DRAFT- STEM Stage 4 | Science, Technology (Mandatory), Mathematics | *Battlebots*

Summary	Duration
This unit of work is a team-based project where students engage in holistic STEM learning. Students will produce a battery-powered or tethered power source vehicle or *Battlebot.* Through a range of design, experimentation and testing procedures students are set the challenge of creating a *Battlebot* with a balance of velocity, durability and aesthetic features. Throughout the design, development and practical creation of the project student teams expand their knowledge of Science, Technology and Mathematics as they collaboratively improve and apply their content knowledge to practical problem-solving situations. To complement the hands-on practical mathematics and science applied in this unit, teams record their evidence of scientific testing, mathematical problem-solving and design successes and failures through the use of BYOD technology, culminating in the presentation of a three-minute video file highlighting their work throughout the unit.	Suggested time frame: 8 weeks

Teacher background information

This unit of work builds on knowledge and skills covered in early Stage 4 Science, Mathematics and Technology (Mandatory). Students should have experience using a process of design, tools, equipment, concepts and knowledge learnt in Science, Mathematics and ICT which will be reinforced and applied in the practical project. Students will have the opportunity to work collaboratively to design, test, manage and document their processes.

Teachers are encouraged to design and produce their own *Battlebots* to use as examples and in demonstrations to students throughout the project.

Students will work in groups to research, design, produce, document and present their *Battlebot*.

Final submissions could include the finished *Battlebot*, a documentation folio and a presentation video.

An example of a tethered power source and some project ideas can be found at http://poweranchorprojects.com/projects.

This is an example of how a STEM unit could be presented. The content in the unit is fluid and should be addressed as appropriate throughout the project.

Key inquiry questions	Vocabulary
• What factors can affect speed? • What happens when objects collide? • How can mathematics and science concepts assist in design solutions?	aesthetics, alignment, axle, circumference, collide, compression, , data, design, engineer, friction, modelling, orthogonal, radius, rotation, safety, skew, solder, solution, speed, symmetry, tension, vehicle, velocity

Outcomes

Technology (Mandatory):
Outcomes from the Technology Mandatory Syllabus
knowledge of and skills in researching, experimenting, generating and communicating creative design ideas and solutions
4.2.1 generates and communicates creative design ideas and solutions
4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources
knowledge and understanding of and skills in the responsible selection and safe use of materials, tools and techniques
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
knowledge of and skills in managing quality solutions to successful completion
4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project
understanding and appreciation of and skills in evaluating and reflecting on the success of their own and others' design activities
4.6.1 applies appropriate evaluation techniques throughout each design project

Science K–10 **Skills** 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 **Knowledge and Understanding** SC4-10PW describes the action of unbalanced forces in everyday situations **Mathematics K–10** **Working Mathematically** MA4-2WM: a student applies appropriate mathematical techniques to solve problems – problem solving **Number and Algebra** MA4-7NA operates with ratios and rates, and explores their graphical representation **Measurement and Geometry** MA4-12MG calculates the perimeters of plane shapes and the circumferences of circles

Content	Teaching, learning and assessment	Student diversity
Technology: **4.2.1 Generates and communicates creative design ideas and solutions:** Students- • Use methods to generate creative design ideas including - 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 - Written reports - Oral presentations - Digital presentations • Communication methods suitable for specific audiences including - Users and clients - Technical experts - Peers • Using ICTs to plan, develop and document design projects. **4.2.2 Selects, analyses, presents and applies research and experimentation from a variety of sources:** Students – • Conduct experimentation and testing of design ideas • Relate experimentation to success criteria • Use research methods such as - Needs analysis - Surveys and interviews - Searching techniques including use of the Internet	**Week 1 – Design brief presented, teams formed, lead roles established and Workplace Health and Safety addressed** **Design brief:** Design and produce a ***Battlebot*** to be tethered and raced around a power source on a circular track against your fellow classmates' *Battlebot*. You will need to engage in a series of learning and testing experiences to develop a *Battlebot* that balances the key features of velocity, durability and aesthetic beauty to win this challenge. While the fastest car may not always take out overall honours, your *Battlebots* must be able to withstand the impact when colliding with another vehicle to continue through the racing rounds. • Students form teams of 4 to produce their *Battlebot*, with each student accepting the lead role for one of the following positions – *lead designer, lead engineer, lead scientist* and *data/media manager*. While all students are encouraged to make holistic and collaborative contributions to the unit, one student needs to accept responsibility for each of the key roles. The *lead designer* is responsible for the graphical design work and aesthetic finishes, *the lead engineer* the practical production, *lead scientist* the research, experimentation and testing, and the *data/media manager* the collation and presentation of ALL of the team's work and data including the creation of the team's presentation video. • There are no limitations to what teams can create using imagination and creativity. The teacher will provide a range of resources including motors, propellers, wiring, wheels and axles. However, the experimentation, selection and use of alternative materials is greatly encouraged! The only limitations with this unit of work include adhering to and considering all mandatory Workplace Health and Safety requirements in both the development of and completion of the *Battlebot*, and ensuring the *Battlebot* travels in the appropriate counter-clockwise direction and efficiently connects to the tethered lines and power source. • Students are provided with an outline to the range of tools, techniques and equipment to be used in the production of their *Battlebots*. Specific demonstration of relevant machinery and processes should occur throughout the unit. • WHS (Workplace Health and Safety) – students are required to complete mandatory safety tests relevant to this unit of work, including the use of the battery drill, drill press, heat gun, hot glue gun, soldering irons, disc sander, and woodworking and metalworking hand tools. • Teacher provides students with research and investigation time. Student teams collaborate to identify the purpose of their investigation. With teacher guidance students are encouraged to explore primary and secondary research methods to collect data and inspiration for their *Battlebot* design ideas.	Alternat, each student could complete this unit of work as an individual project OR as a team producing multiple battlebot prototypes, pending resource availability and teacher direction of the unit.

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4.3.2 Demonstrates responsible and safe use of a range of tools, materials and techniques in each design project. Students use – • Risk management strategies • Responsible behaviour in working environments • Workplace Health and Safety practices • Materials, tools and techniques in each design project safely and responsibly **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:** Students use – • Types and functions of common electronic components such as diodes, resistors, capacitors, switches and batteries • Specific tools relating to electronics technologies • Contemporary tools used for - Cutting - Marking out and measuring - Construction including soldering irons • Machine tools including drill press • Techniques such as - Soldering - Drilling - Cutting • Methods of production of circuits and circuit boards **Graphics Technologies:** Students use– • The range, suitability and use of materials, resources and data types according to industry standards for example, AS1100 • The features of common graphic data types • Specific tools relating to graphics technologies • The function, selection and correct use of a range contemporary tools used for - Marking out and measuring - Construction - CAD and 3D modelling - Simple drafting including multi-view drawing - CAD/paint/draw software - Rendering to enhance communication - Editing a graphic for use in a publication - Printing technologies - Industrial production methods **Information Technologies:** Students use – • The range, suitability and use of data types including hypertext • The internet as a source of information • Software including presentation, draw and paint, word	• Based on the initial research and investigation, teams develop thumbnail sketches with initial dimensions included to identify perimeter, wheel circumference and the various geometries of the components that will make up their *Battlebot* designs. **Resources required** • School/faculty's standard WHS system for demonstration and training of relevant tools, equipment and specialist quality learning environments • Sample Battlebot • Drawing activities. ***Assessment*** • *Informal assessment of student engagement in group formation* • *Adherence to/completion of mandatory WHS demonstrations and training requirements* • *Verbal feedback provided based on student research and thumbnail sketches.* **Week 2 – Design factors, material properties, conceptual design and engineering drawings** Using existing Battlebot designs and available battery/power sources, practical demonstrations are conducted to test the velocity and durability of existing successful designs. Teacher poses the following questions to students for consideration and discussion; ▪ Why doesn't the *Battlebot* start when the switch is on? ▪ Why are some *Battlebots* faster than others? ▪ What causes some *Battlebots* to divert off the track? ▪ Why do some *Battlebots* 'drift'? ▪ What is going to happen when the two *Battlebots* collide? ▪ Why do some *Battlebots* become 'airborne' and what force keeps them touching the floor? ▪ What do the formulas F=ma stand for? Based on the responses to these questions, teacher leads discussions linking these STEM situations to real-life examples. • Students need to complete three PINE (Positive, Interesting, Negative, Evaluation) analyses on existing designs. As part of this testing and evaluation, teams need to estimate the velocity in metres per second outline the product's features that improve durability, and identify positive aesthetic features. To accurately estimate velocity, students will need to explore the concepts of radius, diameter, circumference and π to determine the circumference of the race track. • Teacher also leads discussion for students to question the efficiency of the wheel and axle systems, briefly exploring the concepts of friction, co-efficient of friction and strategies for reducing friction in working components. **Resource: Online video explaining 'friction'** • Teacher leads demonstration on producing high-quality rendered design concepts featuring 3D drawing, texture/colour, black outline, shadow, annotations, dimensioning, background, border, product name and designer/team name. • In conjunction with the previous testing activity and teacher demonstration, teams need to conduct research to help shape their team's design. • Each team member should create one conceptual design sketch each, with four different design concepts presented for consideration. Students collaborate to select their preferred design. The final conceptual design should be presented to a high quality, featuring 3D drawing, texture/colour, outline, shadow, annotations, at least three dimensions, background, border, product name and a team name. • Students are introduced to the basics of orthogonal projection and drawing standards. Students complete a basic third angle projection task with the team required to produce one quality orthogonal drawing of their intended design including a FRONT VIEW, TOP VIEW and RIGHT	Students may use (and modify) the teacher template provided. Students may choose to CAD model an entire battlebot OR design a specific component to be 3D printed or machined using CNC technology. Students may also elect to produce a series of jpeg images and/or prints to include in their folio/presentation. Students/teachers may elect to utilise a relevant CAD package to produce orthogonal drawings of CAD models.

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processing, databases and spreadsheets • A range of input and output tools including - Printer - Scanner - Storage devices • Information processes - Collecting - Organising - Analysing - Storage and retrieval - Processing - Displaying **Mixed Material Technologies:** Students use – • The characteristics and properties of a wide range of materials such as: - Metals - Polymers - Textiles - Timber • Materials in traditional and non-traditional ways • 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 • Traditional and non-traditional techniques used for - Cutting - Shaping a variety of materials - Joining different materials - Finishing **Science:** **Skills – Working scientifically** **SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge** WS4 Students question and predict **SC4-5WS collaboratively and individually produces a plan to investigate questions and problems** WS5.1 Students identify data to be collected in an investigation WS5.2 Students plan first-hand investigations WS5.3 Students choose equipment or resources for an investigation **SC4-10PW describes the action of unbalanced forces in everyday situations** PW1 Change to object's motion is caused by unbalanced forces acting on the object (ACSSU117)	HAND END VIEW. • Teacher leads demonstration on basic CAD modelling techniques using the school/faculty preferred package. • Teacher demonstrates creating and saving a file, X, Y and Z planes, sketching, extrusion, cut outs, rounds, chamfers and applying colours to surfaces. • The team produces ONE basic computer aided design PART file concept to complement their conceptual design sketches and rendering. • Teacher leads the demonstration of a range of materials and their basic properties (compression, tension, mass, bending, torsion, durability, etc.), with students conducting THREE explicit tests using the scientific experiment report (Experiment title, Aim, Method, Results, Application of Conclusions). • Teacher leads students to identify questions and make predictions of how a range of materials will react when forces are applied to them. **Resources required** • Examples of existing product design conceptual renderings • Orthographic projection task sheet • A range of materials samples (metal, timber and polymer). ***Assessment*** • *Informal assessment of student/team designs with feedback provided for possible improvements. Tests, drawings, equations and analysis documents produced.* **Week 3 – Appropriate use of technology to record and present information and the commencement of practical production** Assignment presented to students. • The use of BYOD technology to record progress throughout design, testing and manufacture is emphasised, with students encouraged to photograph their work and record practical design and testing activities. Students may use applications available on school desktop computers. However, they are encouraged to use one of a range of BYOD-friendly web or app-based technologies on their relevant device(s). Discussions around appropriate and acceptable use of recording devices are revised during this task. • Understanding image file creation, saving, storing and transfer. Discussions and demonstrations associated with the methods of saving and transferring image and video files are addressed as per school/faculty/teacher policy. Based on the information and resources provided, students develop the most appropriate solution for storing and transferring files for later collation and presentation. • Chassis construction. Multiple methods for creating the chassis of a *Battlebot* are demonstrated to students, including the 'traditional' framed construction, using a 'block' to shape and form and recycling/upcycling existing materials/objects. A range of MMC (Measure, Mark and Cut) methods are demonstrated, based on the range of materials and tools used. • Student teams identify questions and problems as they arrive through the early stages of the *Battlebot's* production. Students record their ongoing evaluation, predictions, observations and testing for inclusion in their presentation assignment. **Resources required** • Students are encouraged to bring in creative resources and materials. The teacher may provide students with 6x12mm radiata pine, or similar materials. • Hot glue, hot glue guns, PVA and other joining consumables are required. **Week 4 – Related mathematics, mass, force and geometry through scientific practical testing** Teacher leads a demonstration on understanding centre of mass and its importance in relation to the	Teacher may elect for the assignment component of this unit to be an individual student task (as opposed to a team requirement). Teacher may elect to facilitate the design and creation of battlebots using CAD and CNC technology .

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Students: - 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, for example, car safety equipment and footwear design PW2 The action of forces that act at a distance may be observed and related to everyday situations. Students: - Identify that the Earth's gravity pulls objects towards the centre of the Earth (ACSSU118) - Describe everyday situations where gravity acts as an unbalanced force - Distinguish between the terms 'mass' and 'weight' PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes changes within systems. (ACSSU155) Students: - Relate electricity with energy transfer in a simple circuit - Construct and draw circuits containing a number of components to show a transfer of electricity **Mathematics:** **Working Mathematically** MA4-2WM: a student applies appropriate mathematical techniques to solve problems – problem solving **Numbers and Algebra** **MA4-7NA Operates with ratios and rates, and explores their graphical representation** Students: • Recognise and solve problems involving simple ratios (ACMNA173) • Solve a range of problems involving ratios and rates, with and without the use of digital technologies (ACMNA188) • Recognise concepts such as change of speed and direction in distance/time graphs **Measurement and Geometry** **MA4-12MG calculates the perimeters of plane shapes and the circumferences of circles** Students: • Find perimeters of parallelograms, trapeziums, rhombuses and kites (ACMMG196) • Investigate the relationship between features of circles, such	production of a successfully functioning *Battlebot* (as well as many other functional products in society). **Resource: Online video of 'Kids demonstrating what centre of mass is'** • Identify that the Earth's gravity pulls objects toward the centre of the earth • Distinguish between the terms mass and weight • Describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life • Using existing designs and their developing *Battlebot,* students use a straight edge to balance the *Battlebots* on an axis to estimate where the centre of mass is positioned. These experiments help students to determine the most appropriate position for their motor and where the tethered wires will be attached. • Teacher leads demonstration on understanding forces of tension and compression. Students are introduced to the associated forces applicable to racing a *Battlebot* around a power source, including the force of compressing the alligator clips to connect the wiring, of tension in the wires anchoring the *Battlebot* to a power source which is generated by the *Battlebot's* velocity (F=ma) and in the various components of the *Battlebot* upon collision with another *Battlebot.* To further understand these forces, students are asked to play the game at the following link. An interactive game for kids to understand forces. http://www.wonderville.ca/asset/forces-of-wonder **Resources required** • https://www.wisc-online.com/learn/natural-science/physics/tp1502/construction-of-free-body-diagrams ***Assessment*** • *No formal assessment during this week; however, evidence of testing design solutions and free body diagrams MUST be documented and collated for presentation in the team's folio/assignment* **Week 5 – Joining methods and manufacturing using appropriate geometrical and mathematical calculations to ensure tolerances and quality** Teacher leads a collaborative discussion regarding measurements, angles and maths in design and engineering. The progress of student work is presented as the basis of this demonstration to emphasise the importance of accurate geometry in the design and production of a quality product. Citing examples of tolerance in a range of designed products in society, students discuss the difference between product qualities. Refer to design tolerances in vehicles as a suggested point of reference. http://dictionary.sensagent.com/ENGINEERING%20TOLERANCE/en-en/ • With reference to student projects, the teacher demonstrates the most appropriate measurement techniques and tools to ensure accurate dimensions of components, marking out of holes for axles and the creation of desired angles for functional design. Students continue with the practical application of maths in the production of their *Battlebots.* • Teacher leads demonstration on understanding joining methods. A range of joining methods are presented and demonstrated to students. • Discussion around the positives and negatives for using a range of adhesives and fixing components are addressed and demonstrated. • Common joining methods include screws, PVA, hot glue, gusseting, press fits. Students join the components to form the chassis and body of their B*attlebot*. • Teacher leads demonstration of aligning axles, friction and symmetry. Using existing designs as examples, teacher leads discussion on the consequences of axle holes created out of alignment.	Teacher may elect to lead students in the creation of various scaled templates and jigs to aid accuracy/tolerance in the production. Teacher may also lead the opportunity for students to research and present a case study comparing two similar products, comparing and evaluating the similarities and differences between a product with lower and higher tolerances in design. Axle and wheels may be provided in any number of formats. Bamboo skewers are ideal for 3mm axles, wheels may be designed, cut and 'mass produced' in the school workshops using a selected material OR commercial kits from various sources.

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as the circumference, radius and diameter; use formulas to solve problems involving circumference (ACMMG197)
• Demonstrate that the angle sum of a triangle is 180º and use this to find the angle sum of a quadrilateral (ACMMG166)
	• “What other limiting factors will affect the performance of the wheel system in your design?”
	• Teacher leads students to the concepts of friction between the axles and the chassis, wheels and the surface, and the force created from mass above the wheel axis.
	• This discussion then leads on to the importance of symmetry and the importance for equal dispersion of mass on the left and right-hand sides of the *Battlebot.*
	• Students continue with practical production, aligning axles and fitting the wheel system to their design.
	• Students engage in the following online quiz, answering friction questions.
	• Resource: Online video on ‘types of friction’
	Link to online quiz about friction http://www.physics4kids.com/extras/quiz_motion_friction/
	• Teacher leads practical activity demonstrating manufacturing tools and techniques.
	  - Throughout the production of student projects the teacher leads demonstration in the SOP (Safe Operating Procedure) for each process, including the use of a range of wood-working and metal-working hand tools, model-making tools, light machinery, power tools and general workshop safety.
	  - Teacher records these demonstrations using school/faculty/teacher designated policy. Note: This WHS occurs throughout the design and production process.
	Resources required
	• Axles, wheels, motors, propellers.
	Assessment
	• *Ongoing assessment of the group’s practical application of mathematical principles in practical production ensuring high tolerance levels and quality.*
	
	Week 6 – Factors affecting design; aerodynamics, friction, forces, power and electricity
	Teacher leads demonstration on understanding aerodynamics and airflow, using student designs and the link below to demonstrate aerodynamic features and methods of controlling airflow.
	• The use of diagrams featuring student designs and video links complement this learning activity. For example, demonstrations of airflow and aerodynamics in race car design. Students then apply this knowledge to the final stages of their practical project.
	• Teacher leads an introduction to electricity activity including discussion regarding the use of conductive and insulating materials, circuits and some of the common electrical components.
	  - Students complete a basic circuit diagram activity to assist in the learning activity before progressing to ‘wiring up’ their *Battlebots.*
	Resources:
	• Online videos could be shown here to: ‘explain how to draw a simple circuit’,’ explain how a circuit works’ or ‘demonstrate series and parallel circuits’
	
	Teacher leads a demonstration of power, batteries and voltage.
	  - Students are introduced to the concept of power, including how it can be generated, stored and transferred.
	  - Students can use provided batteries to test the functionality of their motors and electrical circuit(s) and assess the impact the power generated and subsequent forces have on their design.
	• Teacher leads demonstration on stripping (electrical wiring) and soldering.
	  - Teacher demonstrates the use of wire cutters, pliers, and cutting and stripping processes and follows with a demonstration of soldering set up, equipment and the soldering of components.
	Resources required
		The use of a wind tunnel or simulated wind tunnel may be a suitable inclusion to this activity.
		
		The use of a POWERANCHOR system is available commercially for this demonstration.
		
		Teacher may provide students with a range of painting/finishing options and may also introduce students to 2D design and manufacturing opportunities including the use of vinyl cutting

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	- Electrical wiring, solder, soldering irons, helping hands, pliers, wire cutters, motors, propellers and batteries. ***Assessment*** *Ongoing assessment of the groups' practical application of scientific principles in practical production ensuring high tolerance levels and quality projects are produced. Feedback and assistance provided as per student need, catering for the pursuit of innovative and creative design solutions.* **Week 7 – Application of aesthetic features and finishing techniques and product testing and evaluation** Teacher leads a creative design planning discussion regarding the application of aesthetic additions and finishing techniques. - Teacher leads discussion regarding the role aesthetics plays in our daily lives and the relevance of aesthetics as a design factor for successful products. - Students apply aesthetic features to their design as per group requirements. - Teacher facilitates the variety of finishing methods and applications. - Teacher sets up and demonstrates the product testing arena. - Teacher outlines the testing process and documentation of data required, including the calculation of the circumference of the 'track', acceleration and top velocity. - Student may elect to use a template provided by the teacher. - Student teams test run their *Battlebot* and analyse, discuss, document, record, evaluate and appropriately modify their design to maximise its functionality. - Based on the evaluation of testing activities, teams record and document their progress and findings and apply the conclusions to their modified project. - When products 'fail' for any one of a number of common reasons, the teacher leads the student inquiry to identify the design flaw and analyse possible solutions. - Add maths chart / data recording / analysis. *NOTE: The most common flaw is when the circuit fails due to the alligator clips touching, in which case students need to modify their project to create some form of insulation or repositioning of the clip attachments.* *The other common flaw is Battlebots skewing off course either due to friction/obstruction of axle/wheel rotation or an imbalanced mass dispersion.* **Resources required** - Assorted resources for aesthetic finishes. - Product testing / racing set up. ***Assessment*** *As final production nears completion, teacher feedback is provided verbally to assist students in producing the highest quality and most innovative design project possible.* **Week 8 – Final racing and evaluation, files collated and edited to present as a collaborative video presentation** Student teams commence their final product testing phase. Teams repeat testing procedures to evaluate the success of their modifications in preparation for knockout racing. - Knockout racing commences. - Teacher leads students to collaborate to rank the class *Battlebots* based on their collective views	design software/hardware and/or laser cutting/marking for including graphical details and images on battlebot designs. Teachers/students may produce a customised modular race track for the unit of work The video evaluation presentation task may also be presented as a traditional hard-copy folio. Students may be provided with the opportunity to share/submit their assignment component of this unit through the use of a school/teacher preferred digital platform or using the traditional technology of a USB drive.

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	of the best to worst designs as per the project criteria. *Battlebots* then race in a' best of 3' format to determine who advances to the following rounds. • Teacher facilitates the student development of their video evaluation presentation task. - Teacher assists students in methods for collating images and videos using desktop applications and BYOD applications. - Students may need to access school computing labs to collate and format their images, videos and resources to produce their video presentation. However, they are encouraged to utilise BYOD technology to complete this task. • Students present their video. Students share/publish their video. - Students may use *edmodo* to embed their video or hand on to the teacher on a USB. **Resources required** • BYOD technology and associated application(s). • Access to a school computing laboratory with appropriate video/image editing software. ***Assessment*** • *Students' projects are raced! Projects are marked using an appropriate marking scheme.* • *Student presentation assignments (folios) are presented and marked using an appropriate marking scheme.*	

Assessment overview

Week 1

- Informal assessment of student engagement in group formation.
- *Adherence to/completion of mandatory WHS demonstrations and training requirements.*
- *Verbal feedback provided based on student research and thumbnail sketches.*

Week 2

- *Informal assessment of student/team designs with feedback provided for possible improvements. Tests, drawings, equations and analysis documents produced.*

Week 3

- *No formal assessment.*

Week 4

- *No formal assessment during this week; however, evidence of testing design solutions and free body diagrams MUST be documented and collated for presentation in the team's folio/assignment.*

Week 5

- *Ongoing assessment of the groups' practical application of mathematical principles in practical production ensuring high tolerance levels and quality.*

Week 6

- *Ongoing assessment of the groups' practical application of scientific principles in practical production ensuring high tolerance levels and quality projects are produced. Feedback and assistance provided as per student need catering for the pursuit of innovative and creative design solutions.*

Week 7

- *As final production nears completion, teacher feedback is provided verbally to assist students in producing the highest quality and most innovative design project possible.*

Week 8

- *Students' projects are raced! Projects are marked using an appropriate marking scheme.*
- *Student presentation assignments (folios) are presented and marked using an appropriate marking scheme.*

Evaluation