



STEM Project 1D - Monitor Dust

Dust: Earth & Beyond

The Challenge

To address dust issues encountered on the Moon, Mars and Earth



Write your
name on the
Earth

Ways to Meet the Challenge

This project has many different parts to it and you will be looking at one area in particular.

Design and test a device to monitor dust levels



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Find Out More and Get Thinking

Here are some points you might like to consider in your design process:

1. Is your device going to collect dust that falls on it from the air in a set time period? Or is it going to pump in a fixed volume sample of air and measure how much dust is in the air sample?
2. Consider the location where your dust monitor will operate as this will change the design. For example, if it is in a very dusty area, the design may need to have a very large collection container. Keep in mind how much dust you would expect to collect as you think about your design.
3. How will your device measure the amount of dust? Will it measure the weight or the volume of dust? Perhaps the dust could collect on a paper or cloth and be weighed or collected in a container that has volumes marked on the side.
4. What size of dust particles (or particulate matter) will your device monitor?
5. What if dust being collected is toxic? Will people need to be near the dust? If they are, how could you protect them?
6. Does your design allow the dust to be collected for further analysis or is it just to monitor the amount of dust?
7. Is your design suitable for use on Earth, the Moon and Mars or just one of these? Could small adjustments make it suitable for other places? Consider atmospheric conditions, and temperatures it can operate in.





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8. Will your design need anyone to operate it or could it be remote control or autonomous (able to work without people operating it)? Will it require a person to take a measurement or could you use a sensor instead?
9. Your design will need to be transportable, especially if it is being used on Mars or the Moon. Consider its size and weight.
10. Does your design require power? What energy source will your design use? Consider batteries (different types), solar panels or others.
11. Consider the materials your design will be made from. How will the materials last in a thin atmosphere such as on the Moon or Mars? It may be exposed to solar radiation more than on Earth as well as meteorites striking it.
12. Consider adding something to your design to help it empty or clean itself, especially if it will be located on the Moon or Mars.



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

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 [PALMS5 STEM Research Guide - Digital](#) to find out more about these things.





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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 will need to design and build a model. The [STEM Project Design Process Worksheet](#) on the following pages will help you with this process.

It is important that you include as much detail as possible so your design could be built by anyone who reads it. If you have trouble attaching pictures or need to submit your work in a different format, contact your teacher.



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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 I test my 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 Brush, 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 diagram to show your planned design and take a picture. Upload the picture by clicking on the icon here:

If that doesn't work, send the picture separately but write here what the name of the file is:





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

Review your design and make any changes needed. Make sure it is well labelled! Take a picture. Upload the picture by clicking on the icon here:

If that doesn't work, send the picture separately but write here what the name of the file is (it should be different to your draft):





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How will you record your progress? (choose an option)

Check your design with your teacher before starting to build it.

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

Take pictures or a video if you can, to show your model.



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Part 2 Extension - Test Your Design

If your prototype model works, you could then test it by designing and carrying out an experiment in the form of a dust survey. This is an extension activity as your resources may be limited, not enabling you to build a working model.

When you are going to design a survey, there are certain things that you always need to consider and include. The [STEM Project Survey Worksheet](#) on the next pages will help you to design your dust survey and organise the data you collect. It is important that you include as much detail as possible so your survey could be repeated by anyone who reads it.



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STEM Project Experiment Worksheet

Date of survey:

Start

End

Time of survey:

24hr time
(hh:mm)

Start

End

Location of dust monitoring: (Give a detailed location using a description and/or picture)

Description

Picture (click on icon to upload)

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 survey, including setting up the dust monitoring device. Avoid using 'I' or 'we'. Labelled diagrams might help)

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

Submit your survey design to your teacher for checking before continuing!

Once they have approved your experiment, you can get started.



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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 photographs, if required, by clicking on the icon below or typing the file names in this box with a brief explanation of what the photo is showing)

Photos:

Conclusions: (What do the results tell you about the dust in the area monitored? What might be a possible source of dust?)



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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 design give you enough information to start monitor dust on Earth, the Moon or Mars tomorrow? What further experiments or tests might you need to do?





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Problem encountered	Possible Solution
<p>Any other ways to improve your solution if you have unlimited resources, time and access to the best people!</p>	





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Report Back To Base

To finish off your STEM Project, you 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 present 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 you found out or discovered that you didn't know before.
- What you designed, built, programmed or tested.
- The STEM skills you used (problem solving, creativity, critical analysis, teamwork, independent thinking, communication, digital literacy)
- How you could better investigate the challenge if you had no limit on resources or time.
- The most challenging aspect of the project.

Don't forget!

- Save this file as a PDF and submit it to your teacher. Don't forget to include your name!
- Check that any photos have uploaded or send them to your teacher separately (tell them the file name)
- Submit your Report Back To Base presentation to your teacher.



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