



EARTH'S RESOURCES UNIT OF WORK

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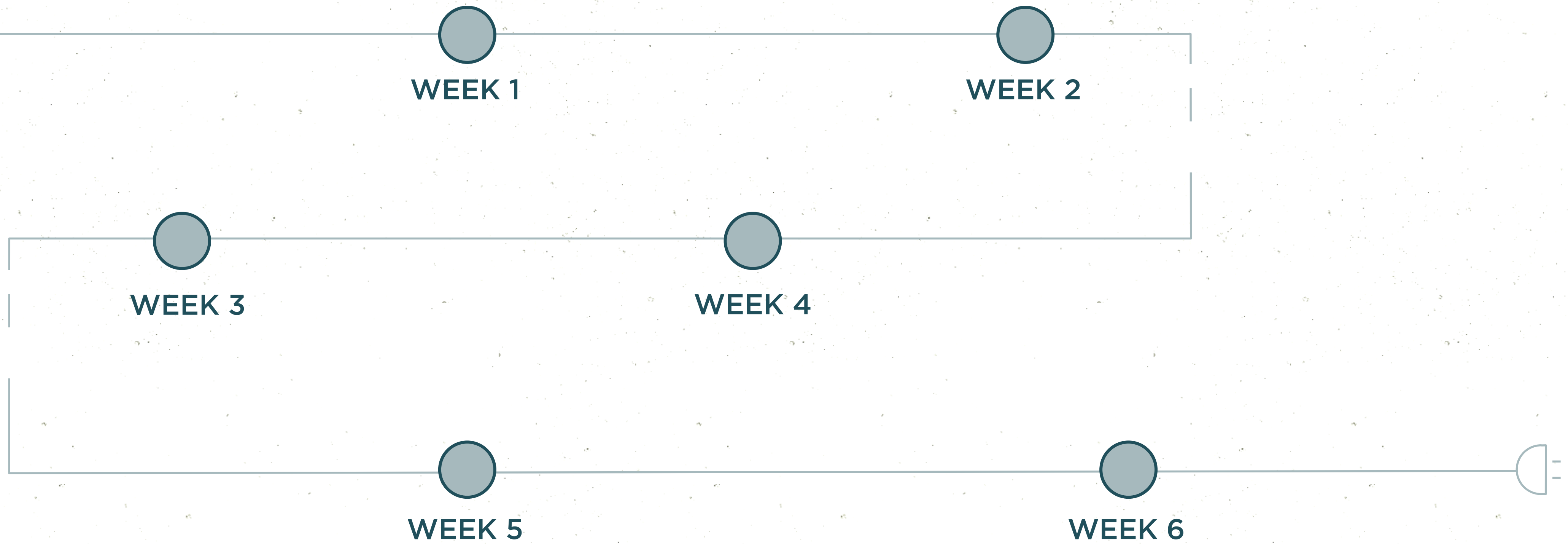
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SUMMARY

RESOURCE MANAGEMENT THROUGH INNOVATION

This unit provides students with an insight into how humans extract and use resources from Earth's spheres. Students will learn the difference between renewable and non-renewable resources and examine some of the strategies being used to make our resource use more sustainable. They will then use the STEM Design Thinking Process to identify a problem related to our resource use and develop an innovative solution that will be entered into the Green Innovation Awards.





DURATION
6 weeks 3 hours/week

OUTCOMES

- **SC4-5WS** collaboratively and individually produces a plan to investigate questions and problems
- **SC4-6WS** follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually
- **SC4-7WS** processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions
- **SC4-8WS** selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems
- **SC4-9WS** presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations
- **SC4-13ES** explains how advances in scientific understanding of processes that occur within and on the Earth, influence the choices people make about resource use and management

UNIT OVERVIEW

Students develop their understanding of how humans extract and use resources from Earth. They study environmental impacts of this resource use, strategies in place to conserve resources. Using of the STEM Design Thinking Process, students will develop their problem-solving skills as they undertake a project to identify an environmental issue and related to resource use and develop an innovative solution, which will form their entry into the Green Innovation Awards.



KEY INQUIRY QUESTIONS

How can we conserve and manage non-renewable resources?

**How can we use innovation to decrease the impact
of our resource use?**

RESOURCES

- Rocking the future 1 student worksheet
- Rocking the future 2 student worksheet
- Rocking the future teacher notes
- Properties of Fossil Fuels sciencing.com/properties-fossil-fuels-8190.html
- Physical Processes: The Four Spheres youtube.com/watch?v=5FooHD0atuc
- Sustainable use of resources youtube.com/watch?v=2YdaYQa8kGs
- Activity: Water Cycle Models resource
- Activity: Water Cycle Models sciencelearn.org.nz/resources/2884-water-cycle-models
- Storm water treatment youtube.com/watch?v=kTZssegH50mk
- Aboriginal Water Values and Management in Northern Australia youtube.com/watch?v=gvSgUdwykrs
- Northern Australia Fire Management youtube.com/watch?v=sFiqu_20s7Q
- Aboriginal Resource Management in NSW ausearthed.blogspot.com/2020/05/resource-management.html

STEM DESIGN PROCESS

RIVERS ACADEMY OF STEM EXCELLENCE

This resource was produced by the Rivers Academy of STEM Excellence

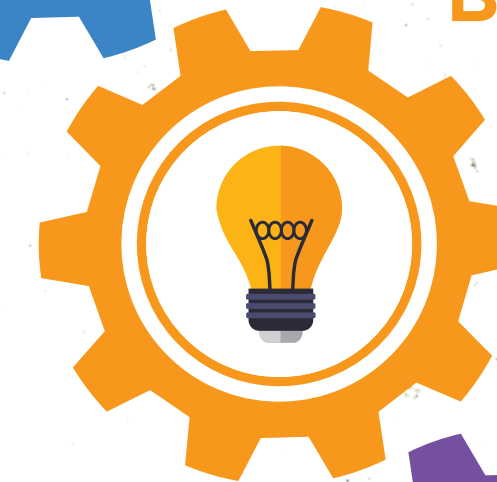
RASE Rivers Academy of STEM Excellence



IDENTIFY & DEFINE
THE PROBLEM



BRAINSTORM / IDEATE
YOUR SOLUTION



COMMUNICATE & SHARE
YOUR SOLUTION



DESIGN / PLAN



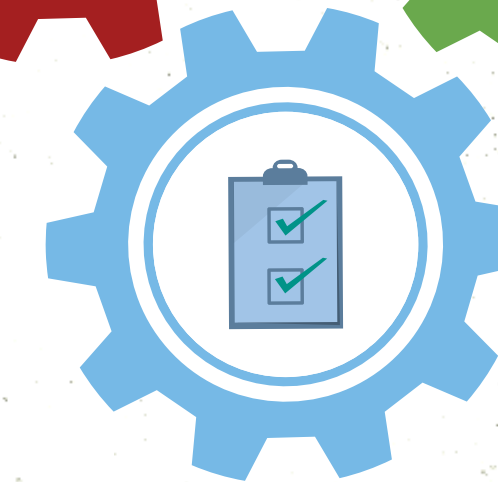
IMPROVE



PROTOTYPE / MAKE



TEST



CONTENT	TEACHING AND LEARNING	EVIDENCE OF LEARNING
<p>Stage 4 – Earth and Space ES3 Scientific knowledge influences the choices people make in regard to the use and management of the Earth’s resources.</p> <p>a. classify a range of the Earth’s resources as renewable or non-renewable (ACSSU116)</p> <p>b. outline features of some non-renewable resources, including metal ores and fossil fuels SC4-7WS SC4-9WS</p>	<p>Teacher asks students to define the terms renewable and non-renewable resources.</p> <p>Students compile a list of renewable and non-renewable resources.</p> <p>Students complete Rocking the future worksheets 1 and 2.</p> <p>Students use the information from Properties of Fossil Fuels to answer the following questions:</p> <ul style="list-style-type: none"> • <i>What is the origin of fossil fuels?</i> • <i>What are the main elements that make up fossil fuels?</i> • <i>Describe the combustion of fossil fuels – what happens during this process, why is it useful?</i> 	<p>Students can describe the difference between renewable and non-renewable resources.</p> <p>Students demonstrate an understanding of high-tech metals and metals that are mined in NSW.</p> <p>Students identify that fossil fuels originate from plant and animal material, are made predominantly of carbon and hydrogen and have high energy output when burnt.</p>
<p>c. describe uses of a variety of natural and made resources extracted from the biosphere, atmosphere, lithosphere and hydrosphere SC4-6WS</p>	<p>Teacher leads class discussion to define and describe the terms biosphere, atmosphere, lithosphere and hydrosphere. Show the video on the four spheres (duration 4:52)</p> <p>Students Identify two resources that are extracted from the spheres above. One resource that is used in its natural form and one resource that needs to be refined/manufactured for use. Describe the use for all the resources.</p> <p>Teacher provides examples if required;</p> <ul style="list-style-type: none"> • Biosphere • wool, cotton, skin (leather), food, oils, timber • Atmosphere • nitrogen, oxygen, helium • Lithosphere • building materials, fertilisers, fossil fuels • Hydrosphere • water, sea salt <p>Students perform an experiment to model the extraction of a resource. For example, “mining” choc chips out of biscuits or using a displacement reaction to extract copper from copper sulfate.</p>	<p>Students can define biosphere, atmosphere, lithosphere and hydrosphere.</p> <p>Students can give examples of resources that are extracted from Earth’s spheres and used in their natural form or manufactured into different materials.</p>

CONTENT	TEACHING AND LEARNING	EVIDENCE OF LEARNING
<p>d. Investigate some strategies used by people to conserve and manage non-renewable resources, eg recycling and the alternative use of natural and made resources SC4-9WS</p>	<p>Teacher shows this video on sustainable resource use (duration 2:23) as a prompt. Students: use the headings Recycle, Reuse, Reduce and Repurpose to answer the inquiry question “<i>How can we conserve and manage non-renewable resources?</i>” This can be presented as a poster, a factual report, or a PowerPoint presentation.</p>	<p>Students can describe strategies used to improve the sustainability of resource use. They can communicate this in written form via a medium of their choice.</p>
<p>e. discuss different viewpoints people may use to weight criteria in making decisions about the use of a major non-renewable resource found in Australia f. outline the choices that need to be made when considering whether to use scientific and technological advances to obtain a resource from Earth’s spheres SC4-7WS, SC4-9WS, SC4-3VA</p>	<p>Teacher selects a non-renewable Australian resource for research (Coal seam gas, iron ore, coal, oil etc.). Divides the class into groups and assigns each group one of the following sectors to represent:</p> <ul style="list-style-type: none"> • Environmental conservation group • Mining company • Farmer • Politician (from a Major party) <p>Students research the resource and present a persuasive pitch from the perspective of their sector of society. Teacher leads a class discussion about why different groups put different weight on criteria about such topics. Extend this discussion to consider the choices that need to be made when considering new scientific and technological advances to obtain Earth’s resources (economic, environmental, political, legal, social).</p>	<p>Students can present the viewpoints of different groups within society and explain why they weight criteria differently.</p>

CONTENT	TEACHING AND LEARNING	EVIDENCE OF LEARNING
<p>ES4 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.</p> <p>a. identify that water is an important resource that cycles through the environment</p> <p>b. explain the water cycle in terms of the physical processes involved</p> <p>WS4-5, WS4-6</p>	<p>Students list five important uses of water in the local area.</p> <p>Teacher leads a class discussion about the importance of water as a resource.</p> <p>Teacher provides students with a diagram of the water cycle and discusses the processes involved. Describes water as a renewable resource, but explains issues associated with the availability of clean, usable water.</p> <p>Students complete the water cycle model activity (worksheet provided).</p> <p>The original resource and supporting information can be found on the sciencelearn website.</p>	<p>Students can describe the importance of water as a resource, that while renewable is of limited supply.</p> <p>Students can describe the water cycle and the physical processes involved both verbally and diagrammatically.</p>
<p>c. demonstrate how scientific knowledge of the water cycle has influenced the development of household, industrial and agricultural water management practices.</p>	<p>Teacher leads class discussion about how our water management practices have changed as a result of scientific knowledge. Examples include closed pipe systems replacing open channels on large farms, stormwater harvesting and desalination plants. Show the video on stormwater treatment (duration 3:27).</p>	<p>Students can explain how practices have changed in order conserve water and improve its quality.</p>
<p>d. research how Aboriginal and Torres Strait Islander Peoples' knowledge is being used in decisions to care for country and place, eg terrestrial and aquatic resource management</p> <p>WS4-7, WS4-9</p>	<p>Teacher shows the video Aboriginal water values and management (duration 14:16) and Northern Australia Fire Management (duration 8:35)</p> <p>Students use information from the videos and the Aboriginal Resource Management post from Australian Earth Science Teachers to describe how traditional Aboriginal strategies are being incorporated into current practices to care for country and place.</p>	<p>Students can describe traditional conservation strategies used by Aboriginal people and give examples of how they have been incorporated into modern management plans.</p>

CONTENT	TEACHING AND LEARNING	EVIDENCE OF LEARNING
<p>SC4-5WS, SC4-7WS, SC4-8WS, SC4-9 WS</p>	<p>Teacher leads a whole class brainstorm about issues created by resource use – examples include; water use and the construction of a new dam, single use plastics, hunting native animals for resources (e.g. hides, tusks).</p> <p>Teacher sets students the challenge of identifying an environmental issue related to resource use, misuse or extraction, then developing a solution to that problem. Initial research will require students to look at existing scientific solutions to environmental issues. Hand out the scaffold for students to follow.</p> <p>Students work in groups to complete an inquiry-based process to identify a problem and develop a solution.</p> <p>Inquiry Question: <i>How can we use innovation to decrease the impact of our resource use?</i></p> <p>Teacher explicitly teaches students how to use the STEM Design Thinking Process to solve a problem. Some key points are:</p> <ul style="list-style-type: none"> • Identify/Define: Prompt students to look beyond the obvious. What is the underlying cause of the problem? • Brainstorm: Crazy ideas are good. Consider fluency (lots of ideas), diversity (ideas are different to each other), innovation (think outside the square) • Design/Plan: Research, set team roles, develop a timeline • Prototype: Fail early fail fast. Make a quick simple prototype, so if it fails, there is time to improve it • Test: Get feedback from multiple people. If your solution is specific to a particular group, get them to test it Improve: Use the feedback to make improvements. <p>Communicate/Share: have an authentic audience. This is where the Green Innovation Awards come into play.</p>	<p>Students can describe how our resource use can impact the environment.</p> <p>Students can identify an environmental problem associated with resource extraction and/or use, and demonstrate how they have developed a solution by using the STEM Design Thinking Process. They have evidence of research, planning and engaging in a cycle of feedback and improvement.</p>