.google.com/file/d/10h-jQS1fJkJqr99ak-IZH3nqa9YkOHhA/view