UNIT TITLE: STEM Rockets **LENGTH: Weeks 10** **YEAR: Stage 4** **CLASS: 7a and 7b**

Area of Study: Information and Communication

Design Specialization: Software

Technologies: Mixed Material

Background and Prior Knowledge: LRCS is a small Central School, Stage 3 students engage in Technology and ICT transition lessons in Term 4. Students participate in a Stage 3 transition program in Science over the duration of 40 weeks this assists them with working scientifically in the high school context. Students have a Year 6 curriculum understanding of mathematics and participate in Term 4 high school transition lessons.

Explanation/Outline: This is an integrated STEM unit of work and will be taught by 3 different teachers from each KLA, 4 periods per week over a 10 week term.

TAS: Students are required to design a H_2O rocket using one or two 1.25 litre plastic bottle. The rocket will require fins and a nose cone. The fins can be any length however will be a maximum of 70 mm in depth. The nose cone must fit onto the bottom end of the 1.25 litre container. The release mechanism to power the rocket will be a nito coupling. The external dimensions of the rocket must fit the internal dimensions of the rocket launcher. Students will also be required to save and document all learning activities in a folio. Students are required to log data in real time as they are testing their rockets and evaluate changes that need to be made to hit the target. Students will be required to redevelop their concepts, re-test and re-evaluate the outcomes based around the new design.

Maths: Students engage in working mathematically, critical and creative thinking to understand and explain the process of improvement of design, they measure, compare and use units to describe the measurement. Students gather data and find ways to format the information so that they can apply it to their designs. They use mathematical language and symbols to communicate their achievement and use rates and ratios to empirically assess improvement. Students will experience applications of design in indigenous contexts. Students use ICT including data logging and display equipment, database and presentation software, as well as other technology for measurement and design. Adjustments will be made to the concurrent mathematics program to allow further exploration of concepts generated in STEM.

Science: Students will learn about matter and the partial model, and will be required to apply and discuss these concepts in relation to their rocket. They will learn about forces and gravity and will be required to use this information to inform their design process. They will develop first hand investigation skills such as development and testing of a hypothesis, collection and analysis of data and modification of their investigation.

Outcomes:

TAS:

- 4.1.1 applies design processes that respond to needs and opportunities in each design project
- 4.2.1 generates and communicates creative design ideas and solutions
- 4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects
- 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project
- 4.5.1 applies management processes to successfully complete design project
- 4.6.1 applies appropriate evaluation techniques throughout each design project

Science:

- SC4-4WS A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge
- SC4-5WS A student collaboratively and individually produces a plan to investigate questions and problems
- SC4-7WS A student processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns, relationships, and draw conclusions
- SC4-16CW A student explains how model, theories and laws about matter have been refined as new scientific evidence becomes available
- SC4-10PW A student describes the action of unbalanced forces in everyday situations
- SC4-11PW A student discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformation

Maths:

- MA4-1WM a student communicates and connects mathematical ideas
- MA4-2WM a student applies mathematical techniques to solve problems
- MA4-3WM a student recognises and explains mathematical relationships using reasoning
- MA4-15MG a student performs calculations of time that involved mixed unis, and interpret time zones
- MA4-14MG a student formulas to calculates the volumes of prisms and cylinders, and coverts between units of volume
- MA4-18MG a student identifies and uses angle relationships, including the related to transversals on sets of parallel lines
- MA4-19SP collects, represents and interprets single sets of data using appropriate statistical displays

Assessment Items:

There will be one integrated assessment for the STEM project that will cover the Maths, Science and Technology outcomes. The Technology outcomes will be covered in the Folio, Safety and Build and Assembly aspects of the Assessment. Mathematics will engage with the measurement, volume, time, angles, rates/ratios and working mathematically outcomes. The Science outcomes will be covered in the matter, forces, gravity, and using the Scientific Method aspects of the Assessment.

Resources:
TAS: K12 lab, K11 workshop, Universal Laser System, 3D printers, Polypropylene, nito fittings, 1.25 pet bottles, rocket launcher, 600mm bottle launcher, water, bike pumps, folios
Maths: cameras, video recorders, calculators, measuring equipment, data recording sheets
Science: film canister, aspro tablets, Computer Labs, Science Lab, rulers, measuring taps, measuring cylinders

Quality Teaching					
Intellectual Quality		**Quality Learning Environment**		**Significance**	
IQ1 Deep Knowledge	IQ4 Higher Order Thinking	QLE1 Explicit Quality Criteria	QLE4 Social Support	S1 Background Knowledge	S4 Inclusivity
IQ2 Deep Understanding	IQ5 Metalanguage	QLE2 Engagement	QLE5 Students' Self-Regulation	S2 Cultural Knowledge	S5 Connectedness
IQ3 Problematic Knowledge	IQ6 Substantive Communication	QLE3 High Expectations	QLE6 Student Direction	S3 Knowledge Integration	S6 Narrative

Indigenous Perspective							
Story Sharing ✓	Community Links	Learning Maps	Non-Verbal ✓	Land Links	Non Linear	Symbols & Images ✓	Deconstruct Reconstruct ✓

General Capabilities: *(See Teaching and Learning Program to identify links to General Capabilities)*

Cross Curriculum Priorities

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

Syllabus Outcomes:

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/

Compressed Water and Air Rockets

		Mathematics	Science	TAS	
W	**L**	**Outcomes**	**Integrated learning experience**		**Notes, comments, adjustments, registration**
Week 1	Lesson 1	Students learn about: • experimentation and testing of design ideas • relationship of experimentation to success criteria Students learn to: • apply the results of experimentation to designing and making when developing each design project • identify, interpret and evaluate data from a variety of sources	Hook – Inquiry based learning activity. Students fly/launch basic bottle rockets (small groups of 3), friction release with bike pump pressure. Students are to establish the difference in flight heights in comparison to air and water ratios. Students log data in the field (online, clipboard or sheet) • that shows size of bottle (600mm coke) ml of water • air pressure achieved • estimated height • Student discuss any other variables Students complete results by end of lesson to use in science and maths.		
	Lesson 2	A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS WS4 Students question and predict by: a. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139) A student collaboratively and individually produces	Introduction to the scientific method - literacy based lesson. Students identify the question/ problem (aim) from the scenario (previous lesson). Students complete literacy activity for investigation - aim and method. Hand out scientific method activity - complete the stages. Have a student directed discussion around what each group discovered.		

		a plan to investigate questions and problems SC4-5WS 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 firsthand data, including fair tests 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	[Conversations about weight, air flow, design ideas, release mechanisms, aesthetics, volume of water to air ratio, conversation is designed to encourage excitement in the project and to get students discussing possible solutions to the variables]	

		perform the task, including safety equipment and digital technologies b. selecting equipment to collect data with accuracy appropriate to the task		
	Lesson 3	• MA4-1WM a student communicates and connects mathematical ideas • MA4-2WM a student applies mathematical techniques to solve problems • MA4-3WMa student recognises and explains mathematical relationships using reasoning • MA4-15G a student performs calculations of time • MA4-14MG a student calculates volumes, coverts between units • MG4-18MG a student identifies and uses angle relationships	Interpretation of results from previous lesson. Look at units of measurement, and implements for measuring. Time, mass, distance, volume and mass. Review events from the hook. Step 1. Comparative language in measurement -this is bigger than that -there is more or less in my bottle -quarters and halves -lines and marks to show comparison Step 2. Disseminating and transferring information. The need for units of measure: -students to construct units of measure WITHOUT SI units -group work then students report with their ideas Measurement: How did you measure how much was in the bottle? How did you measure distance/height? How much did the amount of water change the mass? Analyse strategies. Lead into standardised units. Accuracy of measurement. Discuss practical variables. [Have a student directed discussion around what each group discovered. Conversations in the field include measurement	

			of weight, aesthetics; volume of water to air ratio, conversation is designed to encourage excitement in the project and to get students discussing possible solutions to the variables.]	
	Lesson 4	Students learn about: • design processes including – analysing needs, problems and opportunities – establishing criteria for success -researching – communicating ideas Students learn to: • establish a design process that responds to an identified need and opportunity • apply a design process when developing quality solutions for each design project • establish criteria for successful achievement of needs and opportunities • record design processes and decision making in a design folio for each design project.	Design process – watch MP4 on the Engineering Design Process, jot down stages on the white board as they are demonstrated and discussed. Students discuss similarities and differences with scientific method. Hand out a blank copy of the Design Process that LRCS will be following, question students as to what happens first, the logical order of design, what is included, involved in each stage, why it is a cycle. Students to write their own design brief for the given situation (to design a rocket out of 1.25L PET bottles with fins and a nose cone that can be launched at a set psi and a set angle to land closest to the designated point).	
Week 2	Lesson 5	CW1 The properties of the different states of matter can be explained in terms of the motion and arrangement of particles. (ACSSU151) Students: a. describe the behaviour of matter in terms of particles that are continuously moving and interacting b. relate an increase or decrease in the amount of	Students are introduced to solids, liquids and gases - using context of pet bottle, water and air. Students discuss particle model - activity, student model (classroom S, hallway L, playground G), relate back to investigation.	

		heat energy possessed by particles to changes in particle movement identify the benefits and limitations of using models to explain the properties of solids, liquids and gases	Properties of S, L and G - students discuss properties, matching activity (literacy booklet)	
	Lesson 6	Students learn about: • resource availability including – time – money – materials, tools and techniques – human resources including skills and expertise – other resources Students learn to: • identify resource availability and apply realistic limitations to each design project Students learn about: • management techniques including action, time and budget planning Students learn to: • develop and apply action, time and budget plans in design projects	Time management – Students to create a GANTT chart in word or excel, teacher to lead the number of columns (11) and rows (30 to 40) required. Fill in the activity column and get students to plot when they think these activities need to happen in order to get the project finished in 10 weeks. • Design process • Design brief • Time management chart • Build release mechanism • Safety • Design development of nose cone • Design development of fins • CAD • 3d printing • Illustrator • Cutting and etching of fins • Build rocket • Test fly/launch rocket • Compete for accuracy • Re-design fins and nose cone for accuracy and distance • Test fly/launch rocket • Establish successful outcomes • Reflect and re-design fins and nose cone	

			• Find and use accurate tools for measurement • Geogebra for sketch of theoretical trajectories • Decide system for collection and analysis of experimental data • Display and analyse data • Write report and plan submission/presentation • Add scientific method process Discuss the requirements, limitations, learning, variables and possible outcomes of each stage as they are documented.	
	7	Students learn about: **Materials** • the use of materials in traditional and non-traditional ways Students learn to: • select and use a wide range of materials for the identified needs and opportunities of a design project Students learn about: **Tools** • specific tools related to materials appropriate to a design project • the function and safe use of a range of contemporary tools used for – measuring – marking out – cutting – construction Students learn to: • explore ways that tools can be safely used to achieve new results	Practical – students are to build the rocket release mechanism in their groups. Teacher to demonstrate drilling the hole in the centre of the bottle cap, location and application of the epoxy or silicone to the washers and cap, how to tighten the nito fitting and nut, storage and labelling of the completed component, then students are to build their own release mechanism. Safety test - handout for personal, machine and peer safety.	

		• select and safely use tools and equipment for a design project Students learn about: **Techniques** • traditional and non-traditional techniques used for – cutting – shaping a variety of materials – joining different materials – finishing Students learn to: • experiment with traditional and non-traditional techniques • select and use traditional and non-traditional techniques for the identified needs and opportunities of a design project		
	8	• MA4-1WM communicates and connects mathematical ideas • MA4-2WM applies mathematical techniques to solve problems • MA4-3WM recognises and explains mathematical relationships using reasoning • MA4-15G performs calculations of time • MA4-14MG Calculates volumes, coverts between units • MG4-18MG identifies and uses angle relationships	• Continue measurement from 'comparative' based to unit based. • Learn to use measuring implements accurately What makes them accurate Using measuring instruments. Meniscus on liquid volume, making sure of an accurate "zero". • Introduce but don't define the possibility of angle of trajectory as a factor in rocket launch • Learn to estimate, and measure angles. Geometry bisectors, of lines and angles etc.	
Week 3	9	PW1 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	Students learn about balanced and unbalanced forces using initial rocket investigation as context. Examples of forces, including push and pull. e.g. car, plane, ball - arrows used to depict forces, including net	

		forces are acting b. predict the effect of unbalanced forces acting in everyday situations c. describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, e.g. car safety equipment and Footwear design.	forces. Describe how forces affect objects. Introduction to aerodynamics/air resistance in reference to rockets - students discuss technologies to reduce air resistance - case studies of rockets with difference designs including nose and fin, changing rocket designs over time, students discuss in groups and present ideas.	
	10	Students learn about: • design processes including – analysing needs, problems and opportunities – researching – generating creative ideas – communicating ideas – managing resources – producing design solutions – evaluating ideas and solutions Students learn to: • establish a design process that responds to an identified need and opportunity • apply a design process when developing quality solutions for each design project • record design processes and decision making in a design folio for each design project. • evaluate design processes Students learn about: • risk management strategies • responsible behaviour in working environments • Occupational Health and Safety practices	Design – students to develop concepts for their fin and nose cone designs (free hand drawing, labelling, modelling). Shape, length, width, profile, thickness of material, weight of materials, stiff or flexible, cut out some out to size and shape, place on sample rocket and discuss possible changes. Testing of nose and fin designs using UTS Remote Labs NASA free Wind tunnel - Wind Tunnel app on iPad Safety – Onguard Safety, students to create username and login, go to STEM class and complete safety for 3d printer or laser cutter. Homework – discuss design ideas with	

		• the safe and responsible use of materials, tools and techniques in each design project • maintenance of tools and equipment Students learn to: • 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	parents/guardians/peers to establish other ideas, success/failure, design development	
	11	Students learn about: • risk management strategies • responsible behaviour in working environments • Occupational Health and Safety practices Students learn to: • manage risk when developing design projects Students learn about: • the safe and responsible use of materials, tools and techniques in each design project • maintenance of tools and equipment Students learn to: • use tools, materials and techniques in a responsible and safe manner in each design project. • maintain tools and equipment including computer equipment Students learn about: • design processes including – analysing needs, problems and opportunities	Safety – Onguard Safety, students finish what they didn't complete yesterday on the 3d printer or laser cutter. Design – further develop concepts for the fins and nose cone, students to discuss their findings from external input with their peers and come to a final concept. Groups are then to present their final designs to the class.	

		– researching – generating creative ideas – communicating ideas – managing resources – producing design solutions – evaluating ideas and solutions Students learn to: • establish a design process that responds to an identified need and opportunity • apply a design process when developing quality solutions for each design project • record design processes and decision making in a design folio for each design project. • evaluate design processes		
		• MA3-1WM describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions • MA3-2WM selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations • MA3-3WM gives a valid reason for supporting one possible solution over another • MA4-19SP collects, represents and interprets single sets of data using appropriate statistical displays	As modifications are made, how will we compare success? What measurements need to be made how will we make them? Who will make them? How will they be displayed? Buy in to process of working mathematically - collect information and analysing and describing data from live flights. • Write a list of variables which we can measure and test for. • Sketch data logging sheets and learn to transform to excel sheets.	
4	13	PW2 The action of forces that act at a distance may be observed and related to everyday situations. Students: e. identify that the Earth's gravity pulls objects	Discussion of forces to oppose gravity, including push forces e.g. thrust, fuel	

		towards the centre of the Earth (ACSSU118) f. describe everyday situations where gravity acts as an unbalanced force g. distinguish between the terms 'mass' and 'weight'	Students discuss water to air ratio and opposing gravity. Introduction to mass v weight.	
	14	Students learn about: • communication methods suitable for specific audiences including users and clients, technical experts, peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects Students learn to: • identify suitable materials, tools and techniques for each design project Students learn about: • skill development and refinement • relationship of quality solutions to needs and opportunities and the criteria for success for each	CAD – CREO go through how to find, set up in mm, working planes, how to draw a basic square, turn the square into a cube, edit the dimensions of the square, how to add and subtract surfaces and shapes to and from the cube, students to play/experiment with program, discovery learning and practice.	

		design project Students learn to: • practice and refine skills needed for design projects • produce solutions reflecting quality standards appropriate to each design project		
	15	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project	CAD – CREO, quiz students on how to open program, set up in mm, drawing a basic shape, editing shapes then get students to draw a basic circle, create a cone, and create a thickness from a solid shape, experiment with program.	

		• practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	16	MA4-18MG identifies and uses angle relationships, including those related to transversals on sets of parallel lines • Recognise the geometrical properties of angles at a point use the terms 'complementary' and 'supplementary' for angles adding to 90° and 180°, respectively, and the associated terms 'complement' and 'supplement' • use the term 'adjacent angles' to describe a pair of angles with a common arm and a common vertex, and lie on opposite sides of the common arm • identify and name right angles, straight angles, angles of complete revolution and vertically opposite angles embedded in diagrams • recognise that adjacent angles can form right angles, straight angles and angles of revolution	Launch angles. Measurement. Imagining (approximating) and constructing angles. Language of angles. Woomera & boomerang demonstrations.   Measure angle of bevel on boomerang, and other design features. Photograph and measure angles on woomera throw.	

Week 5	Lesson 17	A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS WS4 Students question and predict by: a. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139) A student collaboratively and individually produces a plan to investigate questions and problems SC4-5WS 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,	Pop top rockets (1st trial) with aspro and water - scaffold. What is our aim? (introduce variables using hook activity and pop top rockets as examples) What are our variables for this project? - controlled, measured and changed. How will we measure these variables? What equipment will we need? How will you carry out this investigation to achieve an aim? Literacy lesson.	

		ACSIS140) b. outlining a logical procedure for undertaking a range of investigations to collect valid firsthand data, including fair tests 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		
	Lesson 18	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including	CAD – draw up nose cone according to designs, save in the STEM folder/share point to be accessed for printing.	

		saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 19	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about:	CAD - draw up nose cone according to designs, save in the STEM folder to be accessed for printing. Start printing of some nose cones.	

		• using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 20	MA4-19SP collects, represents and interprets single sets of data, using appropriate statistical displays • define 'variable' in the context of statistics as something measurable or observable that is expected to change over time or between	Graphing of results using excel etc. Analysis of results and displays. Identify trends in data and relate theory to project for improved outcomes. Nature of data. Value of repetition and repeat-ability. Outliers. Analysis of graphical results of test flights and other	

		individual observations • Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes	experiments.	
Week 6	Lesson 21	SC4-11PW PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems a. students identify objects that possess energy because of their motion (kinetic) or because of other properties (potential) A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS WS4 Students question and predict by: a. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139) A student collaboratively and individually produces a plan to investigate questions and problems SC4-5WS 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	Energy: -Distinguish between kinetic and potential energy. (link back to pop top rocket 1st trial) 2nd trial pop top rockets - open ended, challenged based. - Energy transformations between different forms of energy. - Identifying changes that take place when particular forces are acting. Scientific method: What are we testing? How are we measuring? Can this experiment be improved? (class discussion) Record results and discuss findings as a class + compare with previous trial. Potential to write up formally.	

		needs to be collected in a range of investigation types, including first-hand and secondary sources 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 firsthand data, including fair tests 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		
	Lesson 22	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers	Illustrator – go through how to find, what to open, set up in RGB, 300 x 600, remove excess colours, set R to 255-0-0, set G to 0-255-0, set B to 0-0-0, save as, what each colour means, how to draw a curve, line, set line thickness, size shapes. Play/experiment with program.	

		Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		

	Lesson 23	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each	Illustrator – quiz students on opening and setup, draw a shape, draw an overlapping shape, how to add shapes, erase unwanted line, play/experiment with program.	

		design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 24	MA4-19SP collects, represents and interprets single sets of data, using appropriate statistical displays • 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	In this lesson students communicate mathematically, discussing the data displays created. Describing and reporting on accumulated data as well as trends.	
Week 7	Lesson 25	A student identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge SC4-4WS WS4 Students question and predict by: a. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139) A student collaboratively and individually produces a plan to investigate questions and problems SC4-5WS WS5.1 Students identify data to be collected in an investigation by:	Paper planes - focus on fin design, students replicate their fin and nose design onto paper plane, where possible. - Predict the effect of unbalanced forces, introduce drag and lift - equal and opposite reactions - motion of the paper planes and the opposing forces Scaffold design - students make same plane, move to fixing design. Scientific method: What are we testing? How are we measuring? Can this investigation be improved? (Class discussion) students will retest their plane to improve design.	

		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 firsthand data, including fair tests 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		
	Lesson 26	Students learn about:	Illustrator – Students draw up fins to size and shape,	

		• communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project	save in STEM folder to be accessed for cutting.	

		Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 27	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects	Illustrator – demonstration of cutting out completed fins on the laser. Students to finish drawing up fins.	

		Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 28	MA4-15MG a student performs calculations of time that involved mixed unis, and interpret time zones, a student: • manipulates, classifies and draws two-dimensional shapes • explain the difference between regular and irregular shapes • use computer drawing tools to construct a shape from a description of its side and angle properties • Identify and name parts of circles • create a circle by finding points that are all the same distance from a fixed point (the centre) • identify and name parts of a circle, including the centre, radius, diameter, circumference, sector, semicircle and quadrant	Describing shapes, circles, 2D shapes symmetry. Why? What effect will it have on design? Geogebra - construct shapes (fins and noses) Design, describing shapes, repeatable patterns, tessellations Geogebra. How to open. Construct, save shapes. Transfer to word or other documents. Angles created by constructed shapes	
Week 8	Lesson 29	CW additional content Students: • explain the changes in pressure of gases in terms	Pressure- What is it? Why is it important for our rockets? How did it work in the original investigation?	

		of increases or decreases in the frequency of particle collisions	How might the fitting create better pressure for our final investigation?	
	Lesson 30	Students learn about: **Materials** • the use of materials in traditional and non-traditional ways Students learn to: • select and use a wide range of materials for the identified needs and opportunities of a design project Students learn about: **Tools** • specific tools related to materials appropriate to a design project • the function and safe use of a range of contemporary tools used for – measuring – marking out – cutting – construction Students learn to: • explore ways that tools can be safely used to achieve new results • select and safely use tools and equipment for a design project Students learn about: **Techniques** • traditional and non-traditional techniques used for	Practical – final fitting of nose cones and fins to students rockets, ensure that everything fits in the launcher and the release mechanism works.	

		– cutting – shaping a variety of materials – joining different materials – finishing Students learn to: • experiment with traditional and non-traditional techniques • select and use traditional and non-traditional techniques for the identified needs and opportunities of a design project		
	Lesson 31	Students learn about: • communication methods suitable for specific audiences including – users and clients – technical experts – peers Students learn to: • communicate information appropriate to specified audiences Students learn about: • using ICTs to plan, develop and document design projects Students learn to: • use ICTs to communicate information including saving a document in various file types and storage locations from within the application Students learn about: • suitable materials, tools and techniques for	Testing – test rockets, students to log rocket weight, water volume, PSI, angle, distance and accuracy on Microsoft 365 excel. Conclude what settings are best for each different test.	

		design projects • skill development and refinement Students learn to: • identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects Students learn about: • relationship of quality solutions to needs and opportunities and the criteria for success for each design project Students learn to: • produce solutions reflecting quality standards appropriate to each design project		
	Lesson 32	• MA4-7NA a student operates with ratios and rates, and explores their graphical representation • Solve a range of problems involving ratios and rates, with and without the use of digital technologies (ACMNA188) • interpret and calculate ratios that involve more than two numbers • solve a variety of real-life problems involving ratios • use rates to compare quantities measured in different units • distinguish between ratios, where the comparison is of quantities measured in the	Analysis of results. What are or measurements telling us about speed. Calculations: Distance/time About acceleration? Can we calculate the acceleration of gravity? Discussion, guided exploration.	

		same units, and rates, where the comparison is of quantities measured in different units • convert given information into a simplified rate, solve a variety of real-life problems involving rates, including problems involving rate of travel (speed)		
Week 9	Lesson 33	A student processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions SC4-7WS WS7.1 Students process data & 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 spread sheets c. extracting information from diagrams, flowcharts, tables, databases, other texts, multimedia resources and graphs including histograms and column, sector and line graphs d. accessing information from a range of sources, including using digital technologies e. applying simple numerical procedures, e.g. calculating means when processing data and information, as appropriate WS7.2 Students analyse data and information by: b. constructing and using a range of	Analysis and graphing of results. Identify trends in data and relate theory to project for improved outcomes. Analysis and graphing of data. Internal analysis vs. comparison with previous tests.  EVALUATION Discussion of how scientific concepts manifested in their field testing. 	

		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) f. reflecting on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected (ACSIS131, ACSIS146)		
	Lesson 34	Students learn about: • 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 Students learn to: • 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	Re-development – each group can re-develop their fins, nosecone or both in order to achieve more accurate results. CAD, illustrator, printing and cutting. May only require some fine tuning of pre-existing hardware.	
	Lesson 35	Students learn about:	Re-development – each group can re-develop their fins,	

		• 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 Students learn to: • 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	nosecone or both in order to achieve more accurate results. CAD, illustrator, printing and cutting. May only require some fine tuning of pre-existing hardware.	
	Lesson 36	Preparation for presentation. Format of viva voce. How to prepare, what is required.	 Preparation for presentation.	
Week 10	Lesson 37	Preparation for presentation.		
	Lesson 38	Students learn about: • 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 Students learn to: • apply criteria for success in decision making during the development of each design project • use criteria for success to reflect on the design	Testing – test rockets, students to log rocket weight, water volume, PSI, angle, distance and accuracy on google apps excel. Conclude what settings are best for each different test. 	

		process used and the solutions • evaluate prior to, during and at completion of each design solution		
	Lesson 39	Students learn about: •final evaluation considering – design process used – design solutions – reflection on learning Students learn to: • evaluate prior to, during and at completion of each design solution	Final evaluations handout, re-design, reflections, student discussion regarding success, presentation of awards, folio submission.	
	Lesson 40		Assessment	