YEAR 6
STEM Project 1

Science Technology Engineering and Mathematics (STEM) Project – Student Booklet

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International Space Farm

The Challenge

To address food security issues by designing an International Space Farm!

One of many global issues that planet Earth is facing is food security. For a person to be considered food secure there must be food available to them, it must be affordable and the food must be good enough to provide them the nutrition needed to be healthy.

Growing crops for food on planet Earth is becoming increasingly difficult due to issues such as:

- an increasing population,
- natural disasters destroying food crops and land areas used for farming,
- climate change,
- pests and diseases affecting crops and livestock, and
- the lack of available land suitable for farming.

One possible solution to solve some of these issues is to consider developing an International Space Farm (ISF). The idea of a farm that is not based on Earth is a great way to pique students' interest in the project. This could be a farm based on a station orbiting the Earth or a farm on another planet, even a moon! There are many aspects to be considered in designing and operating an International Space Farm.

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This project has been broken into four main areas:

- Design and build the farm
- What crops will you grow?
- What do you need to grow the crops?
- How will you harvest, store and distribute the crop yield?

Take a look at the *STEM project map* provided by your teacher to see how each of these areas can be broken down into smaller problems for you to solve. You may come up with some other problems that are not listed. This is great as it shows you are thinking like a true STEM problem solver!

Find Out More and Get Thinking

In this section of the project, you need to find out some background information about the issue of food security and how it affects Australia (as well as people across the world). Your teacher will ask you some stimulus questions that you will need to do some research to answer.
Included on the next page is a worksheet that may help you to organise your research findings.

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STEM Project Research Worksheet

Some tips for researching on the internet:

- *Make sure you fully understand what it is you are trying to find out before you start your research.*
    - *You need to understand what all of the words in a question or statement mean so look them up if you don't.*
    - *If you're still stuck ask your peers or your teacher.*
- *Try to use websites that are written by trusted sources.*
    - *Those ending in .gov, .org or .edu are usually reliable.*
- *Always find your information on more than one reliable website or source. If it only appears on one website, how do you know that the information can be trusted?*
    - *Wikipedia can be edited by anyone (even you!) so it may be a good starting point but cross check any information you get from there!*

What are you trying to find out more about? *Is there a question you are trying to answer*

What are the key words you could use in your search? *It is always more effective to search using key words rather than typing a question into a search engine.*

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Do you know what all of these words mean? *If not, look them up and define them below.*	
Word	Definition

Once you have searched, using the key words, summarise what you have found out and write dot points. It isn't necessary to write full sentences (this helps you to put it in your own words).
Make sure you include the full URL of the website you found it on and also the date you recorded this information (websites change all the time!)

Dot point facts	Website URL & date
•	
•	

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Ways to Meet the Challenge

This project has many different parts to it and your teacher may have asked you to look at one area in particular.
Write the project area that you will be looking at in the box below.

In the space below, brainstorm all the ideas you have about how you could investigate the project area.

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When you were brainstorming, were there some things that you found you need to know more about? Write those down here. You may like to use the STEM Project Research Sheet to find out more about these things.

Scientists all over the world organise the way they think about and carry out their work in the same way – we call this the *scientific method*. They also write quite formally in the 'third-person' style (not using phrases such as 'you', 'we' or 'I)'.

To try and solve your part of the STEM problem and meet the challenge, you may need to design and build something, program a piece of technology or perhaps carry out an investigation (by designing and carrying out an experiment).

There are two worksheets on the following pages to help you with this process:

- STEM Project Experiment Worksheet
- STEM Project Design Process Worksheet

If you are going to design an experiment, there are certain things that you always need to consider and include. The STEM Project Experiment Worksheet on the next page will help you to design your experiment and organise the data you collect. It is important that you include as much detail as possible so your experiment could be repeated by anyone who reads it.

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Below are explanations of the terms used in the STEM Project Experiment Worksheet.

Problem/Aim – What problem are you investigating? What is the purpose of the experiment? You only need to write a sentence or two for this section. You would write something like "To investigate the amount of water different types of crops need." You may even like to write it as a question e.g. "What amount of water do different crop types need?"

Variable – A variable is any part of an experiment that can be measured, changed or controlled. It may have factors such as an ingredient, a way of doing something or be part of the surroundings, like temperature.

Independent variable – This is the variable that you are going to change to see what effect it has. A fair test only changes one thing so there is only ever one independent variable.

Dependent variable – This is the variable that you are testing so it is the one you are going to measure.

Controlled variables – These are all the other variables that you keep the same to make sure a fair test is carried out. There will always be more than one of these, including making sure that you are using the same equipment and methods for repeat experiments. You do only need to list the things that will have a direct effect on the experiment.

Hypothesis – What do you think is going to happen? Another way to think of a hypothesis is that it is an informed guess, using the knowledge you gained by researching your problem. This is a sentence that predicts how the independent variable will affect the dependent variable. You could use a sentence such as 'If the amount of water is increased, then the crops will

grow taller'. In this example, the amount of water is the independent variable (you are changing this) and how tall the crop grows is the dependent variable (you are measuring this and it will depend on the independent variable).

Materials and Equipment – This is a detailed list of all the things you will need to complete the experiment. You should include the size of equipment (e.g. a 250mL plastic plant pot) and the quantity.

Method – Write a step by step description of how you will do the experiment. Remember, it needs to be written in third person point of view so avoid using 'I' or 'we'. Make sure you are very detailed so someone else can do exactly the same experiment by following your method. You may even like to include some diagrams of how your experiment is set up.

Safety – Make a list of any things you'll need to do to make sure you work safely and don't create a hazard for anyone else or the environment.

Results – In this section you will record any observations or measurements you make. It is usually best to put your data in a table, making sure you have titles on all of your columns and that the units you are measuring in are included. Whatever your independent variable is should be in the left column. Make sure you make space in your table for any repeat trials you do. You may also like to take photographs or videos to record your results. It may also be appropriate to present your results on a graph – check with your teacher.

Conclusions – What do your results tell you about your original aim or hypothesis? You should write a sentence or two stating whether your results support your hypothesis or not and explain any patterns you notice in your results.

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STEM Project Experiment Worksheet

Title:
Problem/Aim: (What problem are you investigating? What is the purpose of the experiment?)
Variables: Independent Variable (what are you changing?): Dependent Variable (what are you measuring?): Controlled Variables (what are you keeping the same to make it a fair test?):
Hypothesis: (What do you think is going to happen? An informed guess)
Materials and Equipment: (List all things you' will need for the experiment)

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Method: (A step by step description of how you will do the experiment. Avoid using 'I' or 'we'. Labelled diagrams might help)

Safety: (What will you do to minimise hazards to people and the environment?)

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Results: (Record your observations and measurements. A table may be best for this. Remember that the independent variable should be in the left column and you must include the units of measurement. Attach a piece of graph paper or photographs, if required)

Conclusions: (What do the results tell you about your original aim or hypothesis?)

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STEM Project Design Process Worksheet

Do I have a clear understanding of the problem I need to solve? Write the problem in one or two sentences.
How will you test your solution? Remember that you may only be able to build a smaller model of your real-life design.
What materials will I need to work towards a solution and test it?
List any special tools you may need to use. e.g 3D printer, hammer, clamp

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What do I need to do or use to make sure I work safely?
Draw a first draft of a mind-map or diagram to show your planned design or programming steps

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How much will your planned design cost and are all the materials and tools available to you? Where will you get them from? You may need to check with your teacher.

Review your design and make any changes needed. Use the space below to draw your final design or plan. Make sure it is well labelled!

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How will you record your progress? e.g. photographs, video, diary or journal

Once your design is approved by your teacher, go ahead and gather your equipment, build a prototype or start programming!

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Could It Be Better?

Once you have carried out your experiments, built and tested your prototype or programmed and tested your solution, you need to review your ideas and work. In this section, you can identify any problems or difficulties you encountered and suggest ways you could improve your project if you were to start again.

These questions will help with your review process. Write or draw your ideas for improvement in the table below.

- Do you currently have access to enough of the materials you used to make a full-size model? Is there enough of it available in Australia? On Earth?
- Will current technology be useful, or do you need something more, something faster or better?
- Estimate how much it would cost to put your plan in place.
- Estimate how long it would take to put your plan in place.
- Can you do all of this yourself or do you need to bring in some experts? Who might these experts be?
- Did your experiments or tests give you enough information to start an International Space Farm tomorrow? What further experiments or tests might you need to do?

Problem encountered	Possible Solution

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Problem encountered	Possible Solution

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Any other ways to improve your solution if you have unlimited resources, time and access to the best people!

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Report Back To Base

To finish off your STEM Project, you or your group need to let everyone know what you found out and what solution you came up with for your problem.

There are many ways you could do this and your teacher may ask you to do it a particular way or have you come up with your own ideas. When writing or making your presentation, make sure you think carefully about who your audience is and how much detail you need to include. More visual presentations (colourful or with lots of pictures) are always more interesting.

Whatever kind of presentation you end up doing, you should cover the following things:

- What have we found out or discovered that we didn't know before?
- What did we design, build, program, test etc.?
- What STEM skills have we used? (problem solving, creativity, critical analysis, teamwork, independent thinking, communication, digital literacy)
- What data did we generate in our investigation and what does this show? (this may be in the form of tables or graphs and may not be relevant to every section of the project)
- How could we better investigate the challenge if we had no limit on resources or time?
- What was the most challenging aspect of the project?