PowerAnchor STEM Curriculum mapping – Year 10

**NOTE: Bullet points are ACARA provided elaborations for each outcome for this year level.*

Content Area	Outcome Code	Suggested Teaching Activities	*Race and Chase*	*Helicar*	*Protocar*	*Skylap*	*Downforce Racer*
Science Content							
Science Understanding							
Physical sciences: The motion of objects can be described and predicted using the laws of physics • gathering data to analyse everyday motions produced by forces, such as measurements of distance and time, speed, force, mass and acceleration • recognising that a stationary object, or a moving object with constant motion, has balanced forces acting on it • using Newton's Second Law to predict how a force affects the movement of an object	ACSSU229	Students test their PowerAnchor vehicles, recording lap times / flight heights. Using the radius provided by the tether wires, calculate the circular lap path travelled by the vehicles around the PowerAnchor and in turn calculate the average speed of the vehicle. Students document the forces acting upon their vehicle at rest and during movement in their design portfolio. Students predict the effect of forces such as friction and gravity acting upon their vehicles.	✓	✓	✓	✓	✓
Inquiry Skills							
Questioning and predicting: Formulate questions or hypotheses that can be investigated scientifically	ACSIS198	Watch the PowerAnchor project DVD. Students work together to identify a problem/challenge to solve	✓	✓	✓	✓	✓

• formulating questions that can be investigated within the scope of the classroom or field with available resources • developing ideas from students own or others' investigations and experiences to investigate further		using their vehicle (classic stunts as example). Students develop their own problem and investigation and conduct vehicle testing of possible solutions using the PowerAnchor.					
Planning and conducting: Plan, select and use appropriate investigation types, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods • deciding how much data are needed to produce reliable measurements • considering possible confounding variables or effects and ensuring these are controlled	ACSIS199	Watch the PowerAnchor project DVD. Students identify the variables in the PowerAnchor vehicle test and explain how they can be controlled, changed and measured. Students determine how much data is required to produce reliable average speed calculations. Students discuss how the function of the PowerAnchor may impact upon the reliable collection of lap time / flight height data and how they may be controlled.	✓	✓	✓	✓	✓
Planning and conducting: Select and use appropriate equipment, including digital technologies, to collect and record data systematically and accurately • selecting and using probes and data loggers to record information • identifying where human error can influence the reliability of data	ACSIS200	Students identify lap time data collection with stopwatches can be impacted upon by human error. Students use light gates or similar equipment to accurately measure PowerAnchor vehicle lap times data.	✓	✓	✓	✓	✓

Processing and analysing data and information: Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies • using spreadsheets to present data in tables and graphical forms and to carry out mathematical analyses on data • describing sample properties (such as mean, median, range, large gaps visible on a graph) to predict characteristics of the larger population, acknowledging uncertainties and the effects of outliers • exploring relationships between variables using spreadsheets, databases, tables, charts, graphs and statistics	ACSIS203	Vehicle lap times / flight height around the PowerAnchor are recorded in a spreadsheet table and speed is calculated and the data is presented graph form. Students determine mean, median and range, and predict the change as a result of further testing based on sample data. Student explore the relationship between lap time, distance travelled and average speed by entering different values into the spreadsheet and observing the changes to calculations.	✓	✓	✓	✓	✓
Processing and analysing data and information: Use knowledge of scientific concepts to draw conclusions that are consistent with evidence • using primary or secondary scientific evidence to support or refute a conclusion • constructing a scientific argument showing how their evidence supports their claim	ACSIS204	Students compare results of PowerAnchor vehicle tests against predictions of performance made prior to testing. Students explain reasons for differences between predictions and results using test results and internet sourced information as evidence to support their claims.	✓	✓	✓	✓	✓
Evaluating: Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data • evaluating the strength of a conclusion that can be inferred from a particular data set	ACSIS205	Students share and peer review conclusions from PowerAnchor vehicle testing to identify missing information, based on the	✓	✓	✓	✓	✓

• identifying alternative explanations that are also consistent with the evidence		evidence gathered during testing. Following the vehicle testing process, students reflect upon collected data (such as capturing lap time / flight height data) and suggest alternative explanations for unexpected results.					
Communicating: Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations • using the internet to facilitate collaboration in joint projects and discussions • constructing evidence based arguments and engaging in debate about scientific ideas • presenting results and ideas using formal experimental reports, oral presentations, slide shows, poster presentations and contributing to group discussions • using a range of representations, including mathematical and symbolic forms, to communicate science ideas	ACSIS208	Students use a shared online spreadsheet to record PowerAnchor vehicle test results in real-time. Students document the design process and the results of problem solving through a computer-generated design portfolio (which may be a shared online document), including appropriate documentation of investigations (such as vehicle testing) and data presented in tables and graphs. Data from test results used to construct evidence based conclusions. Worked averaged speed calculations are included to explain spreadsheet formula.	✓	✓	✓	✓	✓

Design and Technologies Content							
Knowledge and understanding:							
Investigate and make judgments on how the characteristics and properties of materials are combined with force, motion and energy to create engineered solutions • analysing the relationship between materials of properties, forces and safety in engineered systems such as bridges • critiquing the effectiveness of the combinations of materials, forces, energy and motion in an engineered system such as a 3D printer	ACTDEK043	Students analyse the relationship between vehicle mass and the forces of friction/gravity acting upon their PowerAnchor vehicle design. Students critique the combination of their chosen vehicle materials with its operation around the PowerAnchor during testing. This may include the weight of the vehicle compared to the power provided by the electric motor.	✓	✓	✓	✓	✓
Investigate and make judgments on how the characteristics and properties of materials, systems, components, tools and equipment can be combined to create designed solutions • justifying decisions when selecting from a broad range of technologies − materials, systems, components, tools and equipment, for example selecting low-emission paints and locally sourced materials • analysing and explaining the ways in which the properties and characteristics of materials have been considered in the design of a product with specific requirements such as reduced weight to reduce transport costs in rural Australia • investigating emerging materials and their impact on design decisions	ACTDEK046	Students investigate a range of materials to produce a vehicle from, this may include primary research, such as testing durability and workability or secondary research such as cost and sustainability. Material section is explained and justified based on the advantages provided when producing a solution to the design problem.	✓	✓	✓	✓	✓
Processes and production skills:							
Critique needs or opportunities to develop design briefs and investigate and select an increasingly sophisticated range of	ACTDEP048	Students identify appropriate tools,	✓	✓	✓	✓	✓

materials, systems, components, tools and equipment to develop design ideas • identifying appropriate tools, equipment, techniques and safety procedures for each process and evaluating production processes for accuracy, quality, safety and efficiency		equipment, techniques and safety procedures for the production of their PowerAnchor vehicle. These are evaluated during construction to determine accuracy, quality, safety and efficiency and evaluated overall at the conclusion of the project. Students complete appropriate safety tests and undergo required safety training prior to making their vehicles					
Develop, modify and communicate design ideas by applying design thinking, creativity, innovation and enterprise skills of increasing sophistication • considering competing variables that may hinder or enhance project development, for example weight, strength and price; laws; social protocols and community consultation processes • producing drawings, models and prototypes to explore design ideas, for example using technical drawing techniques, digital imaging programs, 3D printers or augmented reality modelling software; producing multiple prototypes that show an understanding of key aesthetic considerations in competing designs • communicating using appropriate technical terms and recording the generation and development of design ideas for an intended audience including justification of decisions, for example developing a digital portfolio with images and text which clearly communicates each step of a design process	ACTDEP049	Students sketch and annotate a range of possible vehicle concept designs and provide an analysis to determine the most suitable for construction based on the most advantageous characteristics. Most suitable design progresses to a final workshop drawing, which may include a 3D model and/or physical prototype. Students document the design process and the results of problem solving through a computer-generated design portfolio.	✓	✓	✓	✓	✓

Work flexibly to effectively and safely test, select, justify and use appropriate technologies and processes to make designed solutions • refining technical skills and using production skills with independence to produce quality designed solutions and to reduce risks in production • using materials, components, tools, equipment and techniques safely and considering alternatives to maximise sustainability, for example using timber because it stores carbon and offsets the demand for alternative products • experimenting with innovative combinations and ways of manipulating traditional and contemporary materials, components, tools, equipment and techniques, and recording findings in a collaborative space to debate the merits of each with peers • explaining safe working practices required for a specific classroom design project for individual or community use • modifying production processes to respond to unforeseen challenges or opportunities, for example when producing bulk quantities of recipes, lower than average rainfall and impacts on growth, materials with unexpected faults	ACTDEP050	Students refine individual technical skills through the production of a vehicle by hand, including measuring, cutting and joining materials. This includes working safely and minimising the waste of materials. The use of CNC machines, laser cutters and 3D printers should be experimented with to produce components of vehicles. Students should react to solve problems in production due to student error without consuming any additional materials.	✓	✓	✓	✓	✓
Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability • establishing specific criteria for success for evaluating designed solutions • evaluating choices made at various stages of a design process and modifying plans when needed with consideration of criteria for success • reflecting on learning, evaluating processes and transferring new knowledge and skills to future design projects	ACTDEP051	Students develop a criteria for success for measuring against the initial design problem/challenge that includes function, aesthetics and sustainability. The criteria is reflected upon at regular intervals during the production of the PowerAnchor vehicle and again during the final evaluation against the design brief.	✓	✓	✓	✓	✓

Develop project plans using digital technologies to plan and manage projects individually and collaboratively taking into consideration time, cost, risk and production processes • producing, explaining and interpreting drawings; and planning production timelines using digital technologies • creating production flowcharts using digital technologies to ensure efficient, safe and sustainable sequences • establishing materials and equipment needs using digital technologies such as spreadsheets • collaborating to develop production plans for equitable distribution of work • investigating manufacturing processes to identify strategies to enhance production	ACTDEP052	Students annotate design sketches to include details on how their PowerAnchor vehicle is constructed. Student use digital technologies to illustrate productions timelines, such as a flowchart or Gantt chart. This should include a flowchart representing a material lifecycle analysis. Students use a spreadsheet to control the amount of materials required for vehicle construction. When working in groups, production plans should be used to even distribute and monitor team member participation. The use of CNC machines, laser cutters and 3D printers for possible production of vehicle components may be researched.	✓	✓	✓	✓	✓
Mathematics Content							
Measurement and Geometry							
Using units of measurement: Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids • investigating and determining the volumes and surface areas of composite solids by considering the individual solids from which they are constructed	ACMMG242	Students use formulas to calculate the surface area of the vehicle components that are prisms, cylinders and composite solids, to	✓	✓	✓	✓	✓

		determine the quantity of paint/finish required.					
Pythagoras and trigonometry: Solve right-angled triangle problems including those involving direction and angles of elevation and depression • applying Pythagoras' Theorem and trigonometry to problems in surveying and design	ACMMG245	Apply Pythagoras's to sovle problems around the size of the triangles created between the floor, PowerAnchor height, length of the PowerAnchor tether and distance of the vehicle to the PowerAnchor. Use this data to modify vehicle design to suit PowerAnchor use.	✓	✓	✓	✓	✓
Pythagoras and trigonometry: Apply trigonometry to solve right-angled triangle problems • understanding the terms 'adjacent' and 'opposite' sides in a right-angled triangle • selecting and accurately using the correct trigonometric ratio to find unknown sides (adjacent, opposite and hypotenuse) and angles in right-angled triangles	ACMMG224	Students can identify adjacent, opposite and hypotenuse side of a triangle created between between the floor, PowerAnchor height, length of the PowerAnchor tether and distance of the vehicle to the PowerAnchor. Students can determine distances of unknown sides of this triangle, when information is given for two sides.					
Statistics and Probability							
Data representation and interpretation: Investigate the effect of individual data values, including outliers, on the mean and median • using displays of data to explore and investigate effects	(ACMSP207)	Students document vehicle lap times in a spreadsheet and locate mean, median and range. Students add, remove and modify times to investigate the effects on other values.	✓	✓	✓	✓	✓