

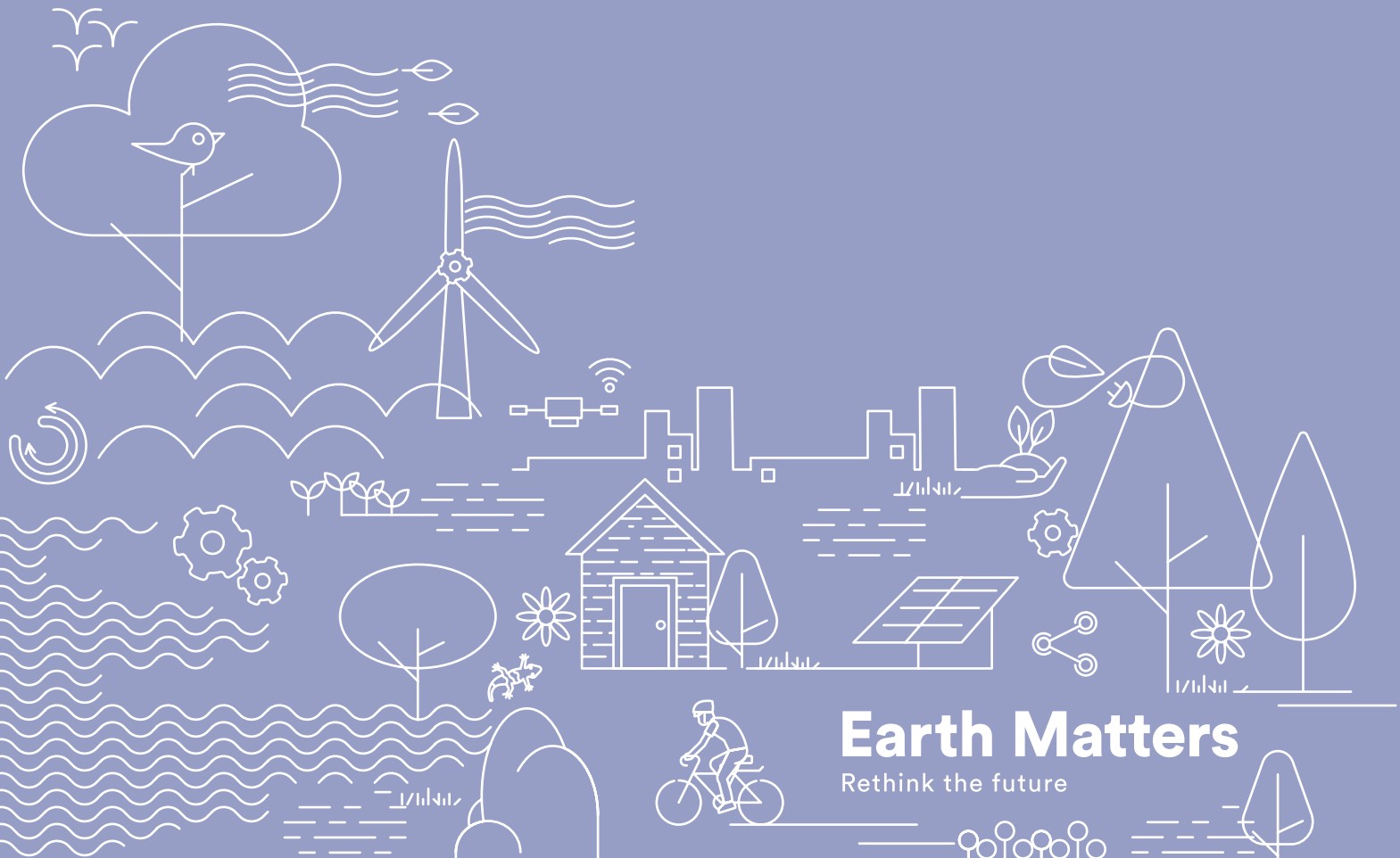


Earth Matters

Education Guide

for Secondary (Years 7-10)

Version 1



Earth Matters

Rethink the future

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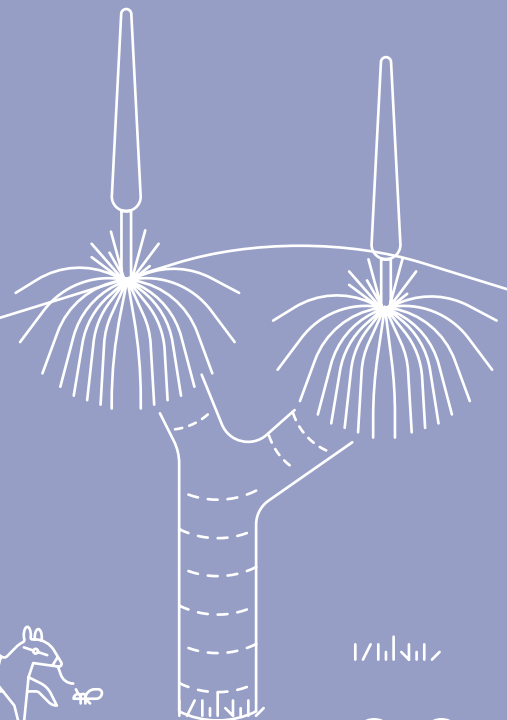
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How to use this guide

The memorable experiences that students (and teachers) gain from excursions can be a powerful tool for inspiring interest and creating “hooks” for engaged learning back in the classroom. This guide and its resources are designed to help teachers incorporate the themes, content and skills explored during an Earth Matters excursion at Scitech into their classroom teaching, before and after their visit.

The following is a recommended process for using the pre and post-visit resources for an Earth Matters excursion:

- 1 Read *About Earth Matters* and browse the range of Earth Matters experiences available across Scitech
- 2 Review the *Pre-visit lesson notes* for teaching strategies and activities to prepare for your visit
- 3 Check the *Tips for during your visit to Scitech*
- 4 Review the *Post-visit lessons* to inform ways you can align an Earth Matters excursion to further classroom investigations and teaching
- 5 Choose the Earth Matters experiences across Scitech for your students and contact our Customer Services Team at 9215 0740 or bookings@scitech.org.au to make your booking
- 6 You may wish to see what other activities we have to offer you and your students by checking the *Further teaching and learning opportunities*

About Earth Matters

Be inspired by the innovations, solutions and new ideas that will help us adapt our way of living for a more sustainable future.



Through a specially curated series of interactive and thought-provoking exhibits, shows and hands-on workshops, you are invited to dive deep into the science behind some of the changes we are seeing in our world, and experience how the smallest of actions can have a big impact on the world around you.



In nature, everything is connected – air, land, water and life. As you explore Earth Matters, look out for the connections along the way.



Solve complex challenges and bring your own ideas to life.

Earth Matters Excursion Experiences

There are several Earth Matters excursion experiences available for school bookings. Each has been designed to provide opportunities to explore cross-curricular priorities and build general capabilities across year levels.



Feature Gallery:
Earth Matters Guided Experience
60 minutes

Our Earth Matters exhibition is a highly immersive, hands-on experience that explores our planet's interconnected systems, and the actions we can all take to ensure a bright future for life on Earth. Our Science Communicators will lead discussions on systems thinking and guide learners to understand both practical and complex relationships between humans and natural ecosystems. Interactions with our exhibits will stimulate discovery that learners can adopt in the classroom to form investigative questions for research.

This experience supports learning in:



Science Understanding	Science Inquiry skills	Science as a Human Endeavour	HASS: Knowledge & Understanding
Biological Sciences Earth & Space Science	Questioning & predicting Communicating	Use and influence of science Nature & development of science	Geography Economics
Mathematics: Statistics	Mathematics: Measurement & Geometry	Mathematics: Number & Algebra	Design and Technologies
Data representation & interpretation	Using units of measurement	Number & Place Value	Technologies & society Food & fibre production





**Scitech Lab:
Underwater Investigators**
60 minutes

This workshop introduces practical, hands-on experiments which explore major challenges affecting our oceans, with students examining:

- microplastics
- oil spills
- carbon cycle
- ocean acidification
- marine bioindicators.

We focus on developing investigation and interpretation skills. Students can build on their understanding of the impact of pollution on our ocean environment, including the implications this has on phytoplankton – the base of marine food chains. Inspire your students to take the first step towards developing innovative solutions for environmental challenges.

This experience supports learning in:

Science Understanding	Science Inquiry skills	Science as a Human Endeavour
Biological Sciences Chemical Sciences	Questioning & predicting Planning & conducting Processing & analysing data & information Evaluating Communicating	Use & influence of science

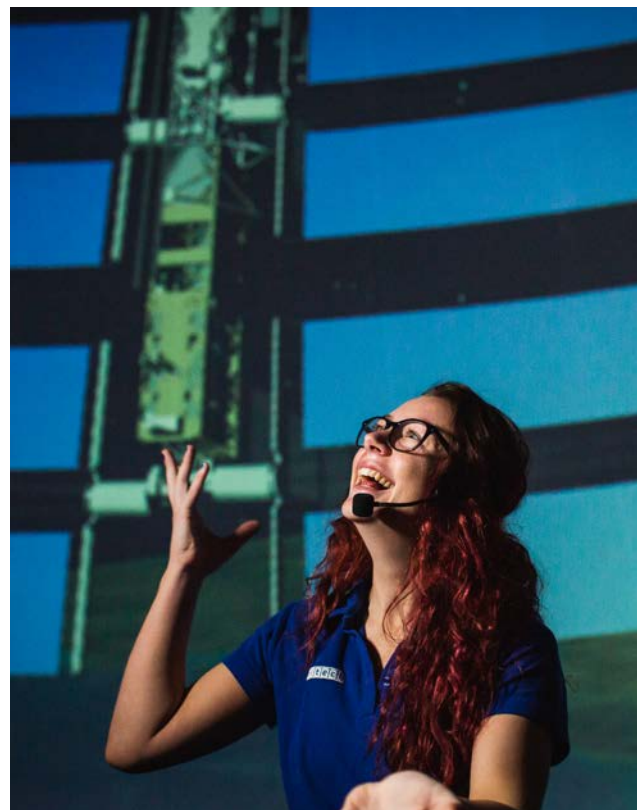


**Scitech Planetarium:
Habitat Earth**
45 minutes (30 minute show
plus a Live Sky Tour)

Discover how different species on Earth take part in complex relationships to create the ecosystems that are all around us. With stunning visualisations of the natural world, students will see the large-scale activities of life on Earth and learn about humanity's place in a global ecosystem.

This experience supports learning in:

Science Understanding	Science Inquiry skills
Earth & Space Science Biological Sciences	Questioning & predicting Communicating
Science as a Human Endeavour	HASS Knowledge & Understanding
Use & influence of science	Geography





**Chevron Science Theatre:
Lightbulb Moments
30 minutes**

How can we reduce the waste we create when generating electricity? Can we reuse our waste to power our world? Lightbulb Moments explores how scientists use creative problem solving to tackle these challenges. Join our energetic Science Presenters to discover some of the weirder ways we might power our world in the future and explore how we can make use of things we'd otherwise throw away. Students develop understanding of how to create new solutions and innovations through their own Lightbulb Moments.

This experience supports learning in:

Science Understanding	Science Inquiry skills	Science as a Human Endeavour	Design & Technologies
Chemical Sciences	Questioning & predicting Communicating	Use and influence of science Nature & development of science	Technologies & society



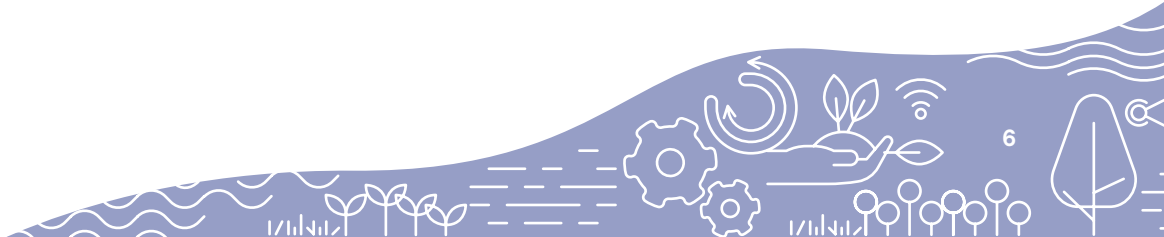
**Rio Tinto Innovation Central Tinkering Space:
Wind Turbine Challenge
60 minutes**

In this hands-on workshop, students follow an innovation process to design, create and test their own prototype wind turbines. Our Science Presenters will demonstrate designs of real turbines and explore with students the types of energy and forces at play. Using this research, student groups work collaboratively to bring their own wind turbine to life. Using PocketLabs to capture and plot turbine velocity data in real time, groups can iterate on their design to improve its efficiency. What changes would they make?



This experience supports learning in:

Science Understanding	Science as a Human Endeavour	Design & Technologies: Knowledge & Understanding	Design & Technologies: Processes & Production Skills
Physical Sciences	Use and influence of science	Technologies & society Engineering Principles & Systems	Designing Producing & Implementing Evaluating Collaborating & Managing
Mathematics: Statistics	Mathematics: Measurement & Geometry		
Data representation & interpretation	Using units of measurement		





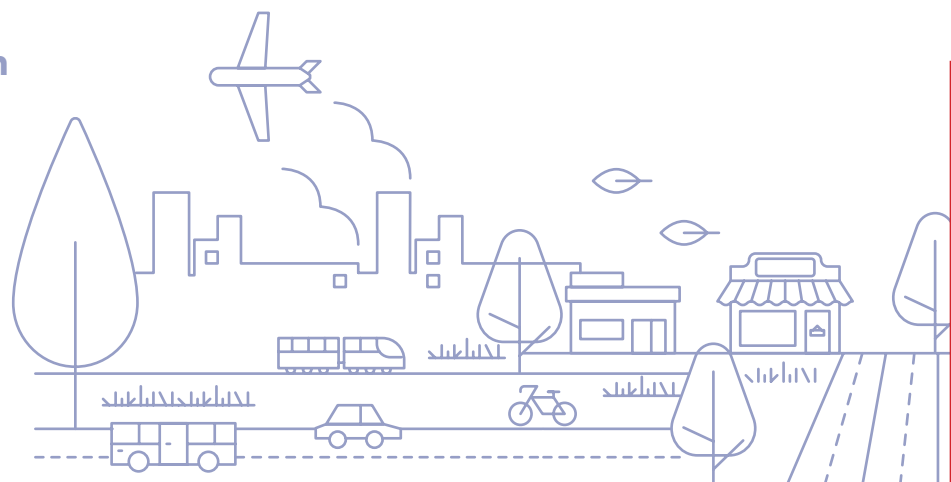
Big Questions

We recommend that you make use of a Big Question to frame your visit. A Big Question is one that provokes deep exploration, covers many ideas and prompts further questioning. Later in the guide, we will provide specific lesson plans on how to use Big Questions before and after your excursion to Scitech, so you can link the visit with your classroom learning.

The experiences and exhibits in Earth Matters provide rich learning opportunities across many learning areas. You are free to combine them however you like for your excursion, including raising your own Big Question to explore.

The Big Questions below can be explored through the listed key experiences and exhibits. The elaborations provided can be used as prompts to help students unpack each question.

We have also provided links to Supporting resources that may be helpful in exploring these Big Questions.



What does a sustainable world look like?

Key experiences



Feature Gallery



Science Theatre



Tinkering Space

Key exhibits



Coral Reef



Banksia Woodlands



Microgrid



Re-imagination Zone

Elaborations

- What does the word “sustainable” mean?
 - Can you find examples of sustainable communities?
 - How are we developing sustainable technologies?
-

How do humans fit into the networks of a global ecosystem?

Key experiences



Feature Gallery



Scitech Planetarium



Scitech Lab

Key exhibits



Show Your Stripes



Arctic Sea Ice



Coral Reef



Banksia Woodlands

Elaborations

- What is an ecosystem?
 - How are ecosystems similar and different?
 - How are ecosystems connected?
 - How do different human cultures interact with their environment?
-

What is the greatest threat to living things?

Key experiences



Feature Gallery



Scitech Planetarium



Scitech Lab

Key exhibits



Arctic Sea Ice



How Trees Work



Threatened Species



Coral Reef

Elaborations

- What do living things need to survive?
 - How are living things connected?
 - What are the different threats to living things across the Earth?
-



How do we reduce our impact on the natural world?

Key experiences



Feature Gallery



Science Theatre



Scitech Lab

Key exhibits



Transport Emissions



Coral Reef



Water Pump



Re-imagination Zone

Elaborations

- Where are humans impacting natural world?
- How are we using natural resources? What are the alternatives?
- What actions are people taking to reduce their impact?

How do we design solutions for environmental challenges?

Key experiences



Feature Gallery



Science Theatre



Tinkering Space

Key exhibits



Re-imagination Zone



Microgrid



Transport Emissions

Elaborations

- What are some environmental challenges faced by our planet today?
- How do people design and innovate in the real world?
- What improvements can we make to how we live?



Supporting resources

The following websites present reputable research, background information and data around a specific topic aligned to Earth Matters. You may find them useful for your own content knowledge or to help you develop resources for student inquiry.

Climate Council	This article and infographic details Australia's carbon emissions from transportation and compares it to the rest of the world. bit.ly/ClimateCouncil_emission
Ellen MacArthur Foundation	Discover how a circular economy could create sustainable production chains. bit.ly/whatiscirculareconomy
Meet the Microgrid	Article describing how Microgrids work and how to incorporate them into larger grids. bit.ly/howmicrogridwork
Our World In Data	Website publishing reputable data, research and articles about how humanity is fighting the big global problems. ourworldindata.org
Show Your Stripes	A striking data visualisation representing Earth's average annual temperature from 1850 to 2018. showyourstripes.info
Smithsonian Ocean	Website with information and videos explaining the how coral reefs work, their importance to marine life and how we can protect them. bit.ly/howcoralreefwork
UN Sustainable Development Goals	Information and recommended actions for achieving the 17 interconnected global goals. bit.ly/UN_sustainabledevelopmentgoals
Worldometers	Independent website that presents live counters of global statistics on population, health, the environment, and much more. worldometers.info



Pre-visit lesson notes

As a pre-visit activity to get students thinking about what they will experience in their Scitech visit, we recommend conducting a self-organised learning environment (SOLE) lesson around one of these Big Questions (or a similar question of your own):

- What does a sustainable world look like?
- How do humans fit into the networks of a global ecosystem?
- What is the greatest threat to living things?
- How do we reduce our impact on the natural world?
- How do we design solutions to environmental challenges?

A SOLE lesson is an opportunity for students to ignite their sense of wonder about a big idea. It gives students ownership of their learning and the freedom to dive deep into aspects of a topic that interest them. It's a perfect way to prime their minds for meaningful engagement with the Earth Matters exhibition.

To run a SOLE lesson, you will need to organise the room into stations (one per four students).

Each station should have:

- an internet-connected device with a large screen for students to conduct research on
- a large sheet of paper with pens, pencils and coloured markers for students to record their findings and ideas.

You should also have a shared whiteboard for students to record new questions that arise and useful sources of information for other groups to use.

Conduct the SOLE lesson in three phases:

01 Question: share the question to be explored, explain the process of a SOLE lesson, and randomly assign starting groups to each of the stations (5 minutes).

02 Investigation: students work in groups to find answers to the Big Question using the internet. Teachers observe and document the process, asking students about what they are learning (30–45 minutes).

03 Review: students report their findings to the class. Teachers should ask the class to consider similarities and differences in what the groups present and encourage discussion and debate (10–20 minutes).

SOLE process guidelines:

- Teachers should hold back from being too directive. Provide support to students as they request it.
- Students should take responsibility for their learning and for any issues that arise in groups.
- Students can change groups at any time. They should choose to work in a group that allows them to gain a new understanding of the question being explored.
- All students are accountable for presenting their findings at the end of the lesson.

For a much more detailed overview of the SOLE process, read the *School in the Cloud SOLE toolkit*. You may want to use the suggested approaches on page 16 as a starting point.

The following websites are useful places to begin an exploration of the Big Questions. Each contain searchable catalogues of information, research and data from a broad range of disciplines.

- coolaustralia.org
- thecrashcourse.com
- ed.ted.com
- sciencenewsforstudents.org
- climatekids.nasa.gov
- khanacademy.org

At the end of the lesson, ask students about their experience of learning through a SOLE process. Explain that during the visit to Scitech's Earth Matters exhibition, they will be able to build on the ideas they have explored today.

Post-visit lesson notes

The following is a sequence of possible post-visit lessons we recommend as a follow up to the visit. You can do the full sequence or any single lesson.

Lesson 1: Question Formulation Technique (QFT)

Before running a Question Formulation Technique (QFT) session, you will need to design a Question Focus. This can be a phrase, statement or visual – but not a question. Try to come up with a provocative phrase based on your experience at Earth Matters and the content you'd like to focus on.

Phrase

Statement

Visual

Alternatively, you may want to use a Question Focus we have designed:

- Our current way of life is sustainable.
- Humans are the most important animal.
- Humans are the protectors of the natural world.
- We have very little impact on our environment.
- Humans have a right to use nature's resources.
- Technology provides the best solutions to our environmental problems.
- Individual actions can have global impacts.

Before beginning the QFT, run a Think/Pair/Share activity about:

What did we discover on our excursion to Scitech and what are we now wondering?

Arrange students into small groups and conduct a QFT in six phases:

- 1. Introduce the Rules:** the students' job will be to come up with questions in response to the Question Focus. The rules are:
 - a. Ask as many questions as you can.
 - b. Do not stop to discuss, judge, or answer the questions.
 - c. Write down every question exactly as it is stated.
 - d. Change any statements into a question.
- 2. Introduce the Question Focus and Produce Questions:** present the Question Focus and instruct students to begin asking and recording questions following the rules.
- 3. Improve questions:** have students categorise questions into closed and open questions. They should then discuss the advantages and disadvantages of each type of

question. Finally, they change one closed question into an open question and change one open question into a closed question.

- 4. Prioritise questions:** instruct students to choose three questions that they consider most important to answer.
- 5. Choosing a question:** make a final set by collecting three chosen questions from each of the groups. Explain that you are going to use one of the questions for a SOLE process (if you are planning to do Lesson 2.) As a class, choose which question you will explore in the SOLE. You might like to use dot-voting: dotmocracy.org/what_is/

Find more information on Question Formulation Technique at rightquestion.org/what-is-the-qft/

Lesson 2: SOLE

Use a question generated in Lesson 1 (or during the visit if you haven't done Lesson 1) and repeat the SOLE process described in the Pre-visit lesson plan (page 11).

Lesson 3: Communicate your findings

This activity can act as a summative assessment of the learning students have been doing through the process. Have students produce a creative work to communicate the urgency of solving a challenge they identified in the previous lessons.

Some ideas:

- Poem, haiku or essay (informative/persuasive text)
- Poster or other artwork
- Video in the style of a Tik Tok/ Snapchat story
- News report
- Advertisement

Have students plan the work by first deciding and documenting responses to these key questions:

- What is the key message of the work?
 - Who is the audience?
 - What is the key information that needs to be included?
 - What will help to convince people?
-

A note on assessments

Learning during STEM activities can supplement data collected in traditional lessons during the semester, contributing to valid data for reporting. The graphic organisers and assessment strategies suggested in the resource are intended to act as a guide, to enable teachers to understand where students are in their learning.

Further information about the ways of assessing can be found at bit.ly/waysofassesing

Refer to the Western Australian Curriculum and Assessment Outline k10outline.scsa.wa.edu.au for further guidance on assessment principles, practices and phases of schooling.

Refer to the Judging Standards tool in the Western Australian Curriculum and Assessment Outline bit.ly/judging_standard when reporting against the Achievement Standards; giving assessment feedback; or explaining the differences between one student's achievement and another's.





Further teaching and learning opportunities

Scitech provides a range of learning opportunities for both teachers and students outside of a visit to the Science Centre.

STEM Learning Project

These resources aim to generate students' interest, enjoyment and engagement with STEM. Each module will support teachers to teach STEM in an integrative way from Kindergarten to Year 12 and have been developed with input from Western Australian school teachers.
education.wa.edu.au/resources-for-educators

Scitech professional development for teachers

Our interactive STEM workshops can be booked by your school or network, and be delivered at Scitech or onsite.
scitech.org.au/educators/professional-development/

STEM resources for teachers

Our STEM resources include DIY Kits to build STEM engagement in students and educators through WA curriculum-aligned experiences. Plus, we even have our own science news channel, Particle.
scitech.org.au/educators/education-resources/

Statewide incursions

Let us bring Scitech to you. Everything can be transported straight from our HQ into your classroom.
scitech.org.au/educators/incursions/

