

YEAR 8 STEM UNIT: Post Earth Pioneers

Unit Description

NASA has announced that they will attempt to establish a colony on Mars in the 2030s. Our students will witness this and some could be involved in the development of this or subsequent colonies.

This unit challenges students to develop an understanding of the needs of life on Earth and then apply problem solving skills to develop solutions for living on other places in the Solar System.

Background / Prior Knowledge

Students should have been through the design process in TAS, at least once, to understand the principles of problem solving and finding and testing solutions, through modelling.

Students should have an understanding of photosynthesis, respiration and the essentials needed for life. The idea of the interconnectedness of life forms (through food chains, food webs etc.) should be covered before this unit of work.

Summary/Rationale of unit of learning

Students need to appreciate the conditions under which life thrives on Earth and the problems posed to life if it was to be transported to another world (which has different conditions)

Students need to apply their knowledge and skills to solving problems and posing creative solutions to situations that they have not encountered before.

The idea of living on another planet / moon is a possibility for some of these students and so this is a “real world” problem. Extensive reference to NASA’s Mars proposal reinforces this point.

The development of 21st century skills in group work and communication and evaluation of ideas will also be encouraged.

Unit Length 6 – 8 weeks

10 x 75 minutes lessons per cycle (4 TAS, 6 science, mathematics was integrated into the rates and ratio unit)

<p>Syllabus Outcomes</p> <p>The outcomes used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW. http://www.boardofstudies.nsw.edu.au/syllabus_sc/</p> <p>Science Outcomes:</p> <ul style="list-style-type: none"> ➤ SC4-15LW - explains how new biological evidence changes people’s understanding of the world ➤ SC4-12ES - describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system ➤ 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 ➤ 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 <p>TAS Outcomes:</p> <ul style="list-style-type: none"> ➤ 4.1.1 applies design processes that respond to needs and opportunities in each design project ➤ 4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications ➤ 4.2.1 generates and communicates creative design ideas and solutions ➤ 4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects ➤ 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project ➤ 4.6.1 applies appropriate evaluation techniques throughout each design project <p>Maths Outcomes:</p> <ul style="list-style-type: none"> ➤ MA4-2WM a student applies appropriate mathematical techniques to solve problems – problem solving ➤ MA4-7NA operates with ratios and rates, and explores their graphical representation ➤ MA4-19SP collects, represents and interprets single sets of data, using appropriate statistical displays 	<p>Assessment of Learning:</p> <p>Milestones</p> <p>Group Presentation</p> <p>Individual evaluation</p>
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General Capabilities: (See Teaching and Learning Program to identify links to General Capabilities)

Learning Across the curriculum used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW

<http://syllabus.bostes.nsw.edu.au/mathematics/mathematics-k10/learning-across-the-curriculum/>

The cross-curriculum priorities:

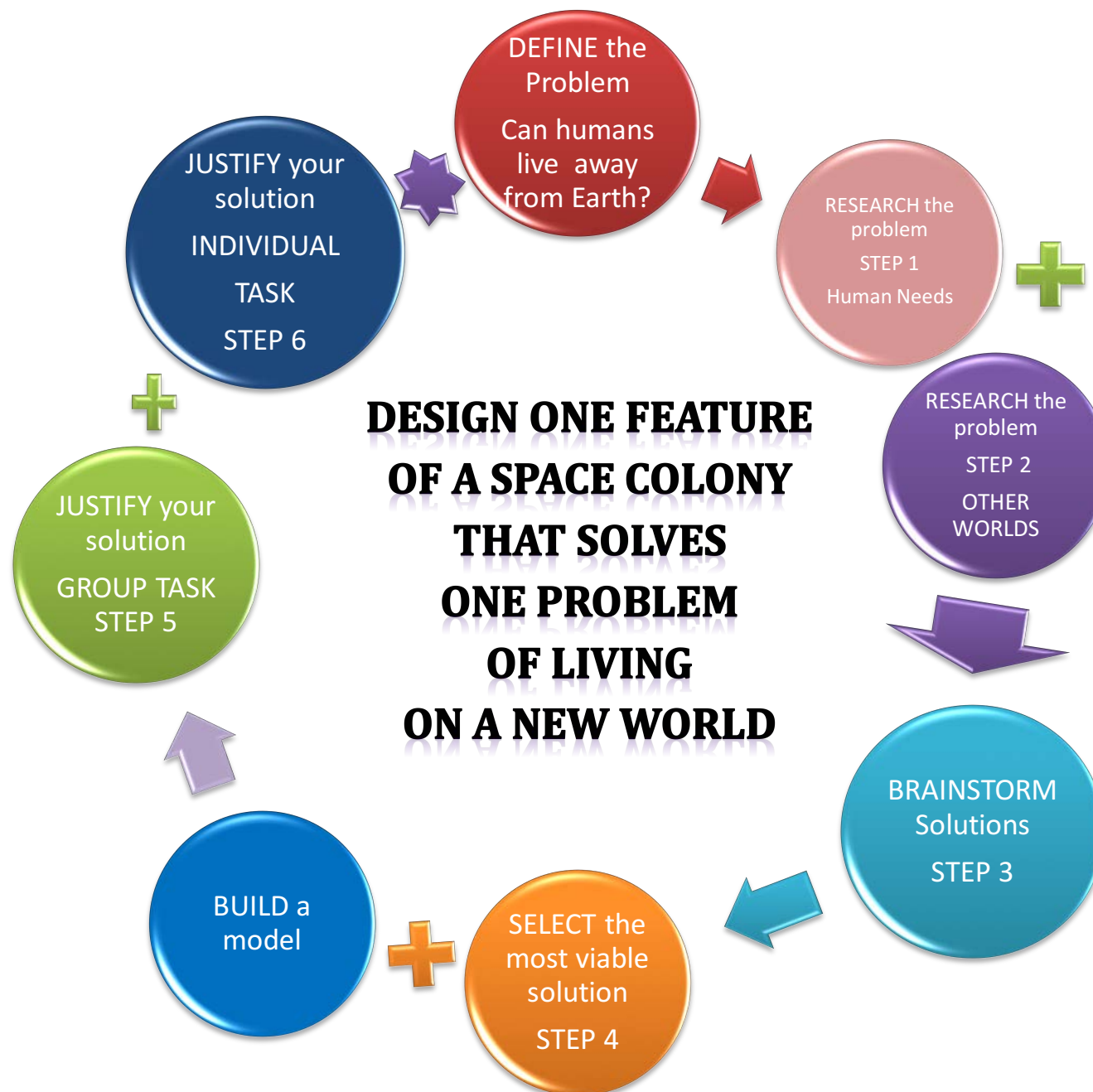
- Aboriginal and Torres Strait Islander histories and cultures 🇺🇸
- Asia and Australia's engagement with Asia 🌏
- Sustainability 🌱

The general capabilities:






- Critical and creative thinking 🧠
- Ethical understanding ⚖️
- Information and communication technology capability 💻
- Intercultural understanding 🌐
- Literacy 📖
- Numeracy 📊
- Personal and social capability 👤

Other learning across the curriculum areas:









- Work and enterprise ⚙️




























	ACTIVITIES	Faculty	ICT lesson	Assessment
STEP 1			TAS lessons will be used to develop skills in Google SketchUp and PREZI.	
Brainstorm and investigate the essentials for life e.g. what materials are needed for photosynthesis, respiration, energy sources, what do we need for a healthy diet etc.	Modern household use	Maths		TEM <small>TECHNOLOGY ENGINEERING MATHEMATICS</small>
	Cycles in Nature	Science		
	Human Requirements			
	Oxygen	Science		
STEP 2				
What conditions/resources will you find in space? How far away are the other planets? Does it make a difference if you go towards or away from the Sun?	Features of the Universe / Solar System	Science		
	Scale model of the Solar System	Maths		
	Information about planets	Science		
	Light and distance from the Sun	Maths		
STEP 3				
What will you need to take with you – living and nonliving? What materials will you need to conserve or recycle? How can you do this? What is/are your energy sources?	Pick an off world site and investigate it in depth	Science		
	Outer Space environment	Science		
	How do astronauts survive in space?	Science		
STEP 4				
Design a model for your solution to one problem of living in your new environment - living space, recycling, work spaces, recreation, food production, medical centre. Use Google Sketch up	What Scale is the Model?	Maths		
	Selection of materials	TAS		
	Shape of structure	TAS		
STEP 5: Group presentation to the class				
Each group will present an audio visual presentation (PREZI) that shows the design and which justifies the solution to the identified problem of living in the new environment. The “Intended” audience will be the Prime Minister and the Chief Scientist of Australia.	Students make a trial presentation to another group	Science / TAS		Peer review
	Each group presents to the class. Each class selects 2 or 3 groups to make a presentation to the entire year group and special judges			
STEP 6: Individual STEP				
Having watched all the presentations you will submit an extended writing piece to persuade the Prime Minister and Chief Scientist to choose ONE of the designs (it does not need to be yours if you think another design is better!)	Group presentations to the whole year group. Each student will write an extended writing piece	Science		Extended response

<p>SC4-13ES <i>ES4 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.</i> (ACSHE121, ACSHE136) c. demonstrate how scientific knowledge of the water cycle has influenced the development of household, industrial and agricultural water management practices</p>	<p>Relate to space colony as a “mini Earth”</p> <p>Production of food using aquaculture; Production of oxygen using algae; Water cycle as part of waste management;</p>		<p>Sustainability </p>	<p>Milestone 1 and 3</p>
<p>SC4-13ES <i>LW4 Scientific knowledge changes as new evidence becomes available, and some scientific discoveries have significantly changed people’s understanding of the world.</i> (ACSHE119, ACSHE134) a. research an example of how changes in scientific knowledge have contributed to finding a solution to a human health issue</p> <p>b. recount how evidence from a scientific discovery has changed understanding and contributed to solving a real world problem, e.g. animal or plant disease, hygiene, food preservation, sewage treatment or biotechnology</p>	<p>Relate to space colony as a “mini Earth” that has solutions for common problems: health and waste disposal.</p> <p>Look at various solutions.</p>		<p>Ethical understanding  Critical and creative thinking  Personal and social capability  Literacy </p>	<p>Milestone 3</p>

<p>c. describe, using examples, how developments in technology have contributed to finding solutions to a contemporary issue, e.g. organ transplantation, artificial joints/limbs, treatment for diabetes, asthma, kidney or heart disease.</p> <p>d. give examples to show that groups of people in society may use or weight criteria differently in making decisions about the application of a solution to a contemporary issue, eg organ transplantation, control and prevention of diseases and dietary deficiencies</p> <p>SC4 - WS9 presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations</p>	<p>Look at different groups in society and their opinions.</p> <p>Individual task to evaluate various projects and make a submission in support of ONE project.</p>		<p>Literacy Information and communication technology capability</p> <p>Personal and social capability Critical and creative thinking Ethical understanding Difference and diversity</p>	<p>Task 6</p>
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TAS Outcomes / Content	Teaching & Learning Strategies	Resources	General Capabilities/ 21 st Century skills	Assessment & Feedback
4.1.1 applies design processes that respond to needs and opportunities in each design project	<ul style="list-style-type: none"> The design process has been incorporated in the overall approach to the unit of work as reflected in the steps 1 to 6 shown on page 2. Class discussion of Design situation and brief Establish criteria for evaluation of success 	Student work / resources structured using design process and is available on the shared STEM drive.	Literacy  Numeracy  Information and communication technology (ICT) capability  Critical and creative thinking  Personal and social capability  Ethical understanding  Intercultural understanding  Communication Collaboration	Students to maintain folio diary to track progress and discussions with teachers. Criteria for success to be used in assessment task 6
4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications	<ul style="list-style-type: none"> Discuss the concepts of aesthetics versus function related to this scenario Reflect on needs for human habitation as presented in Science lessons Investigate Architectural concept and design approach: documentation, constructability, functionality and site selection Investigate Architectural implementation and innovation: Habitability, innovation, energy efficiency and public appeal. Reflect on Systems and sub-systems 		Literacy Numeracy Critical and creative thinking  Personal and social capability Ethical understanding Intercultural understanding Communication Collaboration	

<p>4.2.1 generates and communicates creative design ideas and solutions</p>	<ul style="list-style-type: none"> Investigation of suitable methods to be used to demonstrate creative ideas for post-Earth system e.g. concept board, sketches, charts, artists impressions Students to communicate and discuss initial ideas. 		<p>Literacy  Numeracy  Information and communication technology (ICT) capability  Critical and creative thinking  Personal and social capability  Ethical understanding  Intercultural understanding  Creativity Communication Collaboration critical thinking </p>	<p>Assessment Task 4, 5 and 6</p> <ul style="list-style-type: none"> Design ideas Design sketches created using Google SketchUp demonstrating novel and creative design ideas. e-presentation <p>Feedback: ICT assessment rubric</p>
<p>4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects</p> <p>4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project</p>	<ul style="list-style-type: none"> Reflect on concepts of scale as presented in Mathematics and relate to system Assess the suitability of various presentation tools available Students undertake tutorials in using Goggle SketchUp Create final CAD design of sub system for the new space colony. Ethical use of ICT Create 3D model of system using 3D printer 	<p>Refer to ICT /TAS lesson outline sheet For Tinkercad Thingiverse And other useful strategies</p>	<p>Literacy  Information and communication technology (ICT) capability  Critical and creative thinking  Personal and social capability  Ethical understanding  Intercultural understanding </p>	

4.6.1 applies appropriate evaluation techniques throughout each design project	<ul style="list-style-type: none"> Evaluate based on assessment criteria set at the commencement of the project 		Literacy  Information and communication technology (ICT) capability  Critical and creative thinking  Personal and social capability  Ethical understanding  Intercultural understanding 	Task 6: Peer Assessment Peer evaluation of project presented using a suitable software package chosen by individual groups Feedback: ICT assessment rubric and student feedback sheets
MATHS Outcomes / Content	Teaching & Learning Strategies	Resources	General Capabilities/ 21st Century skills	Assessment & Feedback
MA4-2WM a student applies appropriate mathematical techniques to solve problems, problem solving	Modern Household use Human requirements activity		Critical and creative thinking  Personal and social capability 	Milestone 1
MA4-7NA a student operates with ratios and rates, and explores their graphical representation	Solar System sizes and distances; Light intensity and distance Model building		Critical and creative thinking  Numeracy 	Milestone 2 and Final Presentation
MA4-19SP a student collects, represents and interprets single sets of data, using appropriate statistical displays	Modern Household use Human Requirements		Information and communication technology 	Milestone 1