Rescue Me

Outcome Mapping for Rescue Me!		
Science	**TAS**	**Mathematics**
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 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 SC4-6WS Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually SC4-7WS Processes and analyses data from a first0-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions	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 4.2.2 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 (Electronics Technologies) 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project 4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project 4.6.1 applies appropriate evaluation techniques throughout each design project	Summary of ideas Angles – measuring and drawing angles (perpendicular and parallel lines, bisecting lines Measurement – converting units of measurement, speed Geometric shapes- 2D and 3D shapes Rates - relationship. Speed/Time/Distance Data - display, mean scores, range Outcomes MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols MA4-2WM applies mathematical techniques to solve problems MA4-3WM recognises and explains mathematical relationships using reasoning

Outcome Mapping for Rescue Me!		
Science	**TAS**	**Mathematics**
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	4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects	MA3-9MG selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length MA4-17MG A student classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles MA4-18MG A student identifies and uses angle relationships, including those related to transversals on sets of parallel lines MA4-7NA operates rates (speed) and explores graphical representation MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays MA4-20SP A student analyses single sets of data using measures of location and range

Project Description:

Design situation: **Scenario – Rescue Me**

A number of school students have been kidnapped and are being held in a house with no windows and soundproof walls. They have access to a recycling bin which includes many household items such as plastic bottles and cardboard boxes. They must construct some sort of conveyance which will be capable of sending a rescue message, which will be sent through a small gap in the wall. A guard walks outside the house to prevent the students from escaping. The students are hoping to send an SOS note that will coincide with the postman as he delivers mail to the letterbox. Needless to say, the note needs to make contact with the postman without the guard noticing - it must make the 10 metre distance in a very short period of time. (This distance may change depending on the criteria established by the students). This is the only hope the students have of escaping!

TAS will be involved in the design and construction of the rescue device. Science will test the design of the device and record data using measuring devices. The scientific method will be used to conduct a fair test resulting in credible and reliable results. In Maths, students will be involved in measuring angles, bisecting lines and angles, calculating speeds and displaying collected data.

Design brief:

Working as part of a collaborative team to complete the following:

1. Design and construct a car, powered by an electric toothbrush motor that satisfies a number of criteria determined by the class.
   Your task will involve designing a motorised conveyance from everyday materials.
   - Students explore variables such as shape, wheel sizes, lengths and width etc.
   - Students apply knowledge gained through research and experimentation to develop optimum speed and efficiency in the rescue vehicle, and produce a prototype for testing.
   - Students make decisions and explain principles based on mathematical evidence.
2. Design and construct a device to measure and display the output of electrical energy from your wind turbine.
   - Students explore variables in the design and construction of circuits to measure electrical energy.
   - Students apply knowledge gained through experimentation to develop a vehicle that will satisfy all of the design parameters, and solve the design problem in the best possible time in the most reliable manner.
   - Students explain principles based on mathematical evidence.
3. Use measuring devices to ascertain times and therefore most effective design.

Below are some suggested learning experiences contained within this sample unit of work mapped to the Learning across the curriculum *areas contained within the NSW Syllabuses. This is not an exhaustive list.*							
LITERACY	**NUMERACY**	**ICT CAPABILITY**	**CRITICAL AND CREATIVE THINKING**	**ETHICAL BEHAVIOUR**	**PERSONAL AND SOCIAL CAPABILITY**	**ASIA AND AUSTRALIA'S ENGAGEMENT WITH ASIA**	**SUSTAINABILITY**
• Write scientific reports • Write explanatory texts • Communicate using scientific terminology • Communicate using metalanguage • Write procedural texts • Write evaluation. • Read and follow instructions.	• Make measurements • Converts units of measure • Constructs perpendicular angles • Understand the relationship between speed, distance and time • Analyse data to identify trends • Construct graphs to represent data • calculates speed using distance and time, finding mean scores for trials	• Use data loggers (or smart devices) to gather experimental data • Use spreadsheets as a tool to perform calculations and create graphs • Use multi-media programmes to present presentation • Use CAD programmes to draw finished designs.	• Use thinking skills to complete group activities and open-ended tasks • Solve problems in order to complete a design brief	• Consider how the actions of people impact on the sustainability of systems • Ethical use of 3D printer	• Work together to participate in science investigations • Work together to participate in designing • Work together to participate in learning experiences		• Examine the multifunctionality of everyday materials • Develop a use for recycled materials to suit particular design problems.

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

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/

Stage 4 Technology (Mandatory) Area of Study: Products and Services Design Specialisation: Mechanism Design.			
Outcome:	**Students learn about:**	**Students learn to:**	**Teaching and learning strategies:**
4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects	• environmental and sustainability considerations	• identify ethical, social, and environmental and sustainability considerations relevant to each design project..	**Big Question:** ***How useful is recycling in our modern day environment?*** Discuss uses of recycling – consider life without, impact on society; direct and indirect uses. Define sustainability. Ensure understanding of renewable and non-renewable resources.
4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project	• Tools • specific tools relating to manufacturing technologies • Techniques • techniques such as cutting, drilling, and hot melt gluing. • risk management strategies • responsible behaviour in working environments • Work Health and Safety practices • the safe and responsible use of materials, tools and techniques in each design project • maintenance of tools and equipment	• manage risk when developing design projects • use tools, materials and techniques in a responsible and safe manner in each design project. • maintain tools and equipment including computer equipment	Students to run through tool specific safety instruction. • Students to learn names and uses of tools • Students to be given understanding of safe work processes, areas and techniques. • Students to be given an understanding of risk management strategies • Students to demonstrate knowledge of safe work processes by completing safety test.

Stage 4 Technology (Mandatory) Area of Study: Products and Services Design Specialisation: Mechanism Design.			
Outcome:	**Students learn about:**	**Students learn to:**	**Teaching and learning strategies:**
4.1.2 describes factors influencing design in the areas of study of products and services, mechanism design and Information and Communications	factors affecting design • function • aesthetics • environmental • resource availability	• examine factors affecting design in the areas of study of Built Environments	Define terms - invention/design, research and development. Discuss the many different types of Technology.
4.1.1 applies design processes that respond to needs and opportunities in each design project	design processes including: • analysing needs, problems and opportunities • establishing criteria for success • researching • generating creative ideas • communicating ideas • experimenting and testing ideas • risk management • managing resources • producing design solutions • evaluating ideas and • solutions	• establish a design process that responds to an identified need and opportunity • apply a design process when developing quality solutions • establish criteria for successful achievement of needs and opportunities • record design processes and decision making in a design folio • consider short-term and long-term consequences of design in the design process • identify needs and opportunities that require solutions	Introduce (or revise) the design process. Identify main steps. Discuss cyclical nature of design process, no definitive entry/exit points, documentation, design modification and development in response to research and testing, ongoing evaluation. Discuss the situation and design parameters of: RESCUE ME! • What can we do? • What can't we do? • What will we have to use? • What won't we have to use? • CRITERIA FOR SUCCESS AND FAILURE Students search for and identify products used in recycling, and the potential alternative uses for them. Introduction to CAD. Students work through a series of exercises to develop skills in the manipulation of tools and their uses Students begin • by sketching ideas for use of recycled parts to build a rescue vehicle. • students set up and begin folio in own folders on computer U drives.

Stage 4 Technology (Mandatory) Area of Study: Products and Services Design Specialisation: Mechanism Design.			
Outcome:	**Students learn about:**	**Students learn to:**	**Teaching and learning strategies:**
4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources	• experimentation and testing of design ideas • • relationship of • experimentation to success criteria • research methods • -needs analysis	• 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	Make connections with activities conducted in mathematics • discussions about symmetry, the shape of angles and measurements. Draw upon the experiments conducted in science to make informed decisions about variables: • use of scientific method to eliminate variables. • Students will learn about the cause and effect relationships of working mechanical systems. • They will also study materials requirements for various components of mechanical systems, such as shafts, bearings, springs, axles, levers and gears. • revisit criteria for success. • discuss speed, ratio's and rates ○ run practical tests on speeds ratio's and velocity • evaluate ○ revisit ratios and speed
4.6.1 applies appropriate evaluation techniques throughout each design project	• developing criteria for success as a tool for assessing design development and production • ongoing evaluation of design ideas and decisions • final evaluation considering - design process used - design solutions - reflection on learning	• apply criteria for success in decision making during the development of each design project • use criteria for success to reflect on the design process used and the solutions • evaluate prior to, during and at completion of each design solution • self-assess and peer-assess design solutions	

Stage 4 Technology (Mandatory) Area of Study: Products and Services Design Specialisation: Mechanism Design.			
Outcome:	**Students learn about:**	**Students learn to:**	**Teaching and learning strategies:**
4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects.	Materials/components • types and functions of common electrical components such as battery operated 'throw away items	• select and use electronic technology for a design project	• Discuss different methods of creating motion and attachments • Discuss methods for accurate measurements, such as photo-finish technology to reduce margins for error. • recording of evidence as construction is undertaken.
4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project	• skill development and refinement • relationship of quality solutions to needs and opportunities and the criteria for success	• practice and refine skills • apply a design process that responds to needs and opportunities • produce solutions reflecting quality standards appropriate to each design project	Part 2 of Design Brief- students evaluate and produce report: • discuss ways of improving and re-making their projects o redesign, retest. • students use video (previously used for timing) to measure success and to produce report for parents.

Stage 4 Mathematics	Topics: Angles, Geometrical Figures, Rates and Data	
Outcomes	**Content**	**Teaching and Learning Strategies**
MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols **MA4-2WM** applies mathematical techniques to solve problems **MA4-3WM** recognises and explains mathematical relationships using reasoning		
MA3-9MG selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length 	**Content:** Students • choose appropriate units of measurement of length and perimeter • record lengths and distances using combinations of millimetres, centimetres and metres • calculate the perimeter of shapes	**Big idea: students learn to measure accurately to provide good measurements and be able to compare versions of the design** - introduce accurate measuring devices and the inaccuracies of some - measure accurate distances to compare performance of devices
MA4-17MG A student classifies, describes and uses the properties of triangles and quadrilaterals, and determines congruent triangles to find unknown side lengths and angles 	**Content:** Students • classify triangles according to their sides and angle properties and describe quadrilaterals • Identify line and rotational symmetry • Investigate and determine lines of symmetry and the order of rotational symmetry of polygons, including special quadrilaterals	**Big idea: students learn the properties of shapes and the need to have accurate angles, and symmetry** - Use common conventions to mark equal intervals on their sketches - Label and name the shape of their design - Know the properties of their design - Ensure their design has symmetry as this will affect its performance

Stage 4 Mathematics	Topics: Angles, Geometrical Figures, Rates and Data	
Outcomes	**Content**	**Teaching and Learning Strategies**
MA4-18MG A student identifies and uses angle relationships, including those related to transversals on sets of parallel lines	**Content:** Use the language, notation and conventions of geometry • Define and label angles using common conventions • Recognise the geometrical properties of angles at a point • complimentary, supplementary and adjacent angles Identify, name and find straight angles, revolution, vertically opposite and angles embedded in diagrams	**Big idea: apply angle properties to design and determine the properties of their device allowing improved design after testing** - Naming convention and measuring angles - Students practise measuring angles using a protractor - Students use GeoGebra to investigate angle relationships. - Students investigate other successful devices online
MA4-7NA A student operates with ratios and rates, and explores their graphical representation	**Content:** Students solve a range of problems involving ratios and rates, with and without the use of digital technologies • Interpret and calculate ratios that involve more than two numbers • Solve a variety of real- life problems involving ratios • Convert information into a simplified rate e.g. 150 kilometres travelled in 2hours = 75km/h • Solve a variety of real-life problems involving rates, including problems involving speed which is rate of trave I	**Big idea: apply the concept of rate such as speed to observe, calculate and understand the speed of their device** - Introduce the concept of ratios, rates and speed - Investigate the ratio of the diameter of the wheels front to back - find the speed of each device, using the ratio distance/time by creating a start and finish line, students time how long it takes for the cars to travel the distance to the finish line

Stage 4 Mathematics	Topics: Angles, Geometrical Figures, Rates and Data	
Outcomes	**Content**	**Teaching and Learning Strategies**
MA4-19SP A student collects, represents and interprets single sets of data, using appropriate statistical displays 	**Content:** Students distinguish between types of data and how to collect and display this data - identify examples of different types of data - discuss differences in collecting data by census, sample or observation - analyse a variety of data displays - use spreadsheets for collection and display of data	**Big idea: determine the type of data they will be collecting and how to best display this data** - Practice using spreadsheets and making displays from this information on excel - Load data obtained from their trials with their devices and determine best type of graph to display the outcomes
MA4-20 SP A student analyses single sets of data using measures of location and range 	**Content:** Students calculate mean, medium, mode and range of data collected - calculate these measures of location and range from data represented in histogram, dot plots etc. - draw conclusions based on the analysis of data displays	**Big idea: use their knowledge of measures of location and range to analyse the data they obtain from their trails and then determine the most effective device with appropriate reasoning from the scenario of "Rescue Me"** - practice collecting data, displaying that in a frequency distribution table - analyse data and draw conclusions - make recommendations from this

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-4WS A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge a. identifying questions and problems that can be investigated scientifically b. making predictions based on scientific knowledge and their own observations	1.Identify the skills required by scientists to solve problems: question, discover, understand, compare, measure, observe, record, discuss, research, evaluate, plan, solve, discuss, and experiment. 2. Research and report on one Australian scientist.(Time restraints may not allow for this)	What is Science? What is a scientist? What are the skills of a scientist? Students need to become familiar with Science as a separate subject in high school. https://www.youtube.com/watch?v=de8OzOmUD7c Teacher challenges class to make the connection between the object the teacher has brought into class or what they are doing. E.g. teacher uses a mobile phone and the class may respond by saying science has made it possible for wireless communication, or teacher places their reading glasses on and the class may respond by saying that science has discovered the use of lenses to improve people's vision or the teacher suddenly experiences pain and they take out a packet of Panadol making the connection between analgesics and other medicines. This exercise demonstrates that a problem is being solved by Science. Problems don't get solved by themselves. They investigate and report on the work of one Australian Scientist. What problem were they trying to solve? How did they go about doing this? This activity can lead into the different strands of Science. (Time constraints may mean this activity is left to the end of the unit when the time needed to achieve meaningful research can occur. In this event the teacher may provide an example of an Australian Scientist that worked on solving a problem).

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-5WS A student collaboratively and individually produces a plan to investigate questions and problems **WS5.1** Students identify data to be collected in an investigation by: a. identifying the purpose of an investigation b. proposing the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources c. locating possible sources of data and information, including secondary sources, relevant to the investigation **WS5.2** Students plan first-hand investigations by: a. collaboratively and individually planning a range of investigation types, including fieldwork, experiments, surveys and research (ACSIS125, ACSIS140) b. outlining a logical procedure for undertaking a range of investigations to collect valid first-hand data, including fair tests	3. Identify the scientific method as a way of investigating a problem scientifically. 4. Identify the different sections of a scientific report. 5. Correctly identify independent, dependent and controlled variables in an experiment.	Students introduced to the scientific method. Teacher demonstrates a simple experiment, e.g. more bubbles form in hot water compared to cold water. This experiment is conducted as a demonstration with the teacher purposely making mistakes, such as, putting more water in one jar than the other, or shaking one jar more than the other. The students will hopefully respond that the teacher is not being 'fair'. The teacher can ask the following questions to get the students thinking about the purpose of conducting fair experiments and the consequences of not doing this. How do we make the experiment fair? What is the purpose of making an experiment fair? What are the consequences of not making an experiment 'fair'? **Variables** explained - any factor in an experiment that can cause an effect on the results. Independent, dependent and controlled variables introduced as necessary for the experiment to produce **valid** results. Prior to students conducting practical investigations the following skills are taught: ▪ safety rules in the laboratory ▪ correct use of equipment including the Bunsen burner ▪ scientific drawing skills of equipment and experimental set-ups. ▪ measuring devices used in science. e.g. stopwatches, thermometers, scales In doing this, the students are completing the same skills that the other Year 7 classes are completing that are not involved in the STEM project.

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
c. identifying in fair tests, variables to be controlled (held constant), measured and changed d. describing safety and ethical guidelines to be addressed  **WS5.3** Students choose equipment or resources for an investigation by: a. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies  b. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141) 		

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-6WS A student follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually Students conduct investigations by: a. collaboratively and individually conducting a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140) b. assembling and using appropriate equipment and resources to perform the investigation, including safety equipment c. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141) d. following the planned procedure, including in fair tests, measuring and controlling variables (ACSIS126, ACSIS141) e. recording observations and measurements accurately, using appropriate units for physical quantities f. performing specific roles safely and responsibly when working collaboratively to complete a task within the timeline g. assessing the method used and identifying improvements to the method (ACSIS131, ACSIS146)	6. Perform a scientific investigation safely using scientific equipment in the correct manner and adhering to laboratory safety rules. 7. Work collaboratively with other members in-group situations. 8. Record group information using a web based storage application such as O365. 9. Use appropriate units for data collected.	▪ Experiment: Students conduct and report on a simple experiment. ▪ Does water increase in temperature more than milk when heated for 5 minutes? ▪ Does a juice cup with the lid left on melt more than a juice cup with the lid removed? ▪ Does doubling the amount of water take twice as long to boil? ▪ Students would be provided with a suitable scaffold to complete the scientific report for this experiment. They cannot be expected at this stage to completely write a scientific report without some guidance. The partially completed scaffold provided will do this. ▪ Teacher checks the completed experiment scaffolds of the students and provides them with feedback on how to improve their written reports.

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-7WS A student processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions **WS7.1** Students process data and information by: a. summarising data from students' own investigations and secondary sources (ACSIS130, ACSIS145) b. using a range of representations to organise data, including graphs, keys, models, diagrams, tables and spreadsheets e. applying simple numerical procedures, e.g. calculating means when processing data and information, as appropriate	10. Evaluate the effectiveness of different design features based on a set of criteria.	To establish the above skills in the students it is estimated to take approximately two weeks. During this time the students will have been working on the design of the car in TAS. With the skills they have learnt in previous Science lessons students can now start designing an experiment to test their cars. They will need to identify the criteria whereby the cars will be judged. Students discuss the criteria in which the cars are judged. From the scenario of problem given to the students, they may select a number of criteria. Some of the criteria may include: ▪ fastest car to cover a set distance e.g. 20m ▪ car that fits through a set sized opening ▪ car that is able to carry a SOS note most securely and without getting wet ▪ car that is designed to be the most eye catching so that the postman is most likely to see it ▪ car able to negotiate uneven ground

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
WS7.2 Students analyse data and information by: a. checking the reliability of gathered data and information by comparing with observations or information from other sources b. constructing and using a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129, ACSIS144) c. identifying data which supports or discounts a question being investigated or a proposed solution to a problem d. using scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources (ACSIS130, ACSIS145) e. proposing inferences based on presented information and observations f. reflecting on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected (ACSIS131, ACSIS146)		Each criteria could be given a score from 1 to 5. Five being the score given to the group that demonstrates the best result for that criteria and one being given to the group that demonstrates the criteria to the least effect. If this is done for each criteria an accumulative score is achieved and the overall winner is determined. The class could discuss this method of judgement and others. Class discussion determines a common aim for the experiment. It may be something like, "To determine which group constructs a car that has the overall best score for meeting each of the criteria set." Using the scientific method, students use the cars they have constructed in TAS to test given criteria. Students determine the criteria to be tested and the data that needs to be collected to make a judgement as to how well the criteria was met by each group.

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-8WS A student selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems **WS8** Students solve problems by: a. using identified strategies to suggest possible solutions to a familiar problem b. describing different strategies that could be employed to solve an identified problem with a scientific component c. using scientific knowledge and findings from investigations to evaluate claims (ACSIS132, ACSIS234) d. using cause and effect relationships to explain ideas and findings e. evaluating the appropriateness of different strategies for solving an identified problem	11. Modify design of car to improve performance based on criteria.	Following each test session students evaluate the success of their trial and determine modifications to be made to their design for improved performance. Some modifications may be made in Science lessons while others that require certain equipment will be made in TAS.

Stage 4 Science	Topics: Safe Science & Working Scientifically	
Outcome	**A student should be able to:**	**Teaching/Learning strategies**
4SC-9WS A student presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations **WS9** Students communicate by: a. presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133, ACSIS148) b. using appropriate text types in presentations, including a discussion, explanation, exposition, procedure and recount d. 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 databases e. 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	12. Present project to an audience using assisted computer technology.	A final testing day will be determined to ultimately determine the overall 'winner'. Having an element of competition in the project provides the students with enthusiasm and a sense of competiveness that will hopefully provide a driving force for them to achieve the best possible toothbrush car for their group. They use measuring devices to collect and record data that they will tabulate in Maths. The tabulated data will then be graphically represented in Science and maths lessons. **NB. Students are expected to fail when designing their first toothbrush-powered car. They will be given two electric toothbrushes so a second car can be made using the information they collected from their first design.**

Rescue Me

Design situation:

Scenario – Rescue Me

A number of school students have been kidnapped and are being held in a house with no windows and soundproof walls. They have access to a recycling bin which includes many household items such as plastic bottles and cardboard boxes. They must construct some sort of conveyance which will be capable of sending a rescue message, which will be sent through a small gap in the wall. A guard walks outside the house to prevent the students from escaping. The students are hoping to send an SOS note that will coincide with the postman as he delivers mail to the letterbox. Needless to say, the note needs to make contact with the postman without the guard noticing - it must make the 10 metre distance in a very short period of time. (This distance may change depending on the criteria established by the students). This is the only hope the students have of escaping!!

TAS will be involved in the design and construction of the rescue device. Science will test the design of the device and record data using measuring devices. The scientific method will be used to conduct a fair test resulting in credible and reliable results. In Maths, students will be involved in measuring angles, bisecting lines and angles, calculating speeds and displaying collected data.

Design brief:

Working as part of a collaborative team to complete the following:

4. Design and construct a car, powered by an electric toothbrush motor that satisfies a number of criteria determined by the class.

   Your task will involve designing a motorised conveyance from everyday materials.

   - Students explore variables such as shape, wheel sizes, lengths and width etc.
   - Students apply knowledge gained through research and experimentation to develop optimum speed and efficiency in the rescue vehicle, and produce a prototype for testing.
   - Students make decisions and explain principles based on mathematical evidence.
5. Design and construct a device to measure and display the output of electrical energy from your wind turbine.
   - Students explore variables in the design and construction of circuits to measure electrical energy.
   - Students apply knowledge gained through experimentation to develop a vehicle that will satisfy all of the design parameters, and solve the design problem in the best possible time in the most reliable manner.
   - Students explain principles based on mathematical evidence.
6. Use measuring devices to ascertain times and therefore most effective design.

Common assessment:

Each team will produce a design folio documenting design, criteria for success, research, experimentation, production and evaluation.

- Design – sketches, photos, design modification, justification of design decisions and final design.
- Criteria for success – will be established early in the project and be used as an ongoing evaluation tool to monitor progress and determine success.
- Research – information from a range of sources used to make informed design decisions.
- Experimentation – testing car, making modifications, recording and presenting data
- Production – documentation from initial ideas to finished product (video, webpage)
- Evaluation – justification of decisions made to meet the need identified in the design brief.

Rubric: This is an example as assessment will vary depending on task and context.

Grade	Area	Criteria
A	Science	Demonstrates deep knowledge of the design features of a toothbrush powered car to satisfy set criteria. Clearly identifies all components of the scientific method. Analyses data from experiments and clearly presents findings using tables and/graphs. Clearly justifies decisions made to design and clearly evaluates. Communicates comprehensive understanding of scientific ideas, and related evidence for a particular purpose and audience. Works effectively as a safe, productive and enthusiastic team member.
	Technology	Works in a co-operative and co-ordinated manner in a group situation to solve design problems. Analyses data from research and experimentation and uses this to justify decisions when following a design process to produce an optimal vehicle design. Produces a vehicle which achieves all outcomes of the design brief with outstanding: speed, reliability quality, and finish. Demonstrates a deep understanding of the use of a design process to evaluate design through a well-documented design portfolio.
	Mathematics	Calculates ratios and rates, solves real- life problems involving ratios and rates, and converts information into a simplified rate. Define and label angles. Recognises the geometrical properties of angles at a point complimentary, supplementary and adjacent angles. Identifies straight angles, revolution, vertically opposite angles. Identifies properties of special quadrilaterals, line and rotational symmetry, determine lines of symmetry and the order of rotational symmetry of polygons. Displays data effectively and demonstrates understanding of measures of location and range Communicates mathematically, problem solves and reasons when justifying solutions to solve the problem.
B	Science	Demonstrates good knowledge of the design features of a toothbrush powered car to satisfy set criteria. Clearly identifies most components of the scientific method. Analyses data from experiments and presents findings using tables and/graphs. Clearly justifies decisions made to design and evaluates. Communicates good understanding of scientific ideas, and related evidence for a particular purpose and audience. Works effectively as a safe and productive team member.

Grade	Area	Criteria
	Technology	Works in a co-operative manner in a group situation to solve design problems. Evaluates data from research and experimentation and uses this to justify decisions when following a design process to produce a vehicle design which satisfies all criteria for design of the vehicle. Produces a vehicle which achieves all outcomes of the design brief with high: speed, reliability quality, and finish. Demonstrates a good understanding of the use of a design process to evaluate design through a well-documented design portfolio.
	Mathematics	Calculate ratios and rates, solves some problems involving rates or ratios. Define and label angles. Recognises the geometrical properties of angles at a point complimentary, supplementary and adjacent angles. Identifies straight angles, revolution, vertically opposite and adjacent angles. Identifies properties of special quadrilaterals, line and rotational symmetry, determine lines of symmetry and the order of rotational symmetry of polygons. Displays data well and demonstrates an understanding of measures of location and range Communicates mathematically for some strategies and describes solutions to solve the problem.
C	Science	Demonstrates a sound knowledge of the design features of a toothbrush powered car to satisfy set criteria. Identifies some components of the scientific method. Analyses data from experiments and presents findings using tables and/graphs. Shows some justification of decisions made to design and attempts to evaluate. Communicates good understanding of scientific ideas, and related evidence for a particular purpose and audience. Works effectively as a safe and productive team member.
	Technology	Works in a reasonable manner in a group situation to solve design problems. Uses data from research and experimentation and make decisions when following a design process to produce a vehicle design which satisfies criteria for design of the vehicle. Produces a vehicle which achieves outcomes of the design brief with sound: speed, reliability quality, and finish. Demonstrates an understanding of the use of a design process to evaluate their design through a design portfolio.
	Mathematics	Calculates simple ratios and rates. Defines and labels angles. Recognises some angle properties. Identifies straight angles, revolution, vertically opposite and adjacent angles. Identifies properties of special quadrilaterals. Determine lines of symmetry and the order of rotational symmetry of polygons. Can display data and applies knowledge of some measures of location and range Communicates the strategies used and describes a solution to solve the problem.
D	Science	Demonstrates a basic knowledge of the design features of a toothbrush powered car to satisfy set criteria. Identifies some components of the scientific method. Attempts to analyse data from experiments and attempts to present findings using tables and/graphs. Shows basic justification of decisions made to design and shows basic evaluation. Communicates good understanding of scientific ideas, and related evidence for a particular purpose and audience. Makes some contribution to the workings of the team.

Grade	Area	Criteria
	Technology	Works in a group situation to solve design problems. Uses data from research and experimentation and make when following a design process to produce a vehicle design which satisfies most of the criteria for design of the vehicle. Produces a vehicle which achieves some outcomes of the design brief with: Basic speed, reliability quality, and finish. Produces a design portfolio.
	Mathematics	Calculates some ratios and rates. Defines and labels some angles. Recognises some angle properties. Identifies some angles as straight angles, revolution, vertically opposite and adjacent angles. Identifies properties of some special quadrilaterals. Determine lines of symmetry and the order of rotational symmetry of some polygons. Can display data and analyse to a basic level. Communicates some information and shows the mathematics they are using to solve the problem.
E	Science	Demonstrates a limited knowledge of the design features of a toothbrush powered car to satisfy set criteria. With assistance identifies some components of the scientific method. Limited analysis of data from experiments and some attempt made to present findings using tables and/graphs. Shows limited justification of decisions made to design. With guidance communicates elementary understanding of scientific ideas. Makes some contribution to the workings of the team.
	Technology	Works ineffectively in a group situation to solve design problems. Works towards a vehicle design which attempts to satisfy the criteria for design of the vehicle. Works towards producing a vehicle which achieves some outcomes of the design brief with basic: speed, reliability quality, and finish. Works towards producing a design portfolio.
	Mathematics	Calculates some ratios and rates. Labels some angles. Recognises some angle properties. Identifies some angles as straight angles, revolution, and vertically opposite. Identifies properties of some special quadrilaterals. Determine some lines of symmetry and the order of rotational symmetry of some polygons. Poor data display and little data analysis evident. Communicates some information about the strategy used to solve the problem.