Sample Unit – Technology Mandatory

Sample for implementation from 2019

Technology context	**Project**
Engineered Systems	Rubber-Band Racers (RB Racers)

Overview
The Engineered Systems context focuses on how force, motion, energy and the properties of materials affect the behaviour and performance of engineered systems, machines and structures. Knowledge of these principles and systems enables the design and production of sustainable, engineered solutions. Students will have the opportunity to work collaboratively to design, test and produce their own rubber band powered racers. Students are provided with opportunities to experiment and develop prototypes to test their solutions. There are two extension activities included in this unit that further expand the engineering concepts covered. Students with disability may require adjustments to safely engage in practical tasks. This unit includes personalised adjustments for a student with disability. Read the student's case study. The glossary in the *Technology Mandatory Years 7–8 Syllabus* has definitions for terms used in the Engineered Systems context.

Length of unit	**Assessment opportunity**	**Evidence of learning**
10 weeks (25 hours)	Rubber-band powered vehicle	Throughout the unit of work the content marked with an * indicates opportunities for assessment for, as or of learning. A summary of activities is given at the end of the unit.

Outcomes
A student: **TE4-1DP** designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities **TE4-2DP** plans and manages the production of designed solutions **TE4-3DP** selects and safely applies a broad range of tools, materials and processes in the production of quality projects **TE4-8EN** explains how force, motion and energy are used in engineered systems **TE4-10TS** explains how people in technology-related professions contribute to society now and into the future
Related Life Skills outcomes: TELS-1DP, TELS-2DP, TELS-3DP, TELS-4DP, TELS-9EN, TELS-11TS

Content	Suggested teaching, learning and assessment	Resources
Identifying and defining Students: • investigate the way in which technologies evolve locally, regionally or globally and how competing factors are prioritised in the development of design solutions, for example: (ACTDEK029) **ST** – automation and data transfer in manufacturing, eg Industry 4.0 – GPS and drone technologies used in	**Introduction** Outline the content of the Engineered Systems unit, including assessment procedures. Define an engineered system, identify and discuss a range of engineered systems, how they were developed and how they benefit society. **Questions for discussion** – What are Engineered Systems? – What are some examples of Engineered Systems? – What do Engineering Systems achieve? **Adjustments:** Pair complex terms with more familiar terms. Provide a glossary of key terms with visual supports where possible. **Class discussion** ▪ Teacher to lead a discussion on how an advancing transport technology was developed or implemented to meet the needs of a region or	▪ Introduction to unit presentation ▪ Worksheets/online activities ▪ https://transportnsw.info/tickets-opal/opal/fares-payments/newcastle-

<table>
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<td>
farming

investigate the role of an engineering professional and their impact on the environment and society
investigate the way Aboriginal and/or Torres Strait Islander Peoples use engineered solutions to serve community needs including those of cultural identity, for example:

transport, eg canoe building
tools, eg boomerang, woomera
structures, eg customary shelters, contemporary architecture

investigate needs or opportunities for designing an engineered system and investigate and select from a range of materials, components, tools, equipment and processes (ACTDEP035) DT ST
develop criteria to evaluate design ideas, processes and solutions, the functionality,

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community, for example:

Newcastle Fare Free Zone
Sydney Metro train line
Public transport apps that allow users to customise trips, eg tripview

Activities

Students individually or in groups research an Australian architect, engineer or designer and an example of a project their chosen study was involved in, and the benefit to the environment and/or society of that project.
Students investigate examples of engineered systems developed by Aboriginal and/or Torres Strait Islander Peoples to meet the needs of communities, eg David Unaipon.
Class discusses how the development of engineered systems depends on available resources and cultural priorities.

Adjustments: Provide a scaffold to support when researching. Consider pairing Omar with a peer to model the research process. Provide adjusted notes to assist Omar with information retrieval. Omar could complete his own notes for who/what and work with a partner to answer how.
Example:
<table>
<tr><th>Name of person</th><th>Example of a project</th><th>HOW have they improved the world?</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>
Provide an image of an engineered system developed by an Aboriginal and/or Torres Strait Islander person. Omar can complete a cloze sentence activity to demonstrate his understanding of the engineered system, eg It is shaped like ________. It is made from________. It is used for ________.
</td>
<td>
fare-free-zone

https://www.sydneymetro.info/
https://future.transport.nsw.gov.au/
http://www.murrayriver.com.au/education/david-unaipon/
https://www.sbs.com.au/nitv/the-point-with-stan-grant/article/2016/02/29/david-unaipon-and-50-note-story-behind-image
Eureka video episode 9 – Kinetic energy https://youtu.be/39ga-TGXOwM

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Content	Suggested teaching, learning and assessment	Resources
aesthetics and a range of constraints, eg accessibility, cultural, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) **DT ST**	**Class discussion** ▪ Teacher introduces the concept of energy**.** They discuss energy types such as kinetic and potential. Consider the following questions: – What are some simple terms that may be used to describe kinetic energy? – What is kinetic energy and how will it affect an object going up and over a ramp? ▪ RB racers convert potential energy (wound-up rubber band) to kinetic energy (the racer moving along). The winning rubber-band racers are designed and produced to travel the greatest distance. ▪ Students consider the influences on the design: – What features will the RB racer have? – Will the RB racer that travels the fastest, travel the furthest? – Will the lightest RB racer travel the furthest? – Will the rubber-band racer be judged on appearance? – Should a decorative and/or functional body be added? **Adjustments:** Omar categorises different terms that can be used to help explain kinetic energy, eg *force, motion, movement* and potential energy, eg *stored, possible, standing, ready.* Provide an anchor chart with visual supports that illustrate objects demonstrating the concept of *potential* and *kinetic* energy. Provide Omar with multiple opportunities to observe and experiment with this concept. Pair Omar with a peer for guidance and modelling of key concepts. **Constraints** **RB racers** ▪ The RB racers should be designed to meet the following conditions: – No wheels should be used on the RB racer that were originally produced and intended to be wheels. – The RB racer chassis must be less than 250 mm long and between 10	

Content	Suggested teaching, learning and assessment	Resources
	and 120 mm wide. – Wheels should be a maximum of 150-mm diameter. – The RB racer must not be powered from any source apart from stretched rubber band(s). **Adjustments:** Omar could use materials that are larger in scale to support handling and manipulating items, eg corflute for the wheels and chassis could be cut slightly larger so that it is easier to hold and manipulate. ▪ Students brainstorm criteria for the RB racers. Consideration should be given to: – aesthetics – cost – distance travelled – environmental impact of materials used – mass of materials used – reliability. **Adjustments:** Omar could choose 2 or 3 criteria. Provide a visual cue to reinforce Omar’s understanding of each criteria, eg colours to denote aesthetics. **Class discussion** ▪ Teacher facilitates discussion on what design criteria are important in the RB racer. For example: – Does the RB racer need high speed? – Does it need high torque (power) off the starting line? ▪ Students must then decide the weighting to be placed on each criterion. The teacher should guide the students on how these criteria might be applied by an engineer when evaluating a professional design. **Adjustments:** To decide weighting, Omar can place his chosen criteria in order of importance.	

Content	Suggested teaching, learning and assessment	Resources
Researching and planning Students: • investigate how force, motion and/or energy are utilised when designing engineered systems, for example: (ACTDEK031) – electronic circuits – mechanisms involving simple machines – built environments • select and use a variety of critical and creative thinking strategies to generate innovative design ideas, for example: **DT ST** – brainstorming – sketching – 3-D modelling – experimenting • generate and communicate the development of design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques, for example: (ACTDEP036) **CT DT**	▪ A design and production folio will be presented for assessment to provide evidence of creative thinking, communication skills and production skills learnt throughout the unit. **Adjustments:** Provide a digital design and production folio on Omar's preferred iPad app. Scaffold the folio with spaces for Omar to insert photographs. Include questions for each section that Omar can answer to complete his folio. **Teacher explanation** ▪ Teacher explains the effect of torque and friction on performance, and how energy is stored in a rubber band. **Adjustments:** Evidence of learning can be gathered through observing Omar as he engages in activities such as watching the movement of a seesaw to show torque, dragging rubber soles across the floor to demonstrate friction. ▪ Discuss re-using/recyclability/sustainability options for components of the RB racer, for example: – What properties do the re-used components require (what makes them suitable)? – What are the benefits of re-using components? **Adjustment:** Omar can demonstrate his understanding of sustainability issues by completing a checklist to indicate why recycling is beneficial. Omar could investigate the materials being used in the RB racer and use a checklist to decide how they could be re-used. Omar could plan and implement collection and categorise re-usable materials for recycling. ▪ Teacher discusses the design and production of wheels, considering the following questions; – What effect will the wheel diameter have on performance? – What materials are available? – How might the wheels be manufactured?	▪ Design and production folio scaffold ▪ Building a rubber-band powered car https://www.scientificamerican.com/article/build-a-rubber-band-powered-car/ ▪ http://www.explainthatstuff.com/howwheelswork.html

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<tr><th>Content</th><th>Suggested teaching, learning and assessment</th><th>Resources</th></tr>
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– sketches, drawings and computer-aided drawing (CAD)
– models and prototypes
– engineering reports
– digital presentations
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Adjustment: Pair complex terms with more familiar terms. Provide a glossary of key terms with visual supports where possible, eg diameter.

Provide a scaffold with pre-prepared answers on a separate sheet. Omar can sort answers into correct spaces to demonstrate his understanding of design and production of wheels.

Example:
<table>
<tr><td>What do we measure when making wheels?</td><td>diameter</td></tr>
<tr><td>What materials are available?</td><td>corflute</td></tr>
<tr><td>How might the wheels be made?</td><td>tracing a circle, cutting with a trimming knife</td></tr>
</table>
Activity
▪ Students collaborate in pairs or groups to research RB racer designs and are encouraged to share resources and discuss positives and negatives of each design.*
▪ Teacher discusses ways of visually communicating ideas.
▪ Students develop and sketch design ideas for the RB racer chassis.*
▪ Students demonstrate freehand sketching and the use of a pencil and ruler to draw a full-scale design, including top and front projected views. *

Adjustments: Omar can show his understanding by giving instructions to a teacher or peer, answering direct questions, pointing to a visual to indicate discrimination between two concepts. Omar can be supported through the drawing process using hand-over-hand assistance to help him to complete a freehand sketch or manoeuvring the mouse to perform a step when using CAD software.

▪ Students produce a production timeline, breaking the production down into
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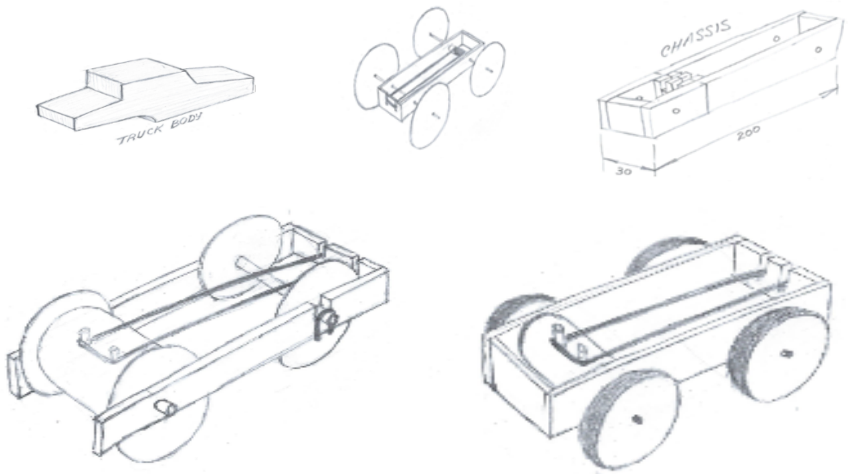
</table>

Content	Suggested teaching, learning and assessment	Resources
	a simple set of instructions. Appropriate time should be assigned to testing and modifying the final solution.* **Adjustments:** Provide Omar with a digital production timeline scaffold. Omar can demonstrate his progress by including images and annotations for each step. ▪ Students use CAD software to develop and model their designs.*	
Producing and implementing Students: • produce products or systems that apply engineering principles, for example: (ACTDEK031, ACTDEP039) **DT** – a product that applies force, motion and/or energy for a purpose, eg toys, windmill – aeronautical vehicles designed according to the principles of flight – structures designed according to statics and properties of materials – electronic circuits designed using electrical laws • develop models, prototypes or products using a range of tools, materials and	**Workshop safety** Teacher ensures that students have been given instruction and demonstration of the safe and appropriate use of all tools, materials and equipment. The teacher should ensure each student's competency is recorded and students are observed and supervised during the use of equipment.* ▪ Teacher outlines safety procedures for the tools and equipment that the students are likely to use, for example: – saws – disc sanders – hot glue guns – trimming knives – hammers – pliers – drilling machines. **Adjustments:** Where possible, provide Omar with one-to-one instructions for safety procedures. Provide clear visual cues to demonstrate safety procedures, eg provide examples to show safe and unsafe use of equipment. Offer multiple opportunities for Omar to practise using equipment safely or ask Omar to indicate the rules of safe handling of selected equipment by pointing to images that demonstrate safe use and/or provide a short verbal response to a direct question.	▪ Safety tests as appropriate

Content	Suggested teaching, learning and assessment	Resources
equipment to test the functionality of design ideas and consider innovative applications of advancing technologies, for example: (ACTDEP037) **DT** – developing computer-aided drawing (CAD) files to automate manufacturing technologies – programming a microcontroller to collect data or automate a task – computer-aided manufacturing (CAM)	**Producing and implementing (suggested processes)** ▪ Teacher provides students with an outline of the range of tools, techniques and equipment to be used in the production of their RB racer. They demonstrate relevant equipment and processes required at appropriate points in the development process including WHS and safe working practices. ▪ Teacher explicitly covers safe working practices with tools, equipment and machines. ▪ Students demonstrate ongoing safe working practices. WHS procedures should be observed and monitored by the teacher. * ▪ Teacher demonstrates measuring and marking out techniques to improve accuracy, for example: – taping identical parts together before drilling axle holes. ▪ The concept of tolerance in measurement should be discussed. ▪ Teacher demonstrates appropriate shaping and joining processes for materials. ▪ Class discussion of wheel design and construction. Reinforce the effect of the diameter of the wheel on performance, and discuss the importance of centring the axle and the wheel. ▪ Students should record the development of the project using sketches and/or photographs. ▪ Students should produce the chassis components and assemble the chassis (the RB Racer frame), based on their design ideas. Suitable chassis material may include: – 10x19 radiata pine strips, students will need approximately 500 mm depending on their particular design – laser cut 5mm plywood ▪ Students construct the drum for the rubber band to be wound around. ▪ Add notch and peg to attach the rubber band. Teacher discusses how the band could be attached and how the vehicle is assembled.	▪ Tools and equipment that measure and mark out and equipment. ▪ Construction materials, tools and equipment. ▪ Digital camera/phone camera. ▪ Making timber joints https://www.garrettsbridges.com/building/bridge-joints/

Content	Suggested teaching, learning and assessment	Resources
	▪ Students who have completed the construction and successfully trialled their RB racers can consider additional features, for example: – a body with painting and/or logo details. ▪ The material must be rigid and able to be cut, drilled and shaped, for example: – recycled polymer (corflute) ▪ Students document design and production processes in their design and production folio.* **Adjustments:** Omar could take part in one or more aspects of the design process. This can be negotiated with Omar prior to this step in the unit, eg Omar may negotiate with his teacher to select and pass material to a peer while describing what he would like them to do. Evidence of learning can be gathered through observation of Omar's selection of correct materials, carrying out a step in construction and/or the detail he supplies in his directions to a peer. Omar can participate in handling and cutting material through hand-over-hand assistance from a peer or teacher. Omar could take photographs with his iPad for his timeline and provide short annotations to show his understanding of the design process to add to his design and production folio, eg a photograph of a logo and annotated note: *This is the logo for my racer. It uses the initials of my name.*	

Content	Suggested teaching, learning and assessment	Resources
		
Testing and evaluating Students: • develop and apply testing procedures to evaluate an engineered system • evaluate the effectiveness and suitability of choices made during the development and production of the engineered solution • assess the solution against the predetermined criteria	**Testing and evaluating** ▪ Students demonstrate the success of their designs in initial trials and record data about the distance travelled. **Adjustments:** Explicitly demonstrate the use of a measuring tape, how to hold it, where to measure from and how to read the measurement units. Provide repeated practice, reducing support as Omar builds mastery. ▪ Data collected should be included in their design and production folio. The teacher may decide to record the best results for each student or leave this week as a test and trial week only. **Adjustments:** Omar could record his measurements by telling a peer who scribes on Omar's recording sheet. ▪ Students take photographs or video their RB racers during testing. ▪ Students should include timeline, sketches, initial data (distance travelled, time travelling, etc) and several photographs of their RB racers in their design and production folio.*	▪ Data collection spreadsheet ▪ Equipment for gathering trial run data, eg tape measure ▪ Digital camera/phone camera. ▪ Design and production folio

Content	Suggested teaching, learning and assessment	Resources
	▪ Students should evaluate and refine their design solutions progressively as they develop their RB racers. ▪ Students should evaluate their final design and results from testing against the criteria determined earlier in the unit.* **Adjustments:** Omar can demonstrate that he has refined his design by taking photographs and annotating the changes he has made, eg *Here is my new logo. I changed it from yellow to blue to make it easier to see.* To demonstrate his evaluation of his design, Omar can answer direct questions about his design and collect data through taking photographs and making annotations against the criteria selected in consultation with Omar.	
	Extension Activity 1 – Adding Suspension	
Researching and planning Students: • generate and communicate the development of design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques, for example: (ACTDEP036) **CT DT** – sketches, drawings and computer-aided drawing (CAD) – models and prototypes	**Suspension** As the RB racer is launched from the ramp to the track, it will need to make a landing. To be assessed as a successful jump, the RB racer will need to continue on its wheels after landing. To help achieve this outcome, suspension can be added to the front landing wheels. The suspension system cannot use springs. It must be designed to use rubber bands to achieve a ‘softer’ landing. **Identifying and defining** ▪ Teacher leads class discussion to determine design criteria for suspension. ▪ Students consider the impact on suspension design determined by either: – a fixed axle with a free spinning wheel, or – a spinning axle in a bearing with fixed axle to wheel connection. **Researching and planning** ▪ Teacher leads discussion on mechanisms. What is a mechanism and what is the purpose?	

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<td>
– engineering reports
– digital presentations
Testing and evaluating
Students:
develop and apply testing procedures to evaluate an engineered system
Producing and implementing
Students:
develop models, prototypes or products using a range of tools, materials and equipment to test the functionality of design ideas and consider innovative applications of advancing technologies, for example: (ACTDEP037) DT
– developing computer-aided drawing (CAD) files to automate manufacturing technologies
– programming a microcontroller to collect data or automate a task
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Teacher discusses the concept of mechanical advantage.
Students identify mechanisms in everyday objects and products (eg eggbeater, pliers, scissors, spanner, spinning top).
Teacher shows a sample racer and the front-wheel suspension system.
Students design a suspension system and complete a pictorial-style design sketch.

Adjustments: Provide visuals to define simple mechanisms. Provide visual demonstrations of simple mechanisms to support Omar’s understanding of the concepts. Provide Omar with a list of everyday objects and ask him to identify the mechanism and what it is designed to do. Omar could demonstrate his understanding by answering direct questions or by completing a note-taking scaffold about levers and gears.
Example:
<table>
<tr><th>Object</th><th>Mechanism</th><th>Function</th></tr>
<tr><td>spanner</td><td>lever</td><td></td></tr>
<tr><td>egg-beater</td><td>gear</td><td></td></tr>
</table>
Producing and implementing

Teacher recaps safety procedures with equipment to be used during production of the suspension system.
Students produce a simple model of a suspension system.
In order to test their designs, students produce a rectangular frame to act as a model chassis using 10 x 19 radiata pine.
Slots can be cut into opposite sides of the frame to house a drinking straw (the bearing). Remind students how they improved the accuracy in production by taping the sides together.
The straw is retained in the slot by a rubber band stretched around the frame and the straw.
A set of wheels can be fixed to a bamboo skewer axle. The axle is free to

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http://encyclopedia.kids.net.au/page/me/Mechanical_advantage
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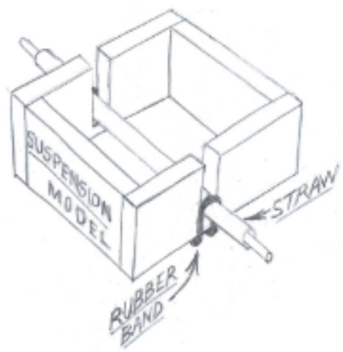
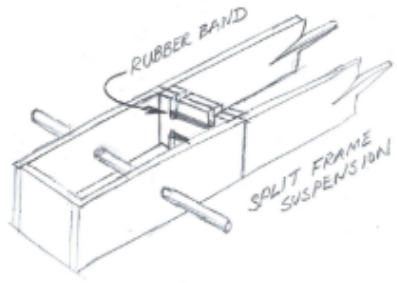
Content	Suggested teaching, learning and assessment	Resources
computer-aided manufacturing (CAM)	spin inside the drinking straw. ▪ Another method of installing suspension is the split frame method. Construct two chassis frames. Join the two frames together with rubber bands inserted into slots in each frame.   **Testing and evaluating** ▪ Students devise a simple method of testing the suspension design and suspension adjustment/settings. ▪ Students test suspension system and document their findings.	
	Extension Activity 2 – Building a Jump Ramp	
Researching and planning Students: • select and use a variety of critical and creative thinking strategies to generate	**Jump ramp** Students to work in teams to design and produce a jump ramp for the RB racer track. Students investigate truss design and then create a suitable ramp for the track for the RB racers. Student teams should complete production of the ramp and test the effectiveness of the ramp using the prototype RB racers that they	

Content	Suggested teaching, learning and assessment	Resources
innovative design ideas, for example: **DT ST** – brainstorming – sketching – 3-D modelling – experimenting • investigate how force, motion and/or energy are utilised when designing engineered systems, for example: (ACTDEK031) – electronic circuits – mechanisms involving simple machines – built environments **Producing and implementing** Students: • produce products or systems that apply engineering principles, for example: (ACTDEK031, ACTDEP039) DT – a product that applies force, motion and/or energy for a purpose, eg toys, windmill – aeronautical vehicles designed according to	have made **Questions for discussion** – What methods are used for communicating data? – What do engineers do? – What shaping and forming methods are used in modern manufacturing? – What methods are used in Aboriginal shaping and forming? For example, shaping of boomerangs for purpose. – What makes the 'best design' for a product? **Identifying and defining** ▪ Class discussion – What is the purpose of the ramp? What criteria should be used to evaluate the ramp produced by each team? For example: – Is build quality important? – Is the amount of material used in the ramp relevant? – Does the amount of material used in a design affect decisions made by engineers? ▪ Teacher discusses the 'best' concept in engineering, the engineering dilemma of ranking or weighting the criteria to decide what is 'best'. ▪ Students consider ramp angles to launch the RB racer. – Why is a 45° angle commonly used? – Is there an advantage to a parabola-shaped ramp? ▪ Teacher discusses the purpose of a truss, the advantages of using truss structures in designs and its suitability for the launching ramp, for example: – Strength – Efficient use of short lengths of material to span long distances. ▪ Teacher presents images of truss designs and their applications.	▪ Eureka video episode 6 https://youtu.be/fI7TQwPcJyI ▪ Interactive game about forces www.wonderville.ca/

Content	Suggested teaching, learning and assessment	Resources
– the principles of flight – structures designed according to statics and properties of materials – electronic circuits designed using electrical laws • develop models, prototypes or products using a range of tools, materials and equipment to test the functionality of design ideas and consider innovative applications of advancing technologies, for example: (ACTDEP037) DT – developing computer-aided drawing (CAD) files to automate manufacturing technologies – programming a microcontroller to collect data or automate a task – computer-aided manufacturing (CAM)	▪ Teacher introduces the concept of **force**. They demonstrate force types such as compression and tension. Consider the following questions: – How can a force or force be measured? – What is gravitational force and how will it affect an object going over a ramp? **Researching and planning** ▪ Students divide into teams (groups) of 4. Each team creates a truss for the ramp. Teacher facilitates a discussion of team member roles, for example: – lead designer – project manager – manufacturing manager ▪ Teacher outlines the production constraints of the ramp including: – maximum 45 sticks for the truss structure – maximum 45 sticks per road surface (if not using a PVC track) – maximum width is the length of one stick – maximum height of the track at the launch edge is 210 mm – maximum length of the truss is 300 mm – the truss design (the side orthogonal view) should fit on an A4 size sheet of paper. **Adjustments:** Consider allocating Omar a role that involves collecting, measuring and categorising materials for production. This will further provide Omar with an opportunity to develop his measurement skills. ▪ Students sketch a side view of the ramp, scale of 1:2. Students are shown how to add 3 major dimensions using Australian drawing standards. ▪ Teacher leads the discussion of the concept of energy, considering the following questions: – What is energy?	asset/forces-of-wonder ▪ Eureka video https://youtu.be/BGmUVoX5s58 https://youtu.be/Tji6PDBck_8 ▪ Eureka video https://youtu.be/8hrFBYp5LYs

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<tr><td>Testing and evaluating
Students:
• develop and apply testing</td><td>– What forms can it take?
– How can we store energy?
– How can energy be distributed?
– Discuss examples of conservation of energy.
Adjustments: Provide Omar with an electronic note-taking scaffold to organise his understanding of energy. Omar could research images using the internet to illustrate his understanding of the concepts, or a selection of digital images could be provided and Omar could match them to each section in the scaffold.
<table><tr><td>What is energy?</td><td>What are the forms of energy?</td><td>How can we store energy?</td><td>How can we move energy?</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>
▪ Teacher leads discussion about motion and its relationship to force.
▪ Class discussion about Isaac Newton and the laws he developed to explain the effect of forces, eg motion.
Adjustments: Use visual supports to reinforce the discussion of Newton’s laws.
▪ Teacher leads discussion about friction, considering the following questions:
– When is friction an advantage?
– When is friction a disadvantage?
▪ Team discussion of friction-reduction methods at the axle bearings and friction-increasing methods at the driving wheels.
▪ Demonstration of a sliding block on a ramp, considering the following questions:
– When does the block begin to slide as the ramp angle increases?
– What can be determined by this activity?
– How can it apply to the RB racer?</td><td>▪ Bridge building https://www.garrettsbridges.com/building/bridge-joints/</td></tr>
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Content	Suggested teaching, learning and assessment	Resources
procedures to evaluate an engineered system	**Producing and implementing** ▪ Teacher demonstrates production techniques and the need for accuracy in measurement and cutting. ▪ Student teams divide the production of the final design into parts and work on different parts of the truss construction prior to final assembly. ▪ Student teams construct trusses, for example: – ice-cream sticks and hot glue as the material and joining method. ▪ Students commence construction of the ramp and apply a road surface. ▪ Class discussion of how to layer and attach the road surface. **Adjustments:** Omar could show his understanding by answering direct questions, responding to a direction to locate materials for the team and giving instructions to a teacher or peer to show his understanding of the construction process. **Evaluation** Students evaluate the ramp design by testing with the RB racer made earlier in the unit. The 'best' ramp will allow the RB racer to travel furthest but students should question whether this should be the only criteria. Students should evaluate against the criteria that was decided upon at the start of the project, ie should the RB racer be required to land on its wheels? **Adjustments:** Allow Omar to collect digital images with his iPad. Omar could annotate images that he believes show the best ramp, using set criteria to justify his choice.	

Evidence of learning

Throughout the unit the content marked with an * indicates opportunities for informal assessment:

- Students collaborate in pairs or groups to research RB racer designs and are encouraged to share resources and discuss positives and negatives of each design.
- Students develop and sketch design ideas for the chassis of the RB racer.
- They demonstrate freehand sketching and the use of a pencil and ruler to draw a full-scale design, including top and front projected views.
- Students produce a production timeline, breaking the production down into a simple set of instructions. The final week should be assigned to testing and modifying the final solution.
- Students use CAD software to develop and model their designs.
- Students should include timeline, sketches, initial data and several photographs of their RB racers in their design and production folio.
- Students should evaluate their final design and results from testing against the criteria determined earlier in the unit.
- Students should document all design and production processes in their design and production folio.

Evidence of learning for Omar:

- Categorises re-usable materials and plans collection of materials.
- Uses a note-taking scaffold to demonstrate understanding of key knowledge.
- Adds photographs to a timeline.
- Takes photographs for design and production folio with iPad.
- Annotates photographs for design and production folio to show key steps in the design process.
- Gives directions to a peer or teacher to demonstrate steps in a procedure.
- Points to images to show understanding of a correct safety procedure.
- Physically demonstrates a skill, eg measurement.
- Asks and answers direct questions.