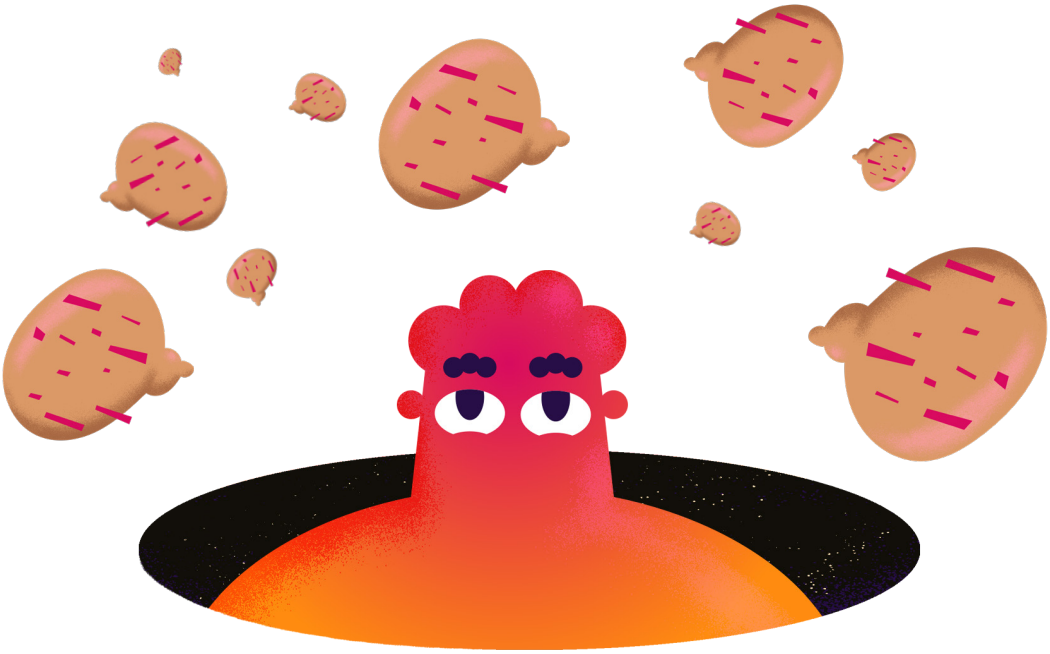
Space Waste

Year 5 – Science; Design Technologies
Year 6 – Science; Design Technologies



(Science; Yr 5, ACSHE083)
Scientific knowledge is used to solve problems and inform personal and community decisions

(Science; Yr 6, ACSSU094)
The growth and survival of living things are affected by physical conditions of their environment

(Science; Yr 6, ACSHE100)
Scientific knowledge is used to solve problems and inform personal and community decisions

(Technologies; Yr 5&6, ACTDEK019)
Examine how people in design and technologies occupations address competing considerations, including sustainability in the design of products, services, and environments for current and future use

(Technologies; Yr 5&6, ACTDEP024)
Critique needs or opportunities for designing, and investigate materials, components, tools, equipment and processes to achieve intended designed solutions

Cross-curriculum priority

Sustainability

Hort Innovation Strategic levy investment | VEGETABLE FUND

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Space Waste

Waste, the Final Frontier

As humankind considers moving towards fully occupied space stations and outposts on Mars, what will we do with our waste? Students compare and contrast the benefits of taking waste home, processing it in space, and trying to ensure there is no waste produced.

Duration:

45 minutes plus time for projects

Location:

The classroom

When you look out into the night sky, it can seem so vast and empty. But Australian scientists believe there are millions of artificial objects orbiting Earth right now. All this 'space junk', made up from things like old rockets and satellites and waste from astronaut suits, could end up posing a big safety risk for future satellites and space craft.

http://www.abc.net.au/news/2017-09-22/the-challenges-of-tracking-space-junk/8972438

Notes:

"We have this extraordinary planet, so lush with life. What can I do, what can we all do, to preserve it?"

— Dianne McGrath, Mars One Astronaut Candidate

Blast-off

? Review what students have learned recently about space missions, including space stations and missions to Mars. For example, what do astronauts eat? What is their daily life like while they're working in space?

Watch **The One with the Space Waste**
Listen to **Nomcast Episode 8**

- Introduce the theme of waste and discuss prior knowledge. Explore:
  - waste management (putting waste in a specific location such as landfill)
  - waste processing (such as using fire to turn paper waste into ash and smoke, or turning food waste into compost)
  - recycling (turning waste into raw materials for new products, such as recycled paper or plastics)
  - waste elimination/zero waste (stopping waste from being produced in the first place).
- Discuss questions students may want to investigate about waste in space, such as:
  - How do international space missions dispose of waste in space?
  - How do astronauts wash their dishes, and what challenges might this pose?
  - Why is water so precious on a space station? What are some of the difficulties that occur as a result?

Waste Warriors

- In groups or as a class, get students to use the grid provided to brainstorm all the types of waste that are likely to be produced in space. Encourage them to think about the human, mechanical and scientific activities on a space station.
- You could start by building a class wall or collage about life on a space station to help students think about the people, plants, scientific activity and machines in use.
- Prompt students to explore what solids, liquids and gases are likely to be produced by living things (e.g. contaminated water from washing, carbon dioxide from breathing, oxygen from plant respiration, methane from toilets) and by machines (ozone and carbon monoxide from engines, heat from machines and science equipment, fumes from chemicals used in experiments).
- When students have a long list of all the types of waste that may be produced in space, they can then consider each waste substance and sort it into the table on the last page of this resource by asking, what is the best thing to do with this substance?
- Add as many columns as are needed for students to assess a representative sample.
- This can be used as an open thinking grid — students may try the logic for each substance against all four options, then circle or star the option that seems best to them.
- When they have completed at least four substances in their groups, each group presents their best idea and why it is a valuable option.

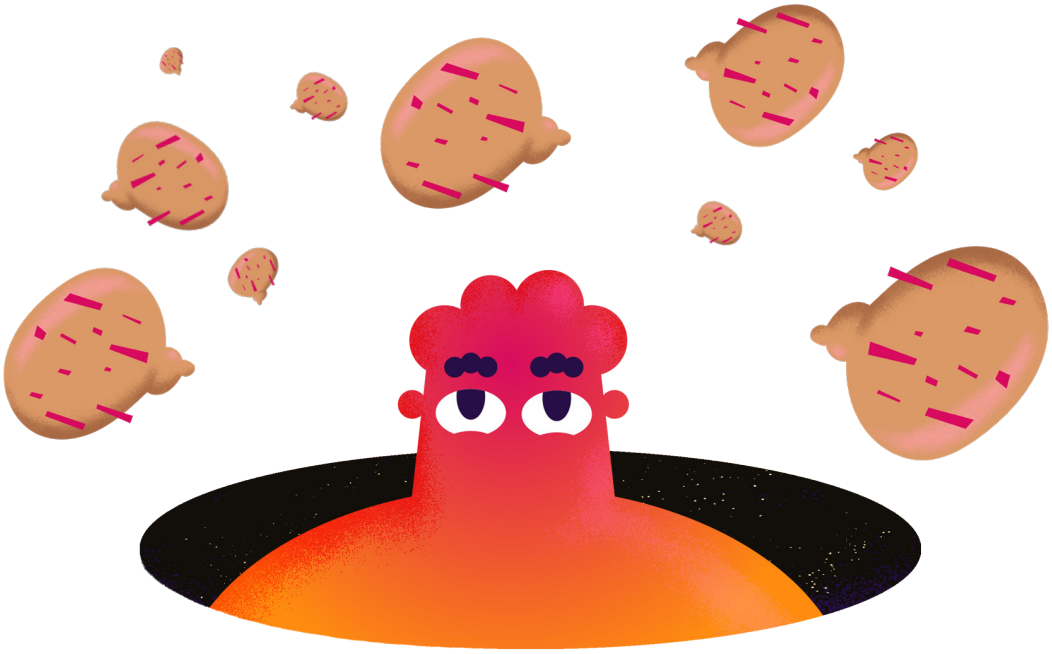
The great wide blue

- After these activities, students can research and prepare a report, poster, presentation, documentary film or podcast about waste.
- To allow for more variety, students can choose to explore solutions for waste in space – OR solutions for the oceans, such as cleaning up the great Great Pacific Garbage Patch.
- For those students who are engaged by the topic challenge them to consider the idea that although recycling systems are better than landfill, they still can't deal with the sheer volume of waste produced by humans.
- Students research the challenges posed by the environment (space or open ocean). Get them to state and define the problem and propose solutions using rationale to decide which potential solutions merit further investigation. (If undertaking this project for Design Technologies, the long but excellent video on Ocean Clean-up will provide a real-world example of this process. It's linked in the Resources list on the right.)

Resources

- A Moment of Science: what is produced when we burn paper? https://indianapublicmedia.org/amomentofscience/burned-burnt-paper/
- National Geographic: The Great Pacific Garbage Patch – how and why it's there: https://www.nationalgeographic.org/encyclopedia/great-pacific-garbage-patch/
- Planet 100 – The Trash Vortex explained (note: mild use of the words 'plastic crap') (video): https://youtu.be/xc6LvdsyJ4U
- The Ocean Cleanup talk by Boyan Slat – How will we rid the oceans of plastic? May 2017 (Long video but excellent research source for students – perhaps choose segments and use https://www.theoceancleanup.com/ as well.) (video: 30:08): https://youtu.be/du5d5PUrH0I
- Financial Post - As China limits waste imports, recycling companies scramble to contain mountains of garbage: http://business.financialpost.com/commodities/recycling-heads-to-the-dump-as-china-gets-picky-about-waste-1
- Here are some great resources from ABC's runaway hit War on Waste: http://education.abc.net.au/newsandarticles/blog/-/b/2535555/25-educational-resources-to-help-kids-with-the-war-on-waste
- Space junk orbiting Earth: http://www.abc.net.au/news/2017-09-22/the-challenges-of-tracking-space-junk/8972438

Talking Tuberman



Who – or what – is Tuberman? He says he comes from space. His ancestors were a space food project. But when they mutated, the astronauts dumped the space potatoes.

And now he's here, walking among us, or calling us for cooking tips...

Actually, even though he's mutated, we don't hold it against him. We reckon Tuberman is a bit of a legend (even if he is pretty random sometimes).

But the point is that we can't simply dump waste in space as problems for a future generation to solve.

We don't know everything about space. Experiments and science projects, like growing food in space, can have unexpected outcomes.

Working on the Waste Problem

Tuberman is a fantasy, but there are some real risks.

When we're looking at waste in space, here are a few thoughts to consider:

- Equipment may break. (There is even the risk of fire or explosion.)
- Radiation may affect materials in ways we don't yet fully understand.
- Near-zero gravity makes processes work differently.
- Waste systems (such as compost or worm farms) rely on live organisms that cannot survive in space without life support. (Would you like to design life support for 10,001 worms?)

What is the best thing to do with this substance?

We should...	Substance 2:	Substance 3:	Substance 4:	Substance 5:
Transport this substance home Why?				
Process this substance into another material (e.g, carbon, hydrogen) What?				
Use this substance for something What, how?				
Avoid creating this substance at all How?				