Technology 7–8 (2023):
– Engineered 3D virtual design challenge

Sample units are provided by NESA to illustrate teaching, learning and assessment of syllabus outcomes and content. Teachers should refer to Curriculum registration and accreditation requirements and programming and record keeping advice for further information.

Unit title: Engineered 3D virtual design challenge (see *Technology 7–8 Syllabus* (2023) Sample scope and sequence: Stage 4 (Blended focus area))

Duration: 20 weeks

Description: Students engineer an immersive virtual reality 3D model of an amusement park. They investigate amusement park design principles, ride functionality and their target audience's ride preferences. Students explore appropriate hardware and software to develop design ideas and solutions. They generate design ideas to attract a specific target audience, authentically replicating the sensation of real-world forces. Students use 3D modelling software equipped with coding capabilities to model and simulate a virtual 3D model. They investigate the forces associated with a roller-coaster or a carousel to set the foundation for simple designs. Students communicate design processes digitally to show how engineered solutions use materials, components and systems.

Outcomes	Subject-specific information
▪ **TE4-SDP-01** explains relationships between sustainability, design and production ▪ **TE4-PDP-01** describes the practices and processes of designers and producers ▪ **TE4-MSC-01** explains how materials, systems and components contribute to solutions ▪ **TE4-PPM-01** applies processes in the planning, management and production of projects ▪ **TE4-DES-01** communicates and evaluates design ideas and solutions ▪ **TE4-SAF-01** selects and safely uses tools, materials, technologies and processes ▪ **TE4-DIG-01** demonstrates technological literacy to safely interact in digital environments ▪ **TE4-DIG-02** uses data and digital systems to code, design and produce projects	This unit explores fundamental aspects of engineering and production by focusing on key topics, such as the consideration of suitable materials and components to address a specific problem, as well as identifying and defining suitable engineering technologies to build a virtual 3D amusement park. Students explore the process of researching and planning ideas to develop innovative solutions. This unit aims to equip students with the knowledge and skills needed to make informed decisions, problem-solve and manage their projects. Students learn through hands-on practical project-based tasks that provide opportunities for a range of formative and summative assessment strategies to be experienced throughout the unit.

Unit information

Engineered 3D virtual design challenge

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<tr><th>Syllabus content</th><th>Suggested teaching, learning and assessment</th><th>Suggested resources</th></tr>
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Document design processes when using digital and communication technologies
Document design and production processes when developing projects

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Introducing the design brief and folio documentation
The teacher introduces the design brief for the project: design and engineer an immersive virtual reality 3D model of an amusement park. Students may work individually to design and develop a virtual reality 3D model ride as well as in teams to collaboratively create the amusement park.
The teacher outlines learning opportunities:

exploring amusement park design principles, including simple forces
outlining how engineering decisions impact user experiences and ride functionality
identifying and describing the needs of target audiences
generating design ideas and evaluating prototypes
using tools, processes and technologies to simulate the sensation of real-world forces
creating working models to experiment with forces and applying engineering processes
working together safely and productively to design, develop and manage projects
documenting design and production processes in a folio.

The teacher identifies key terminology, such as ‘engineering processes’ and ‘user experiences’. They demonstrate how to develop the digital folio layout and explain the management strategies required to document design and production processes.
The teacher may provide feedback progressively to support student skill development in documenting design and production processes.
The teacher observes student knowledge of key terminology to assess prior knowledge relating to engineered systems. This observation may take place through a class brainstorming activity or
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Syllabus content	Suggested teaching, learning and assessment	Suggested resources
	discussion. This may support the teacher to identify student needs regarding the introduction of new knowledge, consolidation of prior learning and opportunities for extension.	
- Identify the characteristics and properties of components in engineered systems - Describe products, systems and technologies developed by engineers and manufacturers	**Identifying and defining engineering technologies and systems** The teacher facilitates student discussion about engineered systems. In pairs, small groups or as a class, students discuss their prior knowledge of examples of engineered systems. Prompts for discussion may include: - What do you think 'engineered systems' are? - What have you previously used or seen that you think was designed or created by engineers? - What are examples of engineered systems that have greatly changed the way we live, work and have fun? This may continue to support the teacher to identify student needs regarding the introduction of new knowledge, consolidation of prior learning and opportunities for extension relating to the fundamental aspects of engineering.	Use a search engine to find information on: - Teach Engineering - CSIRO – examples of engineered systems
- Outline factors affecting the design of engineered systems	The teacher guides class discussion to explore factors that engineers consider when designing engineered systems for amusement parks. Prompts for discussion and/or investigation could include: - What do you think goes into making amusement park rides that are safe, fun, durable and exciting all at once? - How could engineers ensure that rides operate smoothly and reliably under various conditions?	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
▪ Describe products, systems and technologies developed by engineers and manufacturers ▪ Outline factors affecting the design of engineered systems ▪ Create written texts and use graphics applications to communicate design ideas and solutions ▪ Document design and production processes when developing projects	▪ What features and technologies would you want to see included or invented if you were asked to design a cutting-edge virtual amusement park? Students explore features and examples of amusement parks, including virtual rides. Students: ▪ select examples of existing amusement park rides ▪ identify factors affecting the design of the rides ▪ outline key features and engineering considerations ▪ evaluate how technologies are used to enhance the user experience ▪ describe features that could be used as inspiration to generate ideas. Students investigate using search engines to explore websites, videos, media articles and podcasts. Practical investigation could be undertaken through a visit to an amusement park. Students explore and reflect on the importance of factors that affect the design of amusement park rides. Before students commence their investigation of amusement park rides, the teacher may present a worked example of a presentation, to model information selection and approaches to communication and layout. Students could present and communicate the results of their investigation in a mode of their choice. This could be an interactive e-portfolio, slide presentation or written report. The teacher observes student progress in documenting information to identify levels of understanding relating to factors affecting the design of amusement park rides. Some students may require consolidation or further examples to support next steps in learning. Some students may be ready to apply their knowledge by communicating their own preliminary ideas for amusement park ride engineered systems or features.	Use a search engine to find information on: ▪ Academics researching virtual reality roller-coasters ▪ Virtual reality new dimension to theme park rides Refer to *Technology 7–8 Syllabus* (2023)

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
▪ Demonstrate safe practices when selecting and using tools, processes and technologies ▪ Assess cybersecurity and privacy risks ▪ Explain ethical considerations for the ownership of data, information and artificial intelligence (AI) applications ▪ Document design and production processes when developing projects ▪ Demonstrate safe practices when using and developing digital and communication technologies	**Researching and planning ideas and solutions: digital tools for design and production** The teacher demonstrates examples of online digital design tools that may be used in the design, production and management of this project. In pairs, small groups or as a class, students discuss their knowledge of digital literacy and its importance in safely interacting in networked environments. Prompts for discussion could include: ▪ What are examples of online tools that may be used in the design, production and management of this project? ▪ What are common challenges and risks associated with the use of these tools and online interactions? ▪ What are the potential risks and safety practices we can expect when working in this online platform? ▪ Are there any security measures we should consider when sharing access to documents, files and folders? ▪ What processes should be implemented to prevent loss of data and information? Students investigate one or more online software applications appropriate for the design, development or management of the project. In pairs or small groups, students prepare an approach to communicating the potential risks associated with networked environments and practical tips for working collaboratively and safely within this environment. The teacher encourages students to explore online software applications that could be used for the project. The teacher guides students to select online software applications that are appropriate to support differentiation for individual skill development.	Use a search engine to find information on: ▪ eSafety Commissioner Australian cybersecurity centre ▪ Cyber safety projects

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<tr><td></td><td>Students apply their understanding of cybersecurity risks and digital literacy skills through their presentation. Students share their presentation using documentation techniques such as:

- a blog post
- a peer interview in the form of an audio podcast
- a printed or animated poster.

Throughout the project, students use the strategies communicated through the presentations to assess online sources, protect sensitive information and communicate securely with their team members.

Students peer review and provide feedback on their presentations. This feedback may be targeted to certain areas, such as digital literacy principles, cybersecurity or online safety.

Suggested ways to review and provide feedback could include:

- checklists that identify targeted learning opportunities
- descriptive statements that identify strengths and areas for clarification
- questions that support peer discussion.</td><td></td></tr>
<tr><td>- Investigate engineered systems created by Aboriginal and Torres Strait Islander Peoples

- Document design and production processes when developing projects</td><td>Researching and planning ideas and solutions: traditional engineered systems

The teacher guides students to consider broader engineering perspectives as sources of inspiration for design. The teacher introduces engineered systems created by Aboriginal and Torres Strait Islander Peoples.

The teacher uses the example of the Kalwa raft to model how to identify characteristics and properties of components and suggests how this could be used as inspiration for an amusement park ride.

Students may investigate examples of engineered systems created by Aboriginal and Torres Strait</td><td>Use a search engine to find information on:

- CSIRO Australia Indigenous science
- National Museum of Australia</td></tr>
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Syllabus content	Suggested teaching, learning and assessment	Suggested resources
	Islander Peoples that could be used as inspiration for amusement park ride design. Students: ▪ identify the characteristics and properties of components of the engineered solution ▪ outline how this solution could be used as an inspiration source for designing. The teacher observes student outlines of how investigated examples could be used as inspiration sources for their own design. This may provide opportunities for feedback regarding how students engage in design thinking using new learning.	
▪ Explore engineered solutions that address societal needs and contribute to sustainability ▪ Outline factors affecting the design of engineered systems	**Researching and planning ideas and solutions: existing engineered systems** The teacher guides students to continue considering broader engineering perspectives as sources of inspiration for designing. Students explore an engineered system that addresses a societal need and contributes to sustainability. These may include: ▪ smart manufacturing ▪ 3D printed prosthetics ▪ solar-powered technologies. In pairs or small groups, students work collaboratively to: ▪ identify the characteristics and properties of components of the engineered system ▪ outline the factors affecting the design of the engineered solution ▪ consider design factors which may include aesthetics, ergonomics, functionality, safety, sustainability	Refer to *Technology 7–8 Syllabus* (2023)

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- describe how engineering technologies and systems could be applied to amusement park ride design.

Students share their learning of engineering technologies and systems using communication techniques that may include:

- collaborative documents
- interactive graphic formats
- slideshow presentations.

The teacher leads a discussion about engineering technologies and systems. By checking for student understanding of design factor terminology, the teacher can adjust next steps in teaching and learning to identify student needs and to support progress. The teacher may provide a worked example of how existing engineering technologies and systems can be applied to the design of an amusement park ride. Some students may benefit from models or scaffolds that demonstrate and support this transfer and application of knowledge and understanding. Peer collaboration and feedback may be used to support student reflection on how engineered solutions can address societal needs and contribute to sustainability.

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- Explain how force, motion and energy apply to engineered systems
- Collect data and information to develop engineered solutions

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Researching and planning ideas and solutions: force, motion and energy principles

The teacher introduces force, motion and energy in engineered systems, focusing on their relevance to examples of amusement park rides. The teacher models the use of simple systems to demonstrate the basic principles of force, motion and energy.

Students participate in hands-on experimentation and/or 3D simulations to explore basic principles of force, motion and energy, such as the effects of friction and gravity on moving objects. They brainstorm ideas of how their exploration and identified principles could be applied to amusement park ride design.

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Refer to the Stage 4 Forces focus area in the *Science 7–10 Syllabus (2023)* on the NSW Curriculum website.

Refer to the Stage 4 Change focus area in the *Science 7–10 Syllabus (2023)* on the NSW Curriculum website.

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<tr><td></td><td>Examples of applying identified principles to ride design may include observing that:

▪ roller-coaster cars speed up as they lose height
▪ the speed of a bumper car will affect how far another car moves on impact
▪ a Ferris wheel has a constant speed in a circular motion.

Students communicate their brainstorming through their folio documentation that may include:

▪ mind maps
▪ spreadsheets
▪ collaborative documents.

The teacher checks for student understanding of how force, motion and energy apply to amusement park ride design. Some students may require consolidation in this area before progressing to the planning phase for their own design solution.

This unit is designed to support STEM connections across the Stage 4 Curriculum.
In Term 2, Year 7 students typically study Forces (Science 7–10 Syllabus (2023)) and Algebraic techniques (Mathematics 7–10 Syllabus (2022)).</td><td></td></tr>
<tr><td>▪ Create written texts and use graphics applications to communicate design ideas and solutions

▪ Use graphical communication techniques to present ideas for products and systems</td><td>Researching and planning ideas and solutions: 3D amusement park design ideas

The teacher demonstrates graphical communication techniques to support the generation of ideas, providing scaffolds for the documentation of idea development. Annotated examples demonstrate how to produce and annotate storyboards to communicate design development.

The teacher directs students to sketch ideas to plan their 3D amusement park.</td><td></td></tr>
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- Apply design and systems thinking to assess ideas and develop quality solutions

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Student communication of initial ideas may include:

- top-view layout of the amusement park
- storyboards to show ride concept development
- identification of inspiration sources from existing rides and engineered systems
- annotation of forces, motion and energy applied to a ride design.

Students may collaborate on or peer assess initial idea development to support the application of design systems thinking. This may involve:

- students identifying a personal strength, targeting their peers' constructive feedback to one particular area
- groups of students collaborating in the classroom or in digital environments to develop and refine their initial ideas.

Specific design information may include:

- user experiences when engaging with specific hardware, for example a virtual reality headset
- graphical representation of user interface, navigation and scene design
- user experience and interactivity, for example making rides move or start when a user performs a specific action.

Students communicate initial ideas through their folio documentation using techniques that may include:

- concept maps
- sketching and drawing techniques
- verbal explanation and reflection
- digital and graphical communication applications.

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Syllabus content	Suggested teaching, learning and assessment	Suggested resources
	Students continue to provide feedback on each other's ideas using a scaffolded review strategy. This feedback may be targeted to certain areas, such as factors affecting design. Students reflect on their ideas to further refine their work. Constructive teacher feedback should target students' application of design thinking and their use of graphical techniques to express this thinking. Feedback should support refinement before progressing designs to the next step in learning. The teacher may need to work individually with students to apply feedback to design ideas. Students reflect and action feedback by making design refinements and modifications.	
▪ Describe how engineered solutions use materials, components and systems ▪ Use graphical communication techniques to present ideas for products and systems ▪ Create written texts and use graphics applications to communicate design ideas and solutions	**Researching and planning ideas and solutions: materials in amusement parks** The teacher introduces the importance of material selection in amusement park design, emphasising factors such as safety, aesthetics and sustainability. The teacher guides students to investigate different types of materials commonly used in amusement park rides, such as steel, fibreglass and reinforced concrete. In pairs or small groups, students discuss the characteristics of materials commonly used in amusement park attractions. Students investigate the various components and subsystems that make up amusement park rides, including support structures, mechanical assemblies, electrical systems and safety features. Students discuss ways materials could be represented authentically in their 3D amusement park design. Students further develop the initial design of their amusement park plans, incorporating considerations relating to materials and components. Students communicate design ideas through their folio documentation such as: ▪ concept maps ▪ graphic organisers ▪ flow charts ▪ scaffolded collaborative documents.	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
▪ Use hardware and software to design, communicate and manage the development of digital solutions	**Researching and planning ideas and solutions: working collaboratively** The teacher introduces the concept of project management and the importance of teamwork and collaboration in large-scale engineering projects. The teacher guides students to reflect on the significance of teamwork and explores specific roles, responsibilities and tasks that may be suitable for an engineering project. The teacher guides the collaborative opportunities within the project. Students may complete the production of this project individually or in design teams. Team members could each contribute one 3D virtual experience ride design, with the combination of these rides comprising the final 3D amusement park concept. Student 3D virtual reality ride solutions may be presented individually with a description of how they work together as an amusement park concept. Alternatively, a virtual reality 3D model of an amusement park could be created using 3D modelling software applications.	
▪ Use hardware and software to design, communicate and manage the development of digital solutions ▪ Use materials, components, processes and technologies to develop engineering skills	**Researching and planning ideas and solutions: 3D modelling processes** The teacher introduces fundamental principles of 3D modelling and virtual reality. The teacher demonstrates 3D modelling software technologies and facilitates a class discussion about the design opportunities presented. 3D modelling design opportunities and principles may be determined by the 3D modelling software applications available within individual school environments. Students are introduced to the 3D modelling software and environment through a tour of the user interface. The teacher guides students in creating their first simple scene, such as a basic landscape, explaining the basic tools and functionalities.	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
▪ Select components, technologies and systems to make engineering solutions and projects	Students apply their understanding of 3D modelling principles to produce simple virtual objects and structures relevant to amusement park design, such as basic rides, buildings and scenery elements. Students outline how the 3D modelling principles could be applied to generate ideas for their 3D virtual reality ride concept. Students communicate their designs through documentation that may include: ▪ mind maps ▪ annotated screenshots ▪ scaffolded slide shows.	
▪ Use data and digital systems to code, test and evaluate design ideas and quality solutions	**Researching and planning ideas and solutions: control structures** The teacher explains the concept of 'if–then' statements and how they can be used to make decisions in code. The teacher guides students through the changing behaviour, forces or physical properties of objects based on user decisions, using conditional control structures. The teacher introduces the concept of loops and their types, guiding discussion on how loops save time and effort in programming. The teacher demonstrates how to create a simple animation using loops, such as a rotating object or a moving roller-coaster. Students develop skills through experimentation with different types of loops to animate objects. Students apply knowledge of control structures to explore and further develop their own virtual reality 3D ride design. They may document the further development of their design ideas.	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
▪ Select components, technologies and systems to make engineering solutions and projects ▪ Apply design and systems thinking to assess ideas and develop quality solutions ▪ Demonstrate safe practices when selecting and using tools, processes and technologies	**Producing and implementing processes, solutions and projects: 3D virtual ride and amusement park design** 3D modelling software skill development and application experiences are intended to be undertaken throughout the design and production process to ensure ongoing practical learning opportunities for students. The teacher facilitates and demonstrates practical experiences including the use of 3D modelling software with specific tools such as physics engines and coding capabilities. The teacher reviews the design brief for the project: design and engineer an immersive virtual reality 3D model of an amusement park. The teacher guides students to develop manageable learning goals for their production and implementation processes, tailored to their progress so far and the approach being taken to develop the final design solution. Presentation of the final immersive virtual reality 3D amusement park concept may be dependent on prior learning and student skill development. Student 3D virtual reality ride solutions may be presented individually with a description of how they work together as an amusement park Students apply their practical skills to design and produce their virtual reality 3D ride and may work in teams to collaboratively create the amusement park. Students' documentation may include: ▪ outlining factors affecting the final virtual reality 3D ride design ▪ describing engineering technologies and systems needed for ride functionality ▪ communicating the engineering processes undertaken to generate ideas ▪ designing and optimising algorithms for individual ride design ▪ identifying components of the virtual reality 3D ride design ▪ describing the forces, motion and energy in the final virtual reality 3D model of the amusement park ▪ annotating screenshots to show the design development	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
	reflections on challenges faced and skills not yet mastered during the production and implementation stage. The teacher supports students to acquire and provide feedback on learning through practical activities. The teacher observes student documentation of learning to inform consolidation and/or extension as needed.	
- Select data, information, tools, systems and technologies to make digital solutions and projects - Design user interfaces (UI) considering the user experience (UX) of digital systems - Use control structures and functions to implement, modify and test programs using coding	**Producing and implementing processes, solutions and projects: virtual reality interactivity** The teacher demonstrates programming using 3D modelling software, highlighting how scripting languages can be used to automate tasks, integrate physics and enhance interactivity. The teacher explains what variables are and how they are used in programming to control the behaviour of objects. The teacher could develop examples of variables for students, modelling how to control the behaviour of objects within the 3D environment. The level of enhanced interactivity applied to the final ride design may reflect individual student design concepts and skills. The level of interactivity in design may support the teacher to identify different levels of student achievement and support student progress. In pairs, small groups or as a class, students share ways to make their projects interactive. Students create a scene where they use variables to control aspects of their objects. Students explore adding interactive elements to their scenes. These may include clickable objects that cause different behaviours, changes in forces or triggers for movement. The teacher supports individual student decision-making processes, leading a brainstorming session for students to come up with final design ideas that incorporate interactivity and simulate a 3D virtual amusement park. This may support the teacher to identify student needs regarding skill development, the consolidation of prior learning and opportunities for extension.	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
- Apply engineering processes to create and evaluate prototypes and working models - Use results of testing and evaluating to contribute to an engineering report - Use materials, components, processes and technologies to	**Testing and evaluating tools, materials, systems and technologies: force, motion and energy** The testing and evaluating of learning experiences is undertaken throughout the design and production process to ensure ongoing practical learning opportunities for students. Students could provide evaluation throughout the design and development of their project. Practical experiments may occur as a combination of hands-on activities and/or using software tools with physics engines and coding capabilities to simulate forces, motion and energy. Students develop and refine the design for their 3D virtual amusement park through testing and evaluation. Students may work individually or collaboratively to ensure all aspects of the park are cohesive and provide an immersive experience. The teacher provides students with an engineering report structure, including the introduction and methods of testing. Students engage in practical testing and evaluation experiences. They document their results in the engineering report structure provided by the teacher. Students apply conclusions to ideas and solutions. Students demonstrate their knowledge and understanding of the application of force, motion and energy concepts through their participation in testing and evaluation. Criteria may be developed with students to support their testing and evaluation such as: - integration of interactive features in the design that enhance system components and overall user experience - application of computational thinking to assess ideas and test the solution using engineering principles - organisation and refinement of amusement park features to create cohesion across the system and support an immersive user experience.	Use a search engine to find information on: - ABC Education video: effects of g-force on human body - PHET Interactive Simulations - ABC Education: four fundamental forces - Teach Engineering: amusement park rides

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
develop engineering skills ▪ Select components, technologies and systems to make engineering solutions and projects ▪ Justify materials and components used when testing engineering technologies and systems	Testing and evaluation may include: ▪ investigating inertia – by observing how marbles react on different-sized boxes when a tabletop is tilted ▪ investigating the relationship between force, mass and speed – by timing different toy cars' descents down an inclined plane ▪ investigating action and reaction – by attaching inflated balloons to a paper rocket and observing its forward motion ▪ investigating potential and kinetic energy – by building a miniature roller-coaster to observe how potential energy converts to kinetic energy as toy cars descend along the track ▪ investigating the effects of friction and gravity – by constructing a marble run with obstacles including ramps, loops and inclines, to study how friction and gravity affect the speed and trajectory of marbles. Teachers may need to support students in the selection of 3D modelling software and physics engines for the design and production of their ideas and solutions. Teachers could use online tutorials and applications to support individual student learning needs. Students investigate physics engines, a simulation tool for applying forces. Students investigate a range of forces, motion and energy using the physics engine to create simple projects, and observe and document the effects of forces. Student exploration strategies could include the use of the physics engine to: ▪ observe changes to a falling object by adjusting physical properties and gravity ▪ launch an object at various angles and speeds, to determine the maximum distance travelled ▪ collide one object into another object ▪ create a moving vehicle that must travel as far as possible using a limited amount of energy, experimenting with shapes, weights and propulsion methods to find the most efficient design	

Syllabus content	Suggested teaching, learning and assessment	Suggested resources
	▪ create a basic roller-coaster by adjusting variables of physics properties such as friction, to affect the ride's performance. Students observe the effects of forces, motion and energy in play. They apply this learning to refine their own design ideas and solutions. Students communicate how their exploration could be applied to designs through their folio documentation such as: ▪ mind maps ▪ annotated digital images.	
▪ Use factors affecting design to evaluate the quality of engineered solutions ▪ Work collaboratively to test, modify and improve engineered solutions	**Testing and evaluating data, tools, systems and technologies: final evaluation** Students develop a usability testing checklist to ensure each attraction meets a specific criterion. Examples may include assessing whether or not: ▪ rides start and finish smoothly ▪ speed variation enhances user experience ▪ engineered systems create a virtual reality experience. They share the usability testing checklist for peer feedback to provide analysis of the 3D amusement park design. Students peer assess their folio documentation. A focus on asking and responding to clarifying questions could be used to generate discussion about the application of design and production processes. Students are supported to synthesise their learning throughout the unit by creating written texts about engineered systems and their influence on amusement park design. The teacher may choose to summatively assess student achievement by observing the final 3D virtual amusement park design, including their documentation through the digital folio. If summatively assessing student achievement, the teacher should consider all the available information about student learning and achievement as observed throughout the unit when making decisions about next steps in teaching.	

Reflection and evaluation (space for teacher to reflect on and evaluate the unit)