



BURWOOD GIRLS HIGH SCHOOL

Stage 4 STEM - YEAR 7 BALLISTICS CHALLENGE

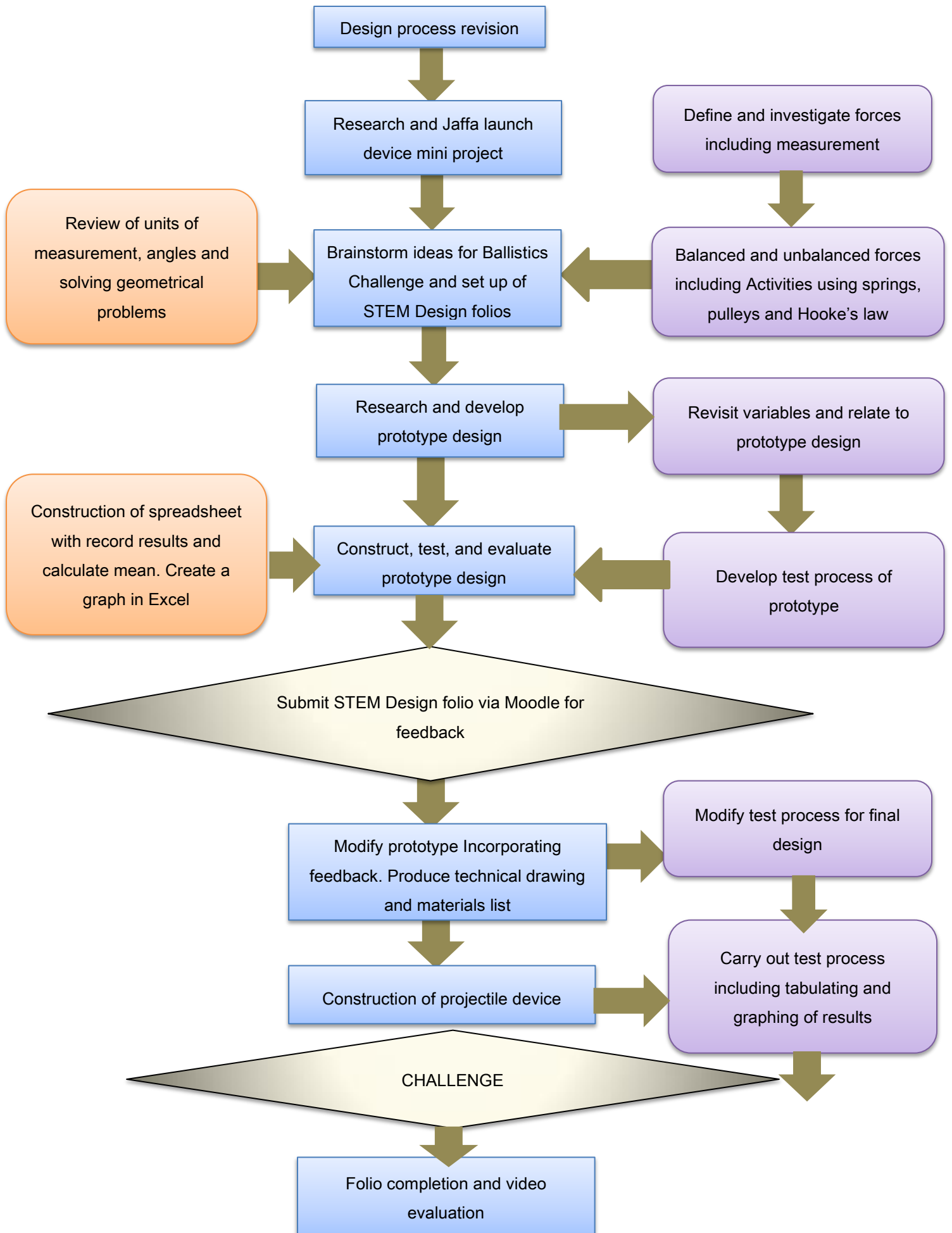
Summary	Duration
<p>"Ballistics - the science or art of designing and accelerating projectiles so as to achieve a desired performance."</p> <p>The Ballistic Challenge invites Year 7 students to work in teams to design, construct and test a device which can accurately deliver a projectile (e.g. squash ball) to a target. Teams will compete within classes for the opportunity to represent their class in an interclass celebration event held at the end of the project.</p>	<p>8 weeks Semester 2</p> <p>TAS – 4 periods / 2 week cycle SCIENCE – integrated into the unit across term 4 plus 4 science lessons for additional construction with TAS MATHEMATICS – integrated into unit across term 4 Each period is 60 minutes</p>
<h4>Background knowledge</h4>	
TAS	Completion of Outcome 4.1.1 in Terms 1, 2 or 3 within other Essential Technologies unit (Food Technologies, Textile Technologies)
Science	Completion of planning investigations and other skills activities in Terms 1, 2 and 3 within other content programs.
Mathematics	<p>Stage 3 Angles – measuring and constructing angles</p> <p>Completion of MA4-5NA during Term 2.</p> <p>Students in Stage 4 can be expected to have some prior knowledge of both dot plots and line graphs, as these types of graph are introduced in Stage 3.</p>
<h4>Syllabus Outcomes</h4> <p>The outcomes used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW . http://www.boardofstudies.nsw.edu.au/syllabus_sc/</p>	

Summary of syllabus outcomes	Overview
<p>Technology (Mandatory) 4.1.1, 4.2.1, 4.3.2, 4.5.2, 4.6.1</p> <p>Science SC4-4WS, SC4-5WS, SC4-6WS, SC4-7WS, SC4-8WS, SC4-9WS, SC4-10PW, SC4-11PW</p> <p>Mathematics MA4-4NA, MA4-1WM, MA4-2WM, MA4-3WM, MA4-19SP, MA4-20SP</p>	<p>Student teams will participate in the design process, prototyping creative solutions prior to construction of a full scale projectile launcher. Students will calibrate their device to understand and describe its performance, as the target distance will not be precisely disclosed until the day of the challenge.</p> <p>Students will work in groups of 3 or 4.</p> <p>Science KLA will introduce concepts of forces and energy in the context of science investigation methodology. Relationships between variables (such as release height vs distance etc.) will be described graphically.</p> <p>Maths KLA will develop measurement, scale, shape and graphical, statistical skills.</p> <p>TAS KLA will encompass design, materials and construction (timber, plastics). Students will be encouraged to develop creative solutions in the challenge which might employ a variety or combination of forces to accelerate the projectile.</p>
<p>General Capabilities: <i>(See Teaching and Learning Program to identify links to General Capabilities)</i></p> <p>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/</p> <p>The cross-curriculum priorities: <i>Aboriginal and Torres Strait Islander histories and cultures</i> 🏠 <i>Asia and Australia's engagement with Asia</i> 🌐 <i>Sustainability</i> 🌱</p> <p>The general capabilities: <i>Critical and creative thinking</i> ⚙️ <i>Ethical understanding</i> 🏛️ <i>Information and communication technology capability</i> 💻 <i>Intercultural understanding</i> 🌐 <i>Literacy</i> 📖 <i>Numeracy</i> 🧮 <i>Personal and social capability</i> 👥</p> <p>Other learning across the curriculum areas: <i>Work and enterprise</i> ⭐</p>	

Mathematics

TAS



Science




Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
2-3 2 x 75 min lessons	<p>TAS 4.1.1</p> <ul style="list-style-type: none"> applies design processes that respond to needs and opportunities in each design project <p>TAS 4.2.1</p> <ul style="list-style-type: none"> generates and communicates creative design ideas and solutions 	<ul style="list-style-type: none"> design processes including <ul style="list-style-type: none"> analysing needs, problems and opportunities establishing criteria for success researching generating creative ideas communicating ideas experimenting and testing ideas managing resources producing design solutions evaluating ideas and solutions methods used to generate creative design ideas including <ul style="list-style-type: none"> mind mapping brain storming sketching and drawing modelling experimenting and testing use of design folio to record and reflect on design ideas and decisions communication methods including drawings, sketches and models 	<ul style="list-style-type: none"> 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. consider short-term and long-term consequences of design in the design process evaluate design processes sketch, draw and model to aid design development 	<p>The Great Jaffa Challenge – to design and make a hand held device to launch a round object (Jaffa lolly) as far as possible.</p> <p>Teacher:</p> <ul style="list-style-type: none"> Revises the Design Process steps (ClickView – ‘Design – a Team approach’) Provides pictures of ideas to motivate student ideas (Moodle STEM Jaffa Challenge PowerPoint) Provide limited equipment for the challenge – 4 tongue depressors, 4 elastic bands, one plastic spoon. Revises evaluation using PMI (Plus, Minus, Improvements) Provides design brief and accompanying criteria including constraints on design development. Provides feedback and guidance to students on their choice of design/materials. Introduce design folios <p>Students:</p> <ul style="list-style-type: none"> Students work in groups of 4 to brainstorm an idea. A quick sketch should be completed of their design. Working in groups students have 30 minutes to produce a launching device, test and modify the device if needed. 	<p>Jaffa launcher sketch</p> <p>Constructed Jaffa launcher</p> <p>Videos taken of Jaffa Challenge</p> <p>Completed PMI</p>	

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		Content, A student: (Science/Mathematics)				Evaluation
	<p>TAS 4.6.1</p> <ul style="list-style-type: none"> applies appropriate evaluation techniques throughout each design project 	<ul style="list-style-type: none"> using ICTs to plan, develop and document design projects final evaluation considering <ul style="list-style-type: none"> design process used design solutions reflection on learning 	<ul style="list-style-type: none"> use criteria for success to reflect on the design process used and the solutions 	<p><i>Personal and social capability</i> 🧑🏫</p> <p><i>Numeracy</i> 🧮</p> <ul style="list-style-type: none"> Students test their design by competing against other class groups. Students evaluate their design using a PMI model. <p><i>Critical and creative thinking</i> ⚙️</p> <ul style="list-style-type: none"> Use the design folios via Moodle Research ideas/materials on the internet for their projectile tool. <p><i>Information and communication technology capability</i> 🖨️</p>		



Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
2-3 5 x 75 min lessons	<p>A student: SC4- 10PW</p> <ul style="list-style-type: none"> describes the action of unbalanced forces in everyday situations <p>SC4-6WS</p> <ul style="list-style-type: none"> follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually <p>SC4-9WS</p> <ul style="list-style-type: none"> presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations <p>SC4-7WS</p> <ul style="list-style-type: none"> processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions 	<p>PW1 Change to an object's motion is caused by unbalanced forces acting on the object. Students:</p> <ol style="list-style-type: none"> identify changes that take place when particular forces are acting predict the effect of unbalanced forces acting in everyday situations 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 <p>PW2 The action of forces that act at a distance may be observed and related to everyday situations.</p> <p>WS7.1 Students process data and information by:</p> <ol style="list-style-type: none"> using a range of representations to organise data, including graphs, keys, models, diagrams, tables and spreadsheets 		<ul style="list-style-type: none"> Define a force as a push or pull (Moodle Interactive PowerPoint – ‘Forces; ClickView – ‘Forces’ + worksheet) <p><i>Literacy</i> 📖</p> <ul style="list-style-type: none"> Carry out a series of activities with ping pong balls, straws, tennis balls etc. to identify forces (Moodle ‘Forces of Wonder interactivity) Identify the changes that take place when forces act on objects, e.g. change of speed, change in direction, change of shape (twists, turns, compressed) (ClickView and worksheet – ‘Balancing Forces’) Make and calibrate a force meter (Moodle – Measuring Forces activity) <p><i>Numeracy</i> 📊</p> <ul style="list-style-type: none"> Practice using spring balances to measure the size of forces in Newtons for a variety of simple contexts Classify forces as either ‘field’ forces or ‘contact’ forces (really, all forces are field forces!) Create team e-portfolio and set up shared file on Google Drive for group including teachers <p><i>Information and communication technology capability</i> 🖨️</p>	<p>Socrative Quiz share code SOC-18703323</p> <p>Constructed force meter</p> <p>Completion of BBC Bitesize Quiz “Forces”</p> <p>Google Doc visible for all members of team including teachers</p>	

Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
4-5 2 x 75 min lessons	<p>A student: TAS 4.2.1</p> <ul style="list-style-type: none"> generates and communicates creative design ideas and solutions. <p>TAS 4.2.2</p> <ul style="list-style-type: none"> selects, analyses, presents and applies research and experimentation from a variety of sources 	<ul style="list-style-type: none"> use of design folio to record and reflect on design ideas and decisions using ICTs to plan, develop and document design projects experimentation and testing of design ideas experimentation to success criteria research methods <ul style="list-style-type: none"> needs analysis surveys and interviews searching techniques including use of the Internet 	<ul style="list-style-type: none"> compose a design folio for a specific audience in electronic format including features such as tabs, indents, headers and footers, margins and line and paragraph spacing and using appropriate layout and graphic design use ICTs to communicate information including saving a document in various file types and storage locations from within the application apply the results of experimentation to designing and making when developing each design project use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project identify solutions to other similar needs and opportunities use the internet when researching 	<p>Teacher:</p> <ul style="list-style-type: none"> Provide ongoing feedback on final design ideas and assist in producing a materials list <p>Students in groups of 3 or 4:</p> <ul style="list-style-type: none"> Evaluate each of their 3 ideas in terms of PMI and discuss outcomes with their teacher. <p><i>Personal and social capability</i> </p> <ul style="list-style-type: none"> Groups to select a design and brainstorm materials needed. Produce a technical drawing that includes measurements and materials. <p><i>Numeracy</i> </p> <ul style="list-style-type: none"> Produce a materials list and share on Google Drive. 	<p>PMI created on Google Drive for each group and each member to have edited.</p> <p>e-folio update on Google drive including design and materials list</p>	

Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
4-5 5 x 75 min lessons	<p>A student: SC4-10PW</p> <ul style="list-style-type: none"> describes the action of unbalanced forces in everyday situations <p>SC4-7WS</p> <ul style="list-style-type: none"> processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions 	<p>PW1 Change to an object's motion is caused by unbalanced forces acting on the object. Students:</p> <ol style="list-style-type: none"> identify changes that take place when particular forces are acting predict the effect of unbalanced forces acting in everyday situations 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 <p>PW2 The action of forces that act at a distance may be observed and related to everyday situations</p> <p>WS7.1 Students process data and information by:</p> <ol style="list-style-type: none"> summarising data from students' own investigations and secondary sources using a range of representations to organise data, including graphs, keys, models, diagrams, tables and spreadsheets extracting information from diagrams, flowcharts, tables, databases, other texts, multimedia resources and graphs including histograms and column, sector and line graphs accessing information from a range of sources, including using digital technologies applying simple numerical procedures, e.g. calculating means when processing data and information, as appropriate <p>WS7.2 Students analyse data and information by:</p> <ol style="list-style-type: none"> checking the reliability of gathered data and information by comparing with observations or information from other sources constructing and using a range of representations, including graphs, keys and models to represent and 		<ul style="list-style-type: none"> re-introduce the concept of variables (Moodle PowerPoint – 'Variables') add forces to find the net force or sum of forces (Moodle worksheet – "Balancing Forces") Activity: use bench pulleys/mechanics pulleys on retorts to investigate masses connected by strings Carry out virtual activity on Hooke's Law, to model the assessment task and graph results. (Moodle link and worksheet) Carry out virtual investigation of effect of forces (Moodle Activity – 'Are all sports shoes the same?') 	<p>Completed Balanced Forces worksheet</p> <p>Hooke's Law written report including graphing of results</p> <p>Experimental Report on Sports shoes activity including graphed results submitted to Moodle</p>	

Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
		<p>analyse patterns or relationships, including using digital technologies as appropriate</p> <p>c. identifying data which supports or discounts a question being investigated or a proposed solution to a problem</p> <p>d. using scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources</p> <p>e. proposing inferences based on presented information and observations</p> <p>f. reflecting on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected</p>				
4-5 2 x 75 min lessons	<p>A student: MA4-4NA</p> <ul style="list-style-type: none"> Compares, order and calculates with integers, applying a range of strategies to aid computation <p>A student: MA4-19SP</p> <ul style="list-style-type: none"> Collects, represents and interprets single 	<ul style="list-style-type: none"> compare initial estimates with answers obtained by written methods and check by using a calculator recognise and describe the 'direction' and 'magnitude' of integers Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies use a calculator to perform the four operations with integers apply the order of operations to mentally evaluate expressions involving integers, including where an operator is contained within the numerator or denominator of a fraction, investigate whether different digital technologies, such as those found in computer software and on mobile devices, apply the order of operation define 'variable' in the context of statistics as something measurable or observable that is 	<ul style="list-style-type: none"> Cambridge Year 7 Chapter 10 ex 10B Cambridge Year 7 Chapter 2 ex 2B Finds the mean (average) of a set of measurements (Moodle activity – 'Finding the average of a spider thorax') Set up Google docs spreadsheet for collecting measurements and calculating average (Moodle Activity – 'Setting up a Google Spreadsheet to average results') <p><i>Information and communication technology capability</i> </p> <ul style="list-style-type: none"> Measures and classifies angles 	<p>Completed worksheet on Finding the average of a spider thorax.</p> <p>Google Spreadsheet on Google Drive for each student.</p> <p>Completed Worksheet Moodle: Angles and using a protractor</p>		

Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
	<p>sets of data, using appropriate statistical displays</p> <p>A student:</p> <p>MA4-2WM</p> <ul style="list-style-type: none"> Applies appropriate mathematical techniques to solve problems. <p>MA4-3WM</p> <ul style="list-style-type: none"> Recognises and explains mathematical relationships using reasoning <p>MA4-1WM</p> <ul style="list-style-type: none"> Communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols <p>MA4-20SP</p> <ul style="list-style-type: none"> Analysis single sets of data using measures of location, and range 	<p>expected to change over time or between individual observations</p> <ul style="list-style-type: none"> recognise variables as categorical or numerical (either discrete or continuous) identify examples of categorical variables (e.g. colour, gender), discrete numerical variables (e.g. number of students, shoe size) and continuous numerical variables (e.g. height, weight) (Communicating) use spreadsheets or statistical software packages to tabulate and graph data construct divided bar graphs, sector graphs and line graphs, with and without the use of digital technologies calculate the mean, \bar{x}, of a set of data using $\bar{x} = \text{sum of data values} / \text{number of data values}$ recognise that the mean is often referred to as the 'average' in everyday language (Communicating) use the statistical functions of a calculator to determine the mean for small sets of data (Problem Solving) use the statistical functions of a spreadsheet to determine the mean for large sets of data (Problem Solving) calculate the mean, \bar{x}, of a set of data using $\bar{x} = \text{sum of data values} / \text{number of data values}$ recognise that the mean is often referred to as the 'average' in everyday language (Communicating) use the statistical functions of a calculator to determine the mean for small sets of data (Problem Solving) use the statistical functions of a spreadsheet to determine the mean for large sets of data 				

Week	Outcome	Students learn about:	Students learn to: (Tech)	Integrated learning experiences	Evidence of learning and Assessment strategies	Register
		Content, A student: (Science/Mathematics)				Evaluation
		(Problem Solving).				
6-9 4 x 75 min lessons	<p>A student: TAS4.3.1</p> <ul style="list-style-type: none"> applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects 	<ul style="list-style-type: none"> characteristics and properties of a wide range of materials such as <ul style="list-style-type: none"> metals polymers textiles timber specific tools related to materials appropriate to a design project suitable materials, tools and techniques for design projects traditional and non-traditional techniques used for <ul style="list-style-type: none"> cutting shaping a variety of materials joining different materials finishing suitable materials, tools and techniques for design projects construction steps that contribute to a quality solution 	<ul style="list-style-type: none"> experiment with combinations of a wide range of materials considering their characteristics and properties select and use a wide range of materials for the identified needs and opportunities of a design project select and safely use tools and equipment for a design project experiment with traditional and non-traditional techniques practice and refine skills needed for design 	<p>Teacher:</p> <p>Demonstrates and assist students in the correct and safe use of specific tools such as saws, adhesives, drills, measuring tools used to complete the design project (ClickView: 'Hand Tools for Woodworking', 'Safety in the Workshop (2)', 'Practical Use of Materials – Plastics')</p> <p>Materials for project</p> <p>Tools – saws, miter boxes, drill/bits</p> <p>Student:</p> <ul style="list-style-type: none"> Employ specific tools and techniques safely and competently in the construction of their design project. Develop a series of construction steps for the completion of the design project. Construction of a projectile device that meets the criteria of the design brief. Evaluate their design project based on the success/performance of their projectile device following testing trials. Adjust their design as a result of graphing results. <p><i>Critical and creative thinking</i> </p> <p><i>Numeracy</i> </p>	<p>Video and photo footage of each construction stage saved to Google Drive STEM team folder</p> <p>Video evaluation completed and stored on Google Drive STEM team folder</p>	

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		Content, A student: (Science/Mathematics)				Evaluation
	TAS4.5.2 <ul style="list-style-type: none"> produces quality solutions that respond to identified needs and opportunities in each design project. 		<ul style="list-style-type: none"> projects apply a design process that responds to needs and opportunities for each design project produce solutions reflecting quality standards appropriate to each design project 	<ul style="list-style-type: none"> Develop a final Video Evaluation as part of their Design Folio. 		
6-9 4 x 75 min lessons	<p>SC4-10PW</p> <ul style="list-style-type: none"> describes the action of unbalanced forces in everyday situations <p>SC4-5WS</p> <ul style="list-style-type: none"> collaboratively and individually produces a plan to investigate questions and problems 	<p>PW1 Change to an object's motion is caused by unbalanced forces acting on the object.</p> <p>d. analyse some everyday common situations where friction operates to oppose motion and produce heat</p> <p>e. investigate factors that influence the size and effect of frictional forces</p> <p>WS5.1 Students identify data to be collected in an investigation by:</p> <p>a. identifying the purpose of an investigation</p> <p>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</p> <p>c. locating possible sources of data and information, including secondary sources, relevant to the investigation</p> <p>WS5.2 Students plan first-hand investigations by:</p> <p>a. collaboratively and individually planning a range of investigation types, including fieldwork, experiments, surveys and research (ACSIS125, ACSIS140)</p> <p>b. outlining a logical procedure for undertaking a range of investigations to collect valid first-hand data, including fair tests</p> <p>c. identifying in fair tests, variables to be controlled (held constant), measured and changed</p>		<ul style="list-style-type: none"> Define friction as a force that opposes motion (ClickView: Friction Scope 1 included worksheet) Investigate everyday situations where friction acts and identify them as useful or not e.g. - walking / running, tyres on road, braking, machine parts moving, body joints.... Activity: What is relationship between surface area and time for a parachute to fall? – air friction Investigate the nature of friction e.g. - by pulling shoes / objects on different surfaces (column graph here!) or different shaped objects in fluids (air/water) Use the results of the above activity to discuss how to increase or decrease friction in different situations – e.g. spikes, 	<p>Completion of worksheets in Moodle section 3 Contact forces including scientific reports on Air Resistance and Friction activities</p> <p>Construction of experimental design of testing of ballistics launcher including experimental report with variables identified results table and all other</p>	

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		Content, A student: (Science/Mathematics)				Evaluation
		<p>d. describing safety and ethical guidelines to be addressed</p> <p>WS5.3 Students choose equipment or resources for an investigation by:</p> <p>a. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies</p> <p>b. selecting equipment to collect data with accuracy appropriate to the task</p>		<p>treads, lubricants, ball bearings</p> <ul style="list-style-type: none"> Activity: Trial testing of final design construction including tabulating/graphing results across the distance range. <p><i>Critical and creative thinking</i> ⚙️</p> <p><i>Numeracy</i> 📊</p> <p><i>Personal and social capability</i> 👥</p>	<p>components of scientific report.</p> <p>Self-assessment completed by all team members against rubric on Moodle. Saved in Google Drive STEM team folder. Saving of report in Google Drive STEM team folder</p>	
10	1 x 75 min lessons + 1 x 40 min lesson	<p>Week 10</p> <p>FINAL CHALLENGE</p> <p>Periods 3 and 4, Tuesday Week B</p>		<p>Teachers:</p> <p>Determine final distances for projectile challenge and set up oval with target and distance markers.</p> <p>Class groups:</p> <p>Complete the challenge, with each group allowed a “best of 3” launch.</p> <p>Student:</p> <p>Peer assessment using Moodle guide. Feedback and comments from each teacher returned to each group via Google Drive and marking grid.</p>	<p>Video of launching</p> <p>Peer and Teacher assessment completed</p> <p>Submission of final portfolio/video evaluation for assessment from all teachers</p>	