**PICTON HIGH SCHOOL**

**STAGE 4 INTEGRATED STEM PROGRAM**

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| **UNIT NAME: MISSION TO MARS** | **STAGE: 4** |
| **Unit Outline** | **Unit Duration** |
| This unit of work brings together Science, Technology and Maths in a collaboration of cross curricular subjects.  The unit uses three design briefs that explore a range of scientific, mathematical and technological concepts through problem based learning.  The unit brings a holistic approach to teaching concepts from each subject area | 20 weeks |
| **Big ideas/ Key concepts** | **Why does this learning matter?** |
| * There is a process that is followed when designing. * Numerous creative strategies are used in the creation of ideas for design. * Design work occurs across a range of areas that include; Built Environments, Products, and ICTs. * Designing incorporates a range of people and a variety of skills in order to meet a design brief and produce a solution. * Designers undertake a range of processes during the course of producing a design from start to finish. * There are a range of Factor that Affect Design * Design work occurs across a range of design specialisations within the areas of Built Environments, Products, and ICTs. * Designers work contributes to the improvement of quality of life. | * Identify and apply the design process. * Learn about the vast range of areas where design takes place. * Develop an understanding of research methods related to design. * Learn about safety in the workshop and how to use and operate specific tools and equipment within the technology specific content. * Understand that designers use a range of processes to produce an item. * Understand the value of designers work within society and how their contributions improve everyday life. * Apply research methods related to design. * Recognise and participate in a range of design specialisations. |

**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 Aboriginal and Torres Strait Islander histories and cultures
* Asia and Australia's engagement with Asia Asia and Australia's engagement with Asia  
* Sustainability Sustainability

The general capabilities:

* Critical and creative thinking Critical and creative thinking
* Ethical understanding Ethical understanding
* Information and communication technology capability Information and communication technology capability
* Intercultural understanding Intercultural understanding
* Literacy Literacy
* Numeracy Numeracy
* Personal and social capability Personal and social capability

Other learning across the curriculum areas:

* Work and enterprise Work and enterprise
* Difference and Diversity

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/>

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| **Resources** | **Target outcomes** |
|  | **A student:**  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.  4.1.3 - Identifies the roles of designers and their contribution to the improvement of the quality of life.  4.2.1 - Generates and communicates creative design ideas and solutions.  4.2.2 - Selects, analyses, presents and applies research and experimentation from a variety of sources.  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.  4.4.1 - Explains the impact of innovation and emerging technologies on society and the environment.  4.5.1 - Applies management processes to successfully complete design projects.  4.5.2 - Produces quality solutions that respond to identified needs and opportunities in each design project.  4.6.2 - Identifies and explains ethical, social, environmental and sustainability considerations related to design projects.  MA4‑1WM communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols  MA4‑2WM applies appropriate mathematical techniques to solve problems  MA4‑3WM recognises and explains mathematical relationships using reasoning  MA4‑5NA operates with fractions, decimals and percentages  MA4‑4NA compares, orders and calculates with integers, applying a range of strategies to aid computation  MA4‑8NA generalises number properties to operate with algebraic expressions  MA4‑12MG calculates the perimeters of plane shapes and the circumferences of circles  MA4‑15MG performs calculations of time that involve mixed units, and interprets time zones  MA4‑19SP collects, represents and interprets single sets of data, using appropriate statistical displays  SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge  SC4-5WS collaboratively and individually produces a plan to investigate questions and problems  SC4 -8WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions  SC4-6WS follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually  SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations  SC4‑10PW describes the action of unbalanced forces in everyday situations  discusses how scientific understanding and technological developments have contributed to finding SC4-11PW solutions to problems involving energy transfers and transformations  SC4-12ES describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system  SC4-16CW describes the observed properties and behaviour of matter, using scientific models and theories about the motion and arrangement of particles  SC4-17CW explains how scientific understanding of, and discoveries about, the properties of elements, compounds and mixtures relate to their uses in everyday life  SC4-14LW relates the structure and function of living things to their classification, survival and reproduction  SC4-15LW explains how new biological evidence changes people's understanding of the world |

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| **Literacy** | **Numeracy** | **ICT** | **Assessment** |
| * Second Glossary of Design Terms * Tool List * Recount * Develop a Report Style Presentation * Graphic organiser * Annotated glossary of mathematics vocabulary * Scientific report writing and language * Scientific method and associated literacy * Scientific glossary * Persuasive Writing | * Measurement units and conversion * Linear Measurement * Interpreting Graphs * Estimation * Developing 3D Models * Creating Graphs * Sketching plans * Time conversions and calculations * Problem Solving | * Moodle * Google classroom * Google Apps * Excel * Infographic freeware * Web based safety program (Onguard) * Internet Research * Designers Assignment: PowerPoint Presentation * Internet Research * Folio Development using computer software. * Smartphone Apps and sensors for data collection | **Formal**   * Assessment Task 1: Space Travel Bottle Rocket STEM * Assessment Task 2: Life in the Bubble STEM   **Informal**   * Questioning * Observation of skills * Pre and Post testing * Graphic organisers * Reflection journal/learning log * Short quiz * Experimental Methods * Hypothesis testing and data collection |

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| **Space Travel: Bottle Rocket (4 Weeks Model Making)** | | | | | | |
| **Outcomes** | **Content (Maths/Science)**  **Learn about | Learn to (Technology)** | | **Learning experiences** | **Evidence of learning** | **Adjustments and extensions** | **Rego**  **Sign/Date** |
| **WEEK 1** | | | | | | |
| **4.1.1**  **4.3.2**  **4.5.2** | Design processes including:  Analysing needs, problems and opportunities  Needs and opportunities in the areas of study  Risk management strategies  Responsible behaviour in working environments  Work, Health and Safety practices.  Suitable materials. tools and techniques for design projects.  Skill development and refinement. | Establish a design process that responds to an identified need and opportunity          Identify needs and opportunities that require solutions in the areas of study    Manage risk when developing design projects.  Identify suitable materials, tools and techniques for each design project.  Practice and refine skills needed for design projects. | Unit Introduction    School Computer & Moodle Log In    Glossary Activity:  What is a glossary?  How do we use a glossary?  Why do we use a glossary?    Glossary of Design terms **(Literacy, SS6 - Making Connections)** These terms should be used in the development of the design folio.    **Assessment Task 1: Space Travel Bottle Rocket STEM**  Task issued to students and explained.  Students directed to Moodle site where additional copies of task can be accessed from home electronically or downloaded and printed if lost.  Freehand Sketch Bottle rocket  Onguard safety test program  Workshop Orientation  HW: Collect Materials   * 1.25lt Bottle * Material for Stabilising fins * Material for aerodynamic cone. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑19SP** | Construct and compare a range of data displays, including stem-and-leaf plots and dot plots (ACMSP170)   * interpret a variety of graphs, including dot plots, stem-and-leaf plots, divided bar graphs, sector graphs and line graphs * compare the strengths and weaknesses of different forms of data display (Reasoning) * identify and explain which graph types are suitable for the type of data being considered, eg sector graphs and divided bar graphs are suitable for categorical data, but not for numerical data (Communicating, Reasoning) | | Students construct a **Graphic Overview** of the topic. Identify types of graphs, discussing their attributes. Look at examples of graphs in the media, particularly the role and influence of infographics.    **Project Task:** Who Am I? Part 1. S  Students develop an infographic of themselves and what they bring to Mission Mars. Students make pencil-and-paper drafts then use Canva.com and their Google education account to create a digital infographic.  **HW** Glossary, Learning Journal |  |  |  |
| **SC4-5WS** | Students question and predict by:   1. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) 2. making predictions based on scientific knowledge and their own [observations](http://syllabus.bos.nsw.edu.au/glossary/sci/observation/?ajax) (ACSIS124, ACSIS139) 3. collaboratively and individually conducting a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140) PSCEU 4. assembling and using appropriate equipment and resources to perform the investigation, including safety equipment 5. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141) ICT 6. following the planned procedure, including in fair tests, measuring and controlling variables (ACSIS126, ACSIS141)EUPSC 7. recording observations and measurements accurately, using appropriate units for physical quantities L 8. performing specific roles safely and responsibly when working collaboratively to complete a task within the timelinePSC 9. assessing the method used and identifying improvements to the method | | Unit introduction and Lab Safety.  What is Science and how does it affect you?  Applying scientific method to everyday activities, questioning and hypotheses, observations  Glossary of Science Terms and applying them to investigations.  Students undertake a number of simple laboratory investigations and learn correct and safe methods for using equipment and collecting data. |  |  |  |
| **WEEK 2** | | | | | | |
| **4.1.1**  **4.3.2** | Design processes including:  generating creative ideas, researching  analysing needs, problems and opportunities  Risk management strategies  Responsible behaviour in working environments  Work Health and Safety practices | Apply a design process when developing quality solutions for each design project  Establish a design process that responds to an identified need and opportunity  Manage risk when developing design projects  Use tools, materials and techniques in a responsible and safe manner in each design project. | Folio Work: Design Process Activity  Debono’s Thinking Hats Activity  Research Existing Ideas: PMI/SCUMPS Model  (Using a variety of sources research existing project ideas. Make points relevant to selected designs that meet with each criteria of the PMI & SCUMPS model. (Folio))  Workshop Orientation: Risk Management  Responsible Behaviour |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑19SP** | draw conclusions from data displayed in a graph, eg 'The graph shows that the majority of Year 8 students who play a musical instrument play a string instrument' (Communicating, Reasoning) | | **Project Task:** Who Am I? Part 2. Students review and reflect on each other’s infographic. Play a game where students have to find someone who has a similar quality e.g. likes the same music, born in the same month etc.  **HW Learning Journal** |  |  |  |
| **SC4-5WS** | Students choose equipment or resources for an investigation by:   1. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies. | | Students begin to develop investigation options to scientifically test potential designs, hypothesise and observe for more investigations relating to rockets. Students will use scientific method: Observe, Problem, Research, Hypothesis, Experiment, Analyse, Conclude. |  |  |  |
| **WEEK 3** | | | | | | |
| **4.1.1**  **4.2.1**  **4.3.1** | Design processes including:  generating creative ideas  researching  Needs and opportunities in the areas of study  Methods used to generate creative design ideas including  mind mapping  brainstorming  sketching and drawing  Use of design folio to record and reflect on design ideas and decisions  Communication methods including  drawings, sketches and models  written reports  oral presentations  digital presentations  **Tools**  specific tools related to model-making technologies the function and correct use of a range of contemporary tools used for   * measuring * marking out * cutting * construction * finishing   **Techniques** techniques such as   * systematic planning for model development * working to pre established scale * cutting accurately * shaping and sanding * joining a range of different materials * clamping and pinning finishing including painting, lacquering, polishing | Establish a design process that responds to an identified need and opportunity  apply a design process when developing quality solutions for each design project  Identify needs and opportunities that require solutions in the areas of study  Use a variety of methods to generate creative design ideas for each design project  Use a design folio to record and reflect on design ideas and decisions  Sketch, draw and model to aid design development  manipulate images with tools such as editing, resizing, grouping, aligning and positioning  Select and correctly use tools and equipment to produce a design project  Experiment with a variety of techniques for cutting, shaping, joining, clamping and finishing  Select and use a variety of techniques appropriate for the purposes of a design project | Tool List should be used to develop recount and procedural texts.  HW Activity: Definition of Design  HW Activity: Tool List for Technology Specific area **(Literacy, SS6 - Making Connections)**  **E-Portfolio Work - Google Sites**   * Setup Homepage with Design breif description. * Upload Design Process for project.         Discussion of production methods   * Tape * Glue * Plastic Weld   Construct Bottle Rocket   * Cone * Fins * Bootle |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑19SP** | * use a tally to organise data into a frequency distribution table * construct and interpret frequency histograms and polygons * select and use appropriate scales and labels on horizontal and vertical axes (Communicating, Problem Solving, Reasoning)recognise why a half-column-width space is necessary between the vertical axis and the first column of a histogram (Reasoning) | | **Teacher led activity: C**reating Graphs. Review types of graphs and important features. Students to work from provided data.  **Worksheet** or text exercise.    **HW** learning journal |  |  |  |
| **SC4-5WS** | WS5.1   1. identifying the purpose of an investigation 2. proposing the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources NCCT 3. locating possible sources of data and information, including secondary sources, relevant to the investigation CCTL | | Students begin investigations of prototypes using trial and error and secondary sources to determine best construction and shapes of rockets |  |  |  |
| **WEEK 4** | | | | | | |
| **4.1.3**  **4.2.1**  **4.3.1** | Relationship of design to the areas of study of Built Environments, Products, and Information and Communications  Communication methods suitable for specific audiences including users and clients technical experts peers  **Tools**  specific tools related to model-making technologies the function and correct use of a range of contemporary tools used for   * measuring * marking out * cutting * construction * finishing   **Techniques** techniques such as:   * systematic planning for model development * working to pre established scale * cutting accurately * shaping and sanding * joining a range of different materials * clamping and pinning finishing including painting, lacquering, polishing | Identify relationships of design to each area of study  Describe the nature of each of the areas of study of Built Environments, Products, and Information and Communications    Identify a range of design specialisations relevant to each area of study  Communicate information appropriate to specified audiences  Select and correctly use tools and equipment to produce a design project  Experiment with a variety of techniques for cutting, shaping, joining, clamping and finishing  Select and use a variety of techniques appropriate for the purposes of a design project | Activity: What is?:   * the Built Environment * a Product * ICT       **HW Task:** Moodle Activity  Definitions:   * Communication * Client * User * Technical Expert * Peer     Assembly of bottle rocket then launch for testing  and modification. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑19SP** | * construct dot plots * explain the importance of aligning data points when constructing dot plots (Communicating, Reasoning) * construct ordered stem-and-leaf plots, including stem-and-leaf plots with two-digit stems * explain the importance of ordering and aligning data values when constructing stem-and-leaf plots (Communicating, Reasoning) * construct divided bar graphs, sector graphs and line graphs, with and without the use of digital technologies * calculate the length of bar required for each section of divided bar graphs and the angle at the centre required for each sector of sector graphs (Problem Solving) | | **Project:** How Will We Populate Mars? Part 1. Read If the World Were a Village by David Smith and Shelagh Armstrong.  [**https://nrich.maths.org/7725&part=note**](https://nrich.maths.org/7725&part=note)    Small groups are to be allocated a page, and are to display it in a suitable graph. Presented on an A3 page to be displayed in the classroom.    **HW** learning journal |  |  |  |
| **SC4-PW10**  **SC4-PW11** | Change to an object’s motion is caused by unbalanced forces acting on the object. (ACSSU117)   * Students: * a.identify changes that take place when particular forces are acting * b.predict the effect of unbalanced forces acting in everyday situations   The action of forces that act at a distance may be observed and related to everyday situations.  Students:   1. identify that the Earth’s gravity pulls objects towards the centre of the Earth (ACSSU118) 2. describe everyday situations where gravity acts as an unbalanced force 3. distinguish between the terms ‘mass’ and ‘weight’ | | Usingsecondary sources and investigations, students develop methods for determining speed, distance and heights of rocket flight and the subsequent forces associated. |  |  |  |

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| **Space Exploration: Mars Rover (6-8 Weeks Control Technologies)** | | | | | | |
| **Outcomes** | **Content (Maths/Science)**  **Learn about | Learn to (Technology)** | | **Learning experiences** | **Evidence of learning** | **Adjustments and extensions** | **Rego**  **Sign/Date** |
| **WEEK 5** | | | | | | |
| **4.2.1**  **4.1.1** | Methods used to generate creative design ideas including  mind mapping  brain storming  Design processes including:  generating creative ideas  researching  analysing needs, problems and opportunities | Use a variety of methods to generate creative design ideas for each design project  Apply a design process when developing quality solutions for each design project  Establish a design process that responds to an identified need and opportunity | Activity: Define Mind mapping and Brainstorming. Explore the difference between each.    Use a Mind Map or Brainstorm to generate ideas: How can we explore space?  Hand out Design Brief**:** Mars Rover |  |  |  |
| **WEEK 6** | | | | | | |
| **4.1.1**  **4.5.2**  **4.3.1**  **4.1.3** | Design processes including:  generating creative ideas  researching  analysing needs, problems and opportunities  Suitable materials, tools and techniques for design projects  Materials/Inputs data types, formats and information as inputs of design and production component categories for hardware, including input devices, processors and output devices  robots and other mechatronic devices, sensors, actuators such as motors, switches, lights  The nature of the work of designers as individuals and as collaborators | Use a variety of methods to generate creative design ideas for each design project  Identify suitable materials, tools and techniques for each design project  Identify and select appropriate data for use in a design project Recognise, connect and use input and output devices to construct systems including sensors, switches, wiring, lights and motors for a design project  Apply group work and collaborative strategies to project development | Research Activity: What are robots and how do they work?  Research Activity: Research materials that could be used in a real mars rover.  Tools related to Control Technologies  Data types and formats  Mechatronics activity: Construct Solar robots and rovers.  **HW:** Designers as Collaborators (Moodle)  What is collaboration?  How do designers work together? |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑19SP** |  | | **Project:** How Will We Populate Mars? Part 2. Students examine each other’s graphs, choose ONE and represent it in a different type of graph using Excel.    **HW** learning journal |  |  |  |
| **SC2-PW11** | PW3 - Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)   1. relate electricity with energy transfer in a simple circuit 2. construct and draw circuits containing a number of components to show a transfer of electricity 3. investigate some everyday energy transformations that cause change within systems, including motion, electricity, heat, sound and light | | Project: Students develop understandings of electrical energies and energy transfer.  - Build a battery  - Understand basic circuits  - Thermal Electric Generators How can these be applied to create a vehicle for Mars |  |  |  |
| **WEEK 7** | | | | | | |
| **4.3.1**  **4.4.1** | Programmable logic controllers (PLCs) and associated hardware  Tools specific tools relating to control technologies the function, selection and correct use of a range of contemporary tools including simple programming languages simple programs that meet identified needs construction tools simple testing tools including multimeter  Industrial production methods  Innovation and emerging technologies relating to tools, materials, techniques or products in each area of study  The impact of innovation and emerging technology on society and the environment | Recognise, connect and use input and output devices to construct systems including sensors, switches, wiring, lights and motors for a design project  Select and correctly use tools appropriate for the construction, maintenance and management of systems for a design project  Select and use techniques appropriate for the purposes of a design project  identify and describe a selected innovation or emerging technology in each area of study of Built Environments, Products, and Information and Communications  Explain the impact of innovations and emerging technologies on society and the environment including new ICTs | Activity: What is a PLC? How and Why are they used?  Activity: Build and programme, Roboitis vehicles.  Modelling and Prototyping  Video Activity: Compare Industry production methods with those used in school. What are the differences?  Class discussion about industry vs school production.    Group Activity: Understanding Robots and their role in society. in groups research a modern day robot its purpose and how this has affected society +ve & -ve. Then report to class. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑8NA** | Introduce the concept of variables as a way of representing numbers using letters (ACMNA175)   * develop the concept that pronumerals (letters) can be used to represent numerical values * model the following using concrete materials or otherwise: * expressions that involve a pronumeral, and a pronumeral added to a constant, eg a, a + 1 * expressions that involve a pronumeral multiplied by a constant, eg 2a, 3a * sums and products, eg 2a + 1, 2(a + 1) * equivalent expressions, eg * simplifying expressions, eg * recognise and use equivalent algebraic expressions, eg * use algebraic symbols to represent mathematical * operations written in words and vice versa, eg the product of x and y is xy, is the sum of x and y | | **Reading: How do astronauts use maths?**  <http://mathforgrownups.com/math-at-work-monday-wendy-the-astronaut/>  <http://curious.astro.cornell.edu/privacy-policy/145-people-in-astronomy/careers-in-astronomy/general-questions/896-how-do-astronauts-use-math-in-their-jobs-beginner>    **Project:** How Much Will my Rover Cost? Part 1: Students create a model of a Mars Rover with lego, straws, blutac etc (whatever is available). Each component is allocated a pronumeral and students are to develop an expression for the cost to build their Rover.  **Discussion:** recognise that pronumerals can represent one or more numerical values (when more than one numerical value, pronumerals may then be referred to as 'variables')  **Adjustment**: Paperclip and Envelope activity (MCTP or NCTM???) Modelling  **HW** Signpost 7 Ex 10:01, 10:02, learning journal |  |  |  |
|  | ES2 Scientific knowledge changes as new evidence becomes available. Some technological developments and scientific discoveries have significantly changed people's understanding of the solar system.   1. describe some examples of how technological advances have led to discoveries and increased scientific understanding of the solar system. | | Design a space travel pamphlet outlining the advancements in space exploration and new technology making it safe. |  |  |  |
| **WEEK 8** | | | | | | |
| **4.2.1**  **4.3.1**  **4.2.2** | Use of design folio to record and reflect on design ideas and decisions  Communication methods including  written reports  Communication methods suitable for specific audiences including users and clients peers  Materials/Inputs data types, formats and information as inputs of design and production component categories for hardware, including input devices, processors and output devices  robots and other mechatronic devices, sensors, actuators such as motors, switches, lights  **Tools** specific tools relating to control technologies the function, selection and correct use of a range of contemporary tools including simple programming languages simple programs that meet identified needs construction tools simple testing tools including multimeter  **Techniques**  program design compiling programs  Connecting interdependent devices  Modelling and prototyping systems  Testing systems in the working environment  Experimentation and testing of design ideas | Use a design folio to record and reflect on design ideas and decisions  Manipulate images with tools such as editing, resizing, grouping, aligning and positioning  Communicate information appropriate to specified audiences  Identify and select appropriate data for use in a design project Recognise, connect and use input and output devices to construct systems including sensors, switches, wiring, lights and motors for a design project  Select and correctly use tools appropriate for the construction, maintenance and management of systems for a design project  Select and use appropriate program development techniques and structures for an identified need  Connect interdependent devices for the purposes of a design solution  Troubleshoot problems with systems  Test function of solutions for a design project  Apply the results of experimentation to designing and making when developing each design project | Report Activity: Generate a report that details the Mars Rover 1 mission, whether the objectives were met and what was learnt from this mission. (Teacher to provide report exemplar).**(Literacy, SS6 - Summarising) (e-portfolio component).**    Programming Activity: Python Scratch online game. Learn programming language basics and perform programming operations to solve game problems.  Activity: Build and programme, Roboitis vehicles.  Test: Test mars explorer   * Alternative terrains * Functionality * Speed * Battery Life   Activity: Construct and Test Solar robots/rovers,  Experimentation Report: Write up analysis of testing Mars explorer, recommend modifications in conclusions based on results. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑8NA** | * translate from everyday language to algebraic language and vice versa * use algebraic symbols to represent simple situations described in words, eg write an expression for the number of cents in x dollars (Communicating) * interpret statements involving algebraic symbols in other contexts, eg cell references when creating and formatting spreadsheets (Communicating) | | **Worksheet**: English to Algebra (modify worksheet to fit within STEM theme)    **HW** Signpost 7 Ex 10:04, learning journal |  |  |  |
|  | WS8 Students solve problems by:   1. using identified strategies to suggest possible solutions to a familiar problem CCT 2. describing different strategies that could be employed to solve an identified problem with a scientific component CCT 3. using scientific knowledge and findings from investigations to evaluate claims (ACSIS132, ACSIS234) CCT 4. using cause and effect relationships to explain findings CCT 5. evaluating the appropriateness of different strategies for solving an identified problem EUCCT | | Students analyse the results of the various testing and provide a feedback reports that outlines the experimental processes, ideas, findings and solutions with explanations and influence behind ideas |  |  |  |
| **WEEK 9** | | | | | | |
| **4.2.1**  **4.3.1**  **4.2.2** | use of design folio to record and reflect on design ideas and decisions  communication methods including written reports  communication methods suitable for specific audiences including users and clients peers  **Tools** specific tools relating to control technologies the function, selection and correct use of a range of contemporary tools including simple programming languages simple programs that meet identified needs construction tools simple testing tools including multimeter  **Techniques**  program design compiling programs  Connecting interdependent devices  Modelling and prototyping systems  Testing systems in the working environment  Experimentation and testing of design ideas | use a design folio to record and reflect on design ideas and decisions  manipulate images with tools such as editing, resizing, grouping, aligning and positioning  communicate information appropriate to specified audiences  Select and correctly use tools appropriate for the construction, maintenance and management of systems for a design project  Select and use appropriate program development techniques and structures for an identified need  Connect interdependent devices for the purposes of a design solution  Troubleshoot problems with systems  Test function of solutions for a design project  Apply the results of experimentation to designing and making when developing each design project | Cont. Report Activity: Generate a report that details the Mars Rover 1 mission, whether the objectives were met and what was learnt from this mission. (Teacher to provide report exemplar).**(Literacy, SS6 - Summarising) (e-portfolio component).**        **Complete e-portfolio work for** **AT1 ready for submission WK 10.**    Modification: Modify Roboitis vehicles.  Testing: Complete testing of Mars explorer after modifications.  Testing/Experimentation: Write up results of second test. Draw conclusions on success. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑8NA** | Extend and apply the laws and properties of arithmetic to algebraic terms and expressions (ACMNA177)   * recognise like terms and add and subtract them to simplify algebraic expressions, eg * verify whether a simplified expression is correct by substituting numbers for pronumerals (Communicating, Reasoning) * connect algebra with the commutative and associative properties of arithmetic to determine that and (Communicating) * recognise the role of grouping symbols and the different meanings of expressions | | **Project:** How Much Will my Rover Cost? Part 2: The class’s expressions are listed, and students then determine the total ‘cost’ for a combination of Rovers suitable for the Mission, describing why they chose that combination.  **HW** Signpost 7 Ex 10:03, learning journal |  |  |  |
| **SC4-12ES** | Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales. (ACSSU153)  Students:   1. describe the structure of the Earth in terms of core, mantle, crust and lithosphere 2. relate the formation of a range of landforms to physical and chemical weathering, erosion and deposition | | Students learn about the various rock types and how to distinguish between them.  Students learn about the structure of Earth and compare it to the known structure of Mars.  Students understand the different landforms and weathering, and apply this to mars for understanding is past and present.  Students apply knowledge to mars rover project and determine how they could equip it with tools/methods for determining rock types. |  |  |  |
| **WEEK 10** | | | | | | |
| **4.2.1** | Use of design folio to record and reflect on design ideas and decisions  Communication methods including  Written reports  Communication methods suitable for specific audiences including  users and clients  peers | Use a design folio to record and reflect on design ideas and decisions  Manipulate images with tools such as editing, resizing, Grouping, aligning and positioning  Communicate information appropriate to specified audiences | Evaluation: Develop evaluation Tool and conduct evaluation of Mars explorer build.  Complete e-portfolio work for AT1 ready for submission WK 10. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑8NA** | * Simplify algebraic expressions that involve multiplication and division * recognise the equivalence of algebraic expressions involving multiplication, eg (Communicating) * connect algebra with the commutative and associative properties of arithmetic to determine that and (Communicating) * recognise whether particular algebraic expressions involving division are equivalent or not, eg is equivalent to and , but is not equivalent to or (Communicating) | | **Project:** How Much Will my Rover Cost? Part 3: Students develop a range of combinations as “questions” for other students to solve.  **HW** Signpost 7 Ex 10:04, learning journal |  |  |  |
|  | 1. WS9 Students communicate by: 2. presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133, ACSIS148) LICT 3. using appropriate [text types](http://syllabus.bos.nsw.edu.au/glossary/sci/text-types/?ajax) in presentations, including a discussion, explanation, exposition, procedure and recount L 4. using a recognised method to acknowledge sources of data and information L 5. constructing and using a range of representations to honestly, clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databasesLICTEU 6. constructing and using the appropriate type of graph (histogram, column, sector or line graph) to express relationships clearly and succinctly, employing digital technologies as appropriate N | | Using Google Apps, students will collate data in the form of a scientific report. |  |  |  |

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| **Colonisation of Mars: Life in the bubble (10 Weeks Mixed Materials)** | | | | | | |
| **Outcomes** | **Content (Maths/Science)**  **Learn about | Learn to (Technology)** | | **Learning experiences** | **Evidence of learning** | **Adjustments and extensions** | **Rego**  **Sign/Date** |
| **WEEK 11** | | | | | | |
| **4.1.3**    **4.3.1** | Relationship of design to the areas of study of Built Environments, Products, and Information and Communications  Different design specialisations  **Materials** characteristics and properties of a wide range of materials such as metals polymers textiles timber the use of materials in traditional and non traditional ways | Identify relationships of design to each area of study  Describe the nature of each of the areas of study of Built Environments, Products, and Information and Communications  Identify a range of design specialisations relevant to each area of study  Experiment with combinations of a wide range of materials considering their characteristics and properties  Identify how materials have been used in innovative and non-traditional ways  Select and use a wide range of materials for the identified needs and opportunities of a design project | Unit Introduction  Safety Onguard Program  **Glossary:** Design Team, Collaboration, Criteria, Parameter, Factor Affecting Design, Design Specialisation, Sketch, Drawing, Experimentation, Testing, Resource.  **Design Specialisations Activity 1:** Built Environment   1. Architectural 2. Environmental 3. Interior 4. Landscape 5. Structural   Images to connect meaning  **(Literacy SS: Making Connections)**  Workshop Orientation  **HW:** *Technology by Design Text*Read Chapter 4pg 104-105 provided in Moodle.  **Assessment Task 2: Life in the Bubble STEM**  Task issued to students and explained.  Students directed to Moodle site where additional copies of task can be accessed from home electronically or downloaded and printed if lost.  Class Discussion: Mixed Materials   * What does it mean? * Selecting Appropriate Materials * Advantages and Disadvantages of materials. * Traditional Materials vs Emerging Materials. |  |  |  |
| **MA4‑1WM**  **MA4‑3WM**  **MA4‑8NA** | * Simplify algebraic expressions involving the four operations (ACMNA192) * simplify a range of algebraic expressions, including those involving mixed operations * apply the order of operations to simplify algebraic expressions (Problem Solving) | | Teacher-led instruction  Suitable worksheet    **HW** Signpost 7 Ex 10:05, 10:06, learning journal |  |  |  |
|  | **LW1 There are differences within and between groups of organisms; classification helps organise this diversity.**  **Students:**   1. identify reasons for classifying living things 2. classify a variety of living things based on similarities and differences in structural features. | |  |  |  |  |
| **WEEK 12** | | | | | | |
| **4.1.3**  **4.1.1**  **4.2.2** | Relationship of design to the areas of study of Built Environments, Products, and Information and Communications  Different design specialisations  Design processes including   * analysing needs, problems and opportunities * researching   Research methods needs analysis surveys and interviews searching techniques including use of the Internet | Identify relationships of design to each area of study  describe the nature of each of the areas of study of Built Environments, Products, and Information and Communications  identify a range of design specialisations relevant to each area of study  Identify needs and opportunities that require solutions in the areas of study  Use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project  Identify solutions to other similar needs and opportunities  Use the internet when researching | Design Specialisations Activity 2: Products   1. Accessories 2. Agricultural 3. Industrial 4. Fashion 5. Food 6. Jewellery   Images to connect meaning  **(Literacy SS: Making Connections)**  **HW:** *Technology by Design Text*Read Chapter 4pg 106-107 provided in Moodle.  Report:Designer's Task handed out and explained. **(Literacy: Report Text Type)**  Research:Respond to design brief by identifying need or opportunity for which a tangible solution can be designed and produced.   * Brainstorm Ideas * Complete needs analysis * Compile relevant information to inform design. |  |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑12MG** |  | | **Review Stage 3 Content:**  Units of Length  Perimeter of other special quadrilaterals    **Activity:** Students decide what they will need to take on a 2-1/2 year journey to Mars. Then plan how to fit everything into a 1 cu.m box, using only a measuring tape, pencil and paper. **Worksheet** here: http://spaceplace.nasa.gov/math-activities/en/    **HW** Signpost 7 Ex 9:01-02, Learning Journal |  |  |  |
|  | 1. outline the structural features used to group living things, including plants, animals, fungi and bacteria 2. explain how the features of some Australian plants and animals are adaptations for survival and reproduction in their environment | | Students research about the different living kingdoms and use microscopes to observe key differences  Apply knowledge to a selected Australian organism with adaptations that may make it suitable and useful for terraforming Mars |  |  |  |
| **WEEK 13** | | | | | | |
| **4.1.3**  4.2.2  **4.2.1** | Relationship of design to the areas of study of Built Environments, Products, and Information and Communications  Different design specialisations  Research methods   1. needs analysis 2. surveys and interviews 3. searching techniques including use of the Internet   methods used to generate creative design ideas including mind mapping brain storming sketching and drawing modelling | Identify relationships of design to each area of study  Describe the nature of each of the areas of study of Built Environments, Products, and Information and Communications  Identify a range of design specialisations relevant to each area of study  Use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project  Use the internet when researching  use a variety of methods to generate creative design ideas for each design project | **Design Specialisations Activity 3:** ICT   1. Communication System 2. Information System 3. Promotional 4. Software 5. Digital Media   Images to connect meaning  **(Literacy SS: Making Connections)**  **HW:** *Technology by Design Text*Complete Springboard activity Q’s 1-3 pg. 103 provided in Moodle.  Report:Designer's Task complete research in conjunction with library lesson outlined below.. **(Literacy: Report Text Type)**  **Research Skills:** Designer Assessment research lesson in library using librarian to teach library and internet research **(2 classes combined for collaborated lesson)**  Sketch: Produce 4 freehand sketches of ideas for your project.  Activity: Orthogonal drawing, set out, dimensioning, views.  Formal Drawing: Produce an orthogonal drawing of your selected design. |  |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑12MG** | compare perimeters of rectangles with the same area (Problem Solving)  solve problems involving the perimeters of plane shapes, eg find the dimensions of a rectangle, given its perimeter and the length of one side | | **Question:** Is random draw a suitable method to determine who gets what land in Mars? Play game Land Owner: Two dice rolled are the L and B of a rectangle Start from opposite corners of an A4 sheet and fill in adjacent land areas. Person with the most land area at the end wins.    **HW** Signpost 7 Ex 9:03-04, Learning Journal |  |  |  |
|  | **LW5 Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.**  **Students:**   1. construct and interpret food chains and food webs, including examples from Australian ecosystems 2. describe interactions between organisms in food chains and food webs, including producers, consumers and decomposers | | **Construct a terrarium project:** Students research and understand the interactions that happen within an ecosystem and design and create an ecosystem in a bottle and research how their design could be applied on Mars. |  |  |  |
| **WEEK 14** | | | | | | |
| **4.1.3**  **4.3.1** | The nature of the work of designers as individuals and as collaborators  The contributions of females and males who engage in design and technology  Materials characteristics and properties of a wide range of materials such as metals polymers textiles timber the use of materials in traditional and non traditional ways | Apply group work and collaborative strategies to project development  Identify the contribution the designer makes to the improvement of everyday life  Identify how materials have been used in innovative and non-traditional ways  select and use a wide range of materials for the identified needs and opportunities of a design project | **HW:** *Technology by Design Text*Complete Springboard activity Question 3 pg. 107 provided in Moodle.  Activity: Identify materials that could be used for project. Collect materials for project.   * Traditional * Non-Traditional * Traditional in non traditional ways * Upcycling/Recycling |  |  |  |
| **WEEK 15 & 16** | | | | | | |
| **4.1.3**  **4.2.1**  **4.1.2**  **4.3.1** | The nature of the work of designers as individuals and as collaborators  The contributions of females and males who engage in design and technology  Using ICTs to plan, develop and document design projects  Factors affecting design   * function * aesthetics * human form * scale * ergonomics * ethical * environmental * legislation including WHS * cost * socio-cultural * resource availability * physical and material properties * safety | Identify the contribution the designer makes to the improvement of everyday life  explore work and training opportunities for people who engage in design and  Use ICTs to communicate information including saving a document in various file types and storage locations from within the application  Use word processing features including page numbering and page breaks, find and replace, word count, spell check and thesaurus, columns and sections, inserting text/objects/images  Examine factors affecting design in the areas of study of Built Environments, Products, and Information and Communications  Describe the factors affecting design in the development of each design project  Evaluate the appropriateness of specific design solutions for different cultural groups including Aboriginal and Torres Strait Islanders and other Indigenous peoples | Designers Assessment Computer Lessons  Factors Affecting Design: *Technology by Design Text*Read &Complete Springboard activities pg. 108-109 in Moodle  Pairs Activity: Identify and Explain Factors that needed to be considered in the design of stimulus items.  Project Activity: Identify and explain three factors that will affect the design of your project. |  |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑12MG** | Find perimeters of parallelograms, trapeziums, rhombuses and kites (ACMMG196)   * the perimeters of a range of plane shapes, including parallelograms, trapeziums, rhombuses, kites and simple composite figures | | **Modelling**: Groups of 4 allocated a parallelogram, trapezium, rhombus or kite. Investigate the area formula (cut-outs provided). Redistribute groups so that one from each shape meets in a new group comprising one of each shape. Discuss.    **HW** Signpost 7 Ex 9:05, Learning Journal |  |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑12MG** |  | | **Project**: What will our pod look like? Part 1. Class determines parameters, and each student is to design living quarters that meet the criteria. Parameters should include minimum land area, a range of shapes, maximum perimeters etc    **HW** Work on project, Learning journal |  |  |  |
| **SC4-14LW** | relates the structure and function of living things to their classification, survival and reproduction | | **Construct a terrarium project:** Students research and understand the interactions that happen within an ecosystem and design and create an ecosystem in a bottle and research how their design could be applied on Mars. Students observer growth of ecosystems and collate data and observations about the biological interactions. Students manipulate abiotic and biotic features of terrarium and form valid test. |  |  |  |
| **WEEK 17** | | | | | | |
| **4.2.2** | Experimentation and testing of design ideas  Relationship of experimentation to success criteria  Research methods   * needs analysis * surveys and interviews * searching techniques including use of the Internet | Apply the results of experimentation to designing and making when developing each design project  Identify, interpret and evaluate data from a variety of sources  Use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project | **Experimentation & Testing:** In line with current technology specific content area setup and conduct an experiment.  Write up experiment using experimental procedure.  **Discussion:** Look at results of experiment and discuss how these inform design and how they are applied to design.  **Research Methods:** Activity other forms of research besides the internet. Questionnaires/Surveys, Interviews & Observation.  **Activity:** Create a survey using Google forms |  |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑12MG** |  | | **Project**: What will our pod look like? Part 2. Students calculate the perimeter and area of their pod. Students present their pod diagram for display.  **HW** Learning Journal |  |  |  |
|  | * explains how new biological evidence changes people's understanding of the world SC4-15LW | | **Construct a terrarium project:** Students research and understand the interactions that happen within an ecosystem and design and create an ecosystem in a bottle and research how their design could be applied on Mars. - continued data collections from various biotic and abiotic manipulations to determine their influences on the ecosystem. Student apply this data and knowledge to the Mars mission and produce a science report outlining what must be in place if we were to grow food on mars. |  |  |  |
| **WEEK 18** | | | | | | |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑15MG** | Solve problems involving duration, including using 12-hour and 24-hour time within a single time zone (ACMMG199)   * add and subtract time mentally using bridging strategies, eg from 2:45 to 3:00 is 15 minutes and from 3:00 to 5:00 is 2 hours, so the time from 2:45 until 5:00 is 15 minutes + 2 hours = 2 hours 15 minutes * add and subtract time with a calculator, including by using the 'degrees, minutes, seconds' button * round answers to time calculations to the nearest minute or hour * interpret calculator displays for time calculations, eg 2.25 on a calculator display for a time calculation means hours or 2 hours 15 minute | | **Pre-Test:** What do you know about time? 10 mins to demonstrate.    **Mini-Investigation:** How Old Am I? Students determine their age. Discuss why their ages differ according to orbit, and determine how large each orbit is in comparison to Earth.<http://curious.astro.cornell.edu/our-solar-system/planets-and-dwarf-planets/56-our-solar-system/planets-and-dwarf-planets/general-questions/227-how-can-i-find-my-age-on-another-planet-beginner>    Calculator instruction and exercises on calculating with units of time.    **HW** Signpost 7 Ex 9:06-07, Learning Journal |  |  |  |
| **SC4-14LW** | Cells are the basic units of living things and have specialised structures and functions. (ACSSU149)  Students: | |  |  |  |  |
| **WEEK 19** | | | | | | |
| **4.2.1** | Methods used to generate creative design ideas including   * mind mapping * brain storming * sketching and drawing * modelling * experimenting and testing   Communication methods including   * drawings, sketches and models * written reports * oral presentations * digital presentations | | Use a variety of methods to generate creative design ideas for each design project    Sketch, draw and model to aid design development | **Activity:** Sketch an Isometric view of a specified item related to the technology specific content.  **Discussion:** Scale – How and Why is it used.  **Activity:** Scale covert scale drawing to actual dimensions. **(Numeracy)**  **Activity:** Convert Isometric Sketch into and Orthogonal Drawing, (Top, Front and Side View) Dimension appropriately. |  |  |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑15MG** | Solve a variety of problems involving duration, including where times are expressed in 12-hour and 24-hour notation, that require the use of mixed units (years, months, days, hours and/or minutes) | | **SOLE Lesson:** Why do we have daylight savings? Would it be necessary on Mars? Or ... What time zones will be necessary on Mars?    **HW** Signpost 7 Ex 9:08, Learning Journal |  |  |  |
| **WEEK 20** | | | | | | |
| **MA4‑1WM**  **MA4‑2WM**  **MA4‑15MG** | Solve problems involving international time zones: compare times in, and calculate time differences between, major cities of the world, e.g. 'Given that London is 10 hours behind Sydney, what time is it in London when it is 6:00 pm in Sydney?' | | **Worksheet/**Google Earth: Interpret and use information related to international time zones from maps.  **Think Pair Share:** Would we need time zones on Mars?  **Clickview Vid** and **Worksheet:** International Time Zones.  **Debate:** Time is an outdated concept. On Mars, being a slave to the clock would not be necessary.  **HW** Signpost 7 Ex 9:09, Learning Journal |  |  |  |

**QUALITY TEACHING FRAMEWORK CODING**

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| **Intellectual Quality** | **Quality Learning Environment** | **Significance** |
| * Deep knowledge (DK) | * Explicit Quality Criteria (EQT) | * Background knowledge (BK) |
| * Deep understanding (DU) | * Engagement (E) | * Cultural knowledge (CK) |
| * Problematic Knowledge (PK) | * High Expectations (HE) | * Knowledge integration (KI) |
| * Higher Order Thinking (HOT) | * Social Support (SS) | * Inclusivity (I) |
| * Metalanguage (ML) | * Student’s self- regulation (SR) | * Connectedness (C) |
| * Substantive Communication (SC) | * Student Direction (SD) | * Narrative (N) |

**UNIT REGISTRATION/EVALUATION**

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| **Registration/Evaluation Questions** | **☺ Good • Ok ☹ Bad** | **Comment** |
| 1. Was the time allocated for the unit appropriate? |  |  |
| 1. Were the aims of the unit achievable? |  |  |
| 1. Do the unit outcomes adequately reflect the syllabus? |  |  |
| 1. Does the unit cater for a variety of student needs, interests and abilities? |  |  |
| 1. Does the unit include a variety of teaching and learning activities? |  |  |
| 1. Does the unit adequately integrate QT/Literacy/Numeracy/ICT strategies? |  |  |
| 1. Are the resources for this unit adequate? |  |  |
| 1. Are the assessment tasks/procedures adequate for this unit? |  |  |
| 1. Do the assessment tasks/procedures assess a range of knowledge and skills? |  |  |
| 1. Did you enjoy teaching this unit? |  |  |
| 1. Did the students enjoy learning throughout this unit? |  |  |
| 1. Were there opportunities for student reflection in this unit? |  |  |

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| **Teacher Comments:** |
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Teacher’s Initials: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Head Teacher’s Initials: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_