Becoming a Martian

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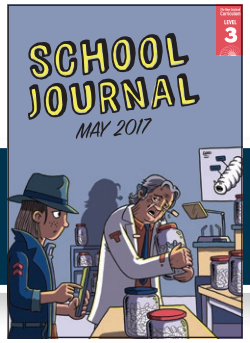
Year 6



Overview

This TSM contains a wide range of information and suggestions for teachers to pick and choose from, depending on the needs of their students and their purpose for using the text. The materials provide multiple opportunities for revisiting the text several times.

"Becoming a Martian" is a challenging article that considers the possibility of humans living on Mars. The article begins with the concept "We have exploration in our DNA." After reminding us of what humans need to survive on Earth (oxygen, water, food, and shelter) the writer explores each of these in relation to Mars, providing factual information about the planet, explaining the challenges of living there, and offering possible solutions. The article then poses questions to the reader about the possibility of ever living on Mars and links back to the opening concept "… exploration's in our DNA."

The text links closely to the item that follows it, "Haritina Mogosanu: Starryteller", in which the scientist and president of the Mars Society in New Zealand tells us what happens at the Mars Desert Research Station in the United States.

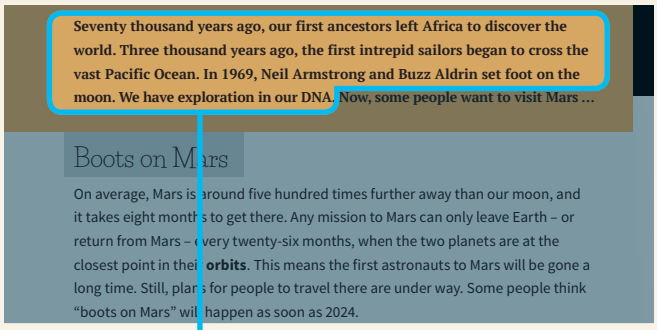
This article:

- provides facts and information about Mars
- has non-continuous text with subheadings
- uses numbered items to organise the information
- includes a glossary.

A PDF of the text is available at www.schooljournal.tki.org.nz

Texts related by theme **"Who Froze Farrell Flint?"** SJ L3 May 2017 | **"Astrobiology"** SJ L4 May 2017 | **"The Trial"** SJ L4 May 2017 | **"Cool Facts about a Hot Place"** SJ L2 Oct 2015 | **"Night Light"** SJ L2 May 2016

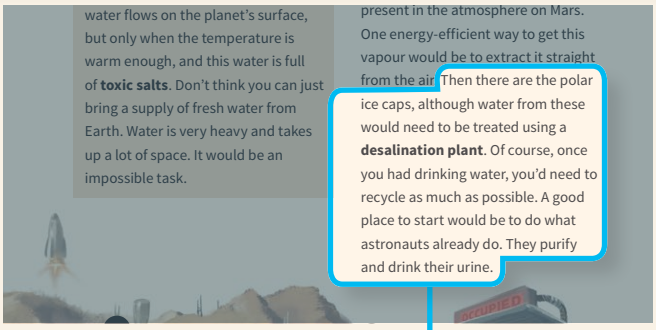
Text characteristics from the year 6 reading standard


Seventy thousand years ago, our first ancestors left Africa to discover the world. Three thousand years ago, the first intrepid sailors began to cross the vast Pacific Ocean. In 1969, Neil Armstrong and Buzz Aldrin set foot on the moon. We have exploration in our DNA. Now, some people want to visit Mars …

Boots on Mars

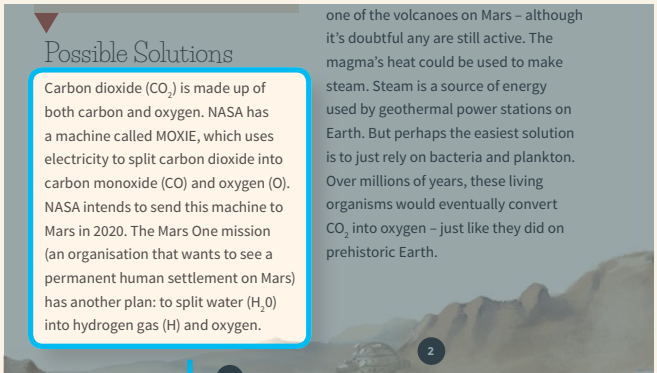
On average, Mars is around five hundred times further away than our moon, and it takes eight months to get there. Any mission to Mars can only leave Earth – or return from Mars – every twenty-six months, when the two planets are at the closest point in their **orbits**. This means the first astronauts to Mars will be gone a long time. Still, plans for people to travel there are under way. Some people think "boots on Mars" will happen as soon as 2024.

abstract ideas, in greater numbers than in texts at earlier levels, accompanied by concrete examples in the text that help support the students' understanding


water flows on the planet's surface, but only when the temperature is warm enough, and this water is full of **toxic salts**. Don't think you can just bring a supply of fresh water from Earth. Water is very heavy and takes up a lot of space. It would be an impossible task.

present in the atmosphere on Mars. One energy-efficient way to get this vapour would be to extract it straight from the air. Then there are the polar ice caps, although water from these would need to be treated using a **desalination plant**. Of course, once you had drinking water, you'd need to recycle as much as possible. A good place to start would be to do what astronauts already do. They purify and drink their urine.

some ideas and information that are conveyed indirectly and require students to infer by drawing on several related pieces of information in the text


Possible Solutions

Carbon dioxide (CO_2) is made up of both carbon and oxygen. NASA has a machine called MOXIE, which uses electricity to split carbon dioxide into carbon monoxide (CO) and oxygen (O). NASA intends to send this machine to Mars in 2020. The Mars One mission (an organisation that wants to see a permanent human settlement on Mars) has another plan: to split water (H_2O) into hydrogen gas (H) and oxygen.

one of the volcanoes on Mars – although it's doubtful any are still active. The magma's heat could be used to make steam. Steam is a source of energy used by geothermal power stations on Earth. But perhaps the easiest solution is to just rely on bacteria and plankton. Over millions of years, these living organisms would eventually convert CO_2 into oxygen – just like they did on prehistoric Earth.

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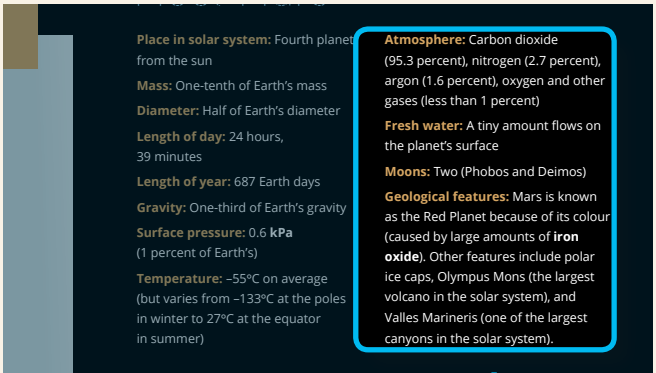
sentences that vary in length and in structure (for example, sentences that begin in different ways and different kinds of complex sentences with a number of subordinate clauses)


Place in solar system: Fourth planet from the sun

Mass: One-tenth of Earth's mass

Diameter: Half of Earth's diameter

Length of day: 24 hours, 39 minutes

Length of year: 687 Earth days

Gravity: One-third of Earth's gravity

Surface pressure: 0.6 **kPa** (1 percent of Earth's)

Temperature: –55°C on average (but varies from –133°C at the poles in winter to 27°C at the equator in summer)

Atmosphere: Carbon dioxide (95.3 percent), nitrogen (2.7 percent), argon (1.6 percent), oxygen and other gases (less than 1 percent)

Fresh water: A tiny amount flows on the planet's surface

Moons: Two (Phobos and Deimos)

Geological features: Mars is known as the Red Planet because of its colour (caused by large amounts of **iron oxide**). Other features include polar ice caps, Olympus Mons (the largest volcano in the solar system), and Valles Marineris (one of the largest canyons in the solar system).

a significant amount of vocabulary that is unfamiliar to the students (including academic and content-specific words and phrases), which is generally explained in the text by words or illustrations

Reading standard: by the end of year 6

Text and language challenges

(Some of the suggestions for possible supporting strategies may be more useful before reading, but they can be used at any time in response to students' needs.)

VOCABULARY	Possible supporting strategies
▪ Possibly unfamiliar words and phrases, including "intrepid", "DNA", "mission", "under way", "convert", "extract", "thawing", "colony", "outweigh", "artificially" ▪ Topic-specific words, including "mass", "gravity", "surface pressure", "atmosphere", "geological", "polar ice caps", "canyons", "energy", "solar panel", "magma", "geothermal", "bacteria", "plankton", "living organisms", "prehistoric", "vapour", "condensed", "purify", "nutrients", "hydroponics", "greenhouse gas", "radiation", "magnetic field", "airlocks", "lava tubes", "particles", "chemicals" ▪ Names such as "Phobos", "Deimos", "Olympus Mons", "Valles Marineris" ▪ The bolded words that appear in the glossary ▪ The use use of hyphenated adjectives, such as "trouble-free", "energy-efficient", "nutrient-rich", "cancer-causing"	▪ Review the purpose of a glossary. ▪ Give the students some background information before they start reading: *This text is packed with interesting facts and figures – there are many scientific terms and maths terms. We'll help each other out as we go through it.* ▪ If appropriate, start a collection of topic-specific words related to the solar system. Where possible, add supporting visuals. ▪ Build knowledge of the topic-specific words. For example, ask students to identify the root word where appropriate (pure – purify; magnet – magnetic) and explore prefixes (such as geo-, hydro-, astro-, bio-, auto-) and ask them to name other words that begin with these prefixes. ▪ Discuss compound words and how each individual word has a different meaning from the combined word, for example, "under" and "way" when put together mean "getting started" or "in progress". ▪ Some words may need pre-teaching. Your knowledge of your students will guide you in this. ▪ Create charts and word maps to show words in the text and their word families. ▪ DIGITAL TOOLS Students could use an online mind-mapping tool such as MindMup Chrome to do this. ▪ Find out what students know about DNA and the expression "We have exploration in our DNA." ▪ Explain a hyphenated adjective. *We know that an adjective tells us more about a noun. Sometimes this adjective can be two words combined, for example, "cancer-causing" in "cancer-causing radiation". The two words go together as one idea, telling us more about the radiation.* ▪ *The English Language Learning Progressions: Introduction*, pages 39–46, has useful information about learning vocabulary. ▪ See also ESOL Online, Vocabulary, for examples of other strategies to support students with vocabulary.

SPECIFIC KNOWLEDGE REQUIRED	Possible supporting strategies
▪ Some understanding of space research, space travel, and the solar system ▪ Mathematical understanding of fractions, percentages, diameter, length, temperature, and average ▪ Understanding the difference between mass and weight ▪ Some knowledge of elements and compounds, such as oxygen and carbon dioxide ▪ Some understanding of the importance of oxygen for human survival ▪ Some understanding of the challenges involved in living in a hostile environment	▪ Prompt students to discuss what they know about exploration, space, space travel, and the solar system. ▪ Ask questions to prompt critical thinking. *Does it cost a lot of money to send a spaceship into space? What is the point of doing that? Explorers have been sailing off to find new places on planet Earth for centuries – were they just as brave as astronauts?* ▪ Remind students about their mathematical knowledge. Provide opportunities for them to talk in pairs or small groups to recall prior knowledge. ▪ Provide explanations when needed, for example, the meanings of mass and weight. ▪ Explain the difference between elements and compounds and how water (H_2O) is made up of hydrogen and oxygen, and carbon dioxide (CO_2) is a combination of carbon and oxygen. ▪ Prompt students to recall their prior knowledge of the importance of oxygen to life. ▪ Where appropriate, provide extra information, using images and diagrams, to build the understanding that without air, people die within minutes, and that on Mars the atmosphere is toxic to humans. ▪ Remind students that water is found in different states depending on the temperature (ice, liquid, gas).

TEXT FEATURES AND STRUCTURE	Possible supporting strategies
▪ A factual article that uses numbered headings to organise the information ▪ Use of text boxes and arrows to direct the reader ▪ Acronyms: NASA ▪ Visual features including drawings of a hypothetical scenario	▪ Before reading, prompt the students to recall the features of an article. Ask the students to talk with a partner and remind each other of the features of information texts. ▪ Have the students preview the text to gain an overview of the purpose and what they expect to find out. ▪ Lead discussion about the layout of the pages, directing students to the numbered text boxes and arrows. ▪ Alert the students to the different formats of the various sections, for example, Boots on Mars and Meet Mars and the numbered sections on pages 26–29. Ask them to discuss the purpose for each of these sections. In particular, focus the students on the challenge-and-solution structure. Have them turn the headings into questions to help them find specific information about each challenge.

Possible curriculum contexts

MATHEMATICS AND STATISTICS (Number and Algebra)

Level 3 – Number knowledge: Know fractions and percentages in everyday use.

SCIENCE (Planet Earth and Beyond)

Level 3 – Astronomical systems: Investigate the components of the solar system, developing an appreciation of the distances between them.

ENGLISH (Reading)

Level 3 – Ideas: Show a developing understanding of ideas within, across, and beyond texts.

– Processes and strategies: thinks critically about texts with developing confidence.

ENGLISH (Writing)

Level 3 – Language features: Use language features appropriately, showing a developing understanding of their effects.

Possible first reading purpose

- To identify the challenges involved in travelling to and living on Mars

Possible subsequent reading purposes

- To make comparisons between Earth and Mars
- To create questions for further inquiry

Possible writing purposes

- To write to persuade others that "We should spend money to sort out this planet before we spend money on space travel"
- To write an application, volunteering to be one of the first Martian settlers
- To write about the challenges and solutions for living in an unfamiliar place

The New Zealand Curriculum

Instructional focus – Reading

English Level 3 – Ideas: Show a developing understanding of ideas within, across, and beyond texts; Processes and strategies: thinks critically about texts with developing confidence.

First reading

- Set the purpose for reading, then skim and scan the article together, prompting students to identify the main topic: would it be possible to survive on Mars?
- Use think-alouds to invite responses. *I wonder how likely this would be? I don't think we've had anyone actually go to Mars yet, have we? Why would anyone want to go there? How far from Earth is Mars? I like travel – but maybe not that far …*
- Have students talk in pairs and then share ideas with the whole group.
- Direct them to manageable portions of the text to read independently. *Read the text in the orange text box. Talk to your partner – what did you find out? Read the paragraph that is headed "Boots on Mars". What does that heading suggest?*

If the students struggle with this text

- Use questioning to support students' predictions. *We're going to read some facts and figures about the planet Mars. Look at the title – "Becoming a Martian". What can we expect to find out?*
- Check that students are aware of the basic requirements for survival on Earth (oxygen, water, food, and shelter).
- Direct students to the visual text. Ask questions to support their understanding of a concept beyond our experience. *Why are there drawings and not photographs of the surface of Mars?*
- Provide visual information that shows the solar system to put Earth and Mars into perspective.
- DIGITAL TOOLS Students could explore our solar system using this interactive: NASA Kids Solar System Exploration
- Support students with vocabulary challenges as they read chunks of text.

Subsequent readings

How you approach subsequent readings will depend on your reading purpose.

The teacher

Direct the students to identify the four major challenges to living on Mars

- *What are the main ideas in each of the four challenges? We can record these in a chart. Are some of the issues more challenging than others? Are there other solutions?*

DIGITAL TOOLS Consider creating a Google doc for the students to complete to allow them to collaborate and to give targeted feedback.

Direct students to the related text "Who Froze Farrell Flint?" Prompt recall of the fictional future setting and the research on the bacteria of Mars. Make links to the possible solutions to The Oxgen Challenge.

The students:

- work in pairs to find information in the text and organise it into a framework like the one below:

What are the challenges involved?

Need	Challenge	Possible solution
Oxygen	95% carbon dioxide	Split CO_2 into carbon monoxide and oxygen
Water		
Food		
Shelter		

OR

MARS	EARTH
4th planet from the sun	3rd planet from the sun
687 Earth days = 1 year (time to complete 1 orbit of sun)	365 days = 1 year (time to complete 1 orbit of sun)
No soil	Soil for growing plants

The teacher

Ask the students to discuss what humans need to survive. Extend their thinking with questions.

- *Are the things we need the same as for other living things?*
- *What does a fish need?*
- *Choose a different creature from the living world and have a chat with your partner about their requirements.*

The students:

- work in pairs to locate appropriate information across the text, check for agreement, and record it
- integrate information in the text and the chart to answer their own questions or other questions.

The teacher

Encourage curiosity by modelling and thinking aloud.

- *I am wondering what sort of time frame is involved with getting people to Mars. Would it be in my lifetime?*

The students:

- compile questions for further research.

METACOGNITION

- *When you were working in a small group, what helped you to reach decisions about how your character should speak and act? Is it always easy to make up your own mind?*

GIVE FEEDBACK

- *You have carefully chosen information that was relevant for your question and discarded information that wasn't. I heard you ask questions as you read with your partner to make sure you found specific information. Good strategy! Keep using it whenever you are faced with a lot of information to read.*

Reading standard: by the end of year 6

The Literacy Learning Progressions

Assessment Resource Banks

Instructional focus – Writing

English Level 3 – Language features: Use language features appropriately, showing a developing understanding of their effects.

Text excerpts from "Becoming a Martian"	Examples of text characteristics	Teacher (possible deliberate acts of teaching)
Page 29 The first settlers could live in their landing module. Extra inflatable modules could be added for more space, but these modules would need to be buried to protect them from radiation. Another option is to live in caves or underground lava tubes. When they go outside, settlers would need to wear spacesuits. NASA is already working on the next generation of spacesuit. These will keep astronauts comfortable – and alive!	**LANGUAGE FEATURES** *Writers make deliberate choices to communicate and make meaning. They choose specific features to have an effect on their readers.*	Explain that factual information can lead us to form opinions. Sometimes, after we have read the facts, we have to decide where we stand. Direct students to the last sentence in this excerpt. Invite a response. ▪ *Are all humans comfortable and safe on Earth? Do we need to address the challenges on Earth before worrying about the challenges of living on Mars?* Prompt their prior knowledge about the features of writing to persuade. ▪ *What do we mean by "emotive" language? How are rhetorical questions used to persuade a reader? How do we make our position clear?* Model some examples. ▪ *So you have exploration in your DNA? Where do you think we need to explore – Mars or somewhere closer to home?* If English language learners are having difficulty using the correct verb form, you could use a verb story activity. Take a section of the article and list all the verbs in the order they appear. The students use the verbs as a prompt to recreate the text orally (without looking at the original text). All the verbs must be used in the retelling and in the same order that they are written. To reinforce the learning, the students could then use the verbs as a basis to write their own version of the text.
Page 27 You could look for water by drilling deeper into the ground. Another option is to dig up the underground ice and use heat to turn it into vapour. This vapour could be condensed back into drinking water … … Of course, once you had drinking water, you'd need to recycle as much as possible. A good place to start would be to do what astronauts already do. They purify and drink their urine.	**POINT OF VIEW** *Writers will sometimes write directly to the reader using the second person: "You could look …". At other times, writers can write in the first person, providing the perspective of a particular person, real or imagined. When we put ourselves in the shoes of a character, we can write in the first person, as if it is them talking.*	Have students work in pairs to create a conversation, orally. ▪ *If there was a meeting between a human from Earth and a Martian, what would they tell each other about their planets? If there were living Martians, what would they say about managing their environment?* Model the use of speech bubbles to record speech in a dialogue. Have the students look through their writing to see if they need to add more information or details to an explanation. Make links to prior knowledge about writing. ▪ *Think about the example we explored. In your explanation, what else do you need to make clear to your reader?* ▪ *What would they say about managing their environment?* **GIVE FEEDBACK** ▪ *Your use of rhetorical questions will make your readers think! You have made it quite clear that it is absolutely essential to continue with space exploration.*

METACOGNITION

▪ *Tell me how you decided which way to record the speech. Is one way easier than the other?*

Reading standard: by the end of year 6

The Literacy Learning Progressions

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MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA
New Zealand Government