***Granville Boys High School  
 Stage 4 Integrated STEM Project***

**Make** It Move

|  |  |  |
| --- | --- | --- |
| **Name of Unit:**  **Make it Move** | **GBHS Stage 4-Year: 7 “Make it Move”** | |
| **Teachers Names & Signatures** | | **Maths Teacher:** |
| **TAS Teacher:** | | **Science Teacher:** |
| **Year: 7**  **Duration: One full day a week for 10-12 weeks** | | **Starting date \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Finishing date \_\_\_\_\_\_\_\_\_\_\_\_\_** |

|  |
| --- |
| **Unit outline:**  In this unit, students individually and collaboratively plan and conduct a range of types of first-hand investigations, including fieldwork and controlled experimental methods, ensuring that fairness, safety and ethical guidelines are followed. Students process and analyse data and information from first-hand investigations and secondary sources to identify trends, patterns and relationships, drawing relevant, evidence-based conclusions. They reflect on how the methods, strategies used and the quality of data obtained could be improved. Their ideas, methods and findings are communicated to a given audience using appropriate scientific language, representations, text types and finally producing a product that they have invented.  Students will also learn about forces and how forces act as well as predict unbalanced forces in everyday situations. They will describe some everyday examples of technological design that reduce impact on forces. They will look at friction, everyday situations where it operates, and investigate factors that influence the size and effect of friction forces. Students will use the term ‘field’ in describing forces acting at a distance such as gravity and how it pulls objects towards the centre of Earth as well as how it acts in everyday situations. Students will also learn to contrast the terms ‘mass’ and ‘weight.’  Students will apply knowledge and understandings learnt in Science and Mathematics and create a vehicle in a practical workshop. They will work collaboratively to produce a vehicle suitable to race at the end of the term. |

|  |  |  |
| --- | --- | --- |
| Outcome Mapping for Make It! Move – Vehicle production | | |
| Science | TAS | **Mathematics** |
| 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  SC4-6WS Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually  SC4-7WS Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusion  SC4‑10PW describes the action of unbalanced forces in everyday situations | 4.1.1 applies design processes that respond to needs and opportunities in each design project  4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications  4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources  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)  4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project  4.4.1 explains the impact of innovation and emerging technologies on society and the environment  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project  4.6.1 applies appropriate evaluation techniques throughout each design project | MA4-1WM a student communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols- communicating  MA4-2WM a student applies appropriate mathematical techniques to solve problems- problem solving  MA4-3WM a student recognises and explains mathematical relationships using reasoning- reasoning  MA 4-7NA operates with ratios and rates, and explores their graphical representation  MA 4-18MG identifies and uses angle relationships, including those related to transversals on sets of parallel lines |

**General Capabilities:** *(See Teaching and Learning Program to identify links to General Capabilities)*

Learning Across the curriculum used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW <http://syllabus.bostes.nsw.edu.au/mathematics/mathematics-k10/learning-across-the-curriculum/>

The cross-curriculum priorities:

* *Aboriginal and Torres Strait Islander histories and cultures Aboriginal and Torres Strait Islander histories and cultures*
* *Asia and Australia's engagement with Asia Asia and Australia's engagement with Asia  *
* *Sustainability* Sustainability

The general capabilities:

* *Critical and creative thinking Critical and creative thinking*
* *Ethical understanding Ethical understanding*
* *Information and communication technology capability Information and communication technology capability*
* *Intercultural understanding Intercultural understanding*
* *Literacy Literacy*
* *Numeracy Numeracy*
* *Personal and social capability Personal and social capability*

Other learning across the curriculum areas:

* *Work and enterprise* Work and enterprise

The outcomes used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW. <http://www.boardofstudies.nsw.edu.au/syllabus_sc/>

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *Below are some suggested learning experiences contained within this sample unit of work mapped to the* Learning across the curriculum *areas contained within the NSW Syllabuses. This is not an exhaustive list.* | | | | | | | |
| **LITERACY** | **NUMERACY** | **ICT CAPABILITY** | **CRITICAL AND CREATIVE THINKING** | **ETHICAL BEHAVIOUR** | **PERSONAL AND SOCIAL CAPABILITY** | **ASIA AND AUSTRALIA’S ENGAGEMENT WITH ASIA** | **SUSTAINABILITY** |
| * Write scientific reports * Write explanatory texts * Communicate using scientific terminology * Communicate using metalanguage * Write procedural texts * Write evaluation. * Read and follow instructions. | * Make measurements * Analyse data to identify trends * Construct graphs to represent data * Derive equations from graphical data | * Use smart devices to gather experimental data * Use spreadsheets as a tool to perform calculations and create graphs   program.   * Use iPad to develop portfolio | * Use thinking skills to complete group activities and open-ended tasks * Solve problems in order to complete a design brief | * Consider how the actions of people impact on the sustainability of systems * Ethical use of materials | * Work together to participate in science investigations * Work together to participate in designing and production of vehicle * Work together to participate in learning experiences | * Investigate development of recycling of ICT resources and technologies in the APR | * Debate how using recycled material can improve the sustainability of resources |

| **Stage 4 Technology (Mandatory)**  **Area of Study: Product**  **Design Specialisation: Industrial Design**  **Technologies Specific Content: Mixed Materials** | | | |
| --- | --- | --- | --- |
| **Outcome:** | **Students learn about:** | **Students learn to:** | **Teaching and learning strategies:** |
| 4.4.1 explains the impact of innovation and emerging technologies on society and the environment | * the impact of innovation and emerging technology on society and the environment | * explain the impact of innovations and emerging technologies on society and the environment including new ICTs | **Big Question: *What impact does the development of innovative and emerging technology have on Australia’s society and environment?***  Discuss uses of technology – consider life without it.  Investigate the impact on society – focus on activity levels.  Define emerging technology. Ensure understanding of innovative and emerging technological resources. Relate to work covered in science  Review:   * Use of innovative technology in Australia * Emerging technology developed in Australia * problems associated with each   Investigate the impact within Australia and overseas with respect to products – impact on natural environment and on society.  Focus on product development– brief historical perspective, evolution of products and improvement, benefits of innovation. |
| 4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications | factors affecting design   * function * aesthetics * environmental * resource availability | * examine factors affecting design in the areas of study of Product | When designing products, it is important to consider human form, environmental, socio-cultural, safety and functional impacts of the development.  Students search for and identify images of innovative and emerging technology that demonstrate positive and negative impact on the environment.  Discuss impact on the natural environment   * Huge demand for technology * Pollution – recycling and reusing * Visual impact   Discuss Australia’s growing population, changes in the way we live and work, urbanisation and increasing needs for products. Investigate Australia’s use of technology and changes over time. How has it impacted the socio-cultural development?  Discuss impact on society   * Changing way of work and how we live * Health of society * Jobs available |
| 4.1.1 applies design processes that respond to needs and opportunities in each design project | design processes including:   * analysing needs, problems and opportunities * establishing criteria for success * researching * generating creative ideas * communicating ideas * experimenting and testing ideas * risk management * managing resources * producing design solutions * evaluating ideas and * solutions | * establish a design process that responds to an identified need and opportunity * apply a design process when developing quality solutions * establish criteria for successful achievement of needs and opportunities * record design processes and decision making in a design folio * consider short-term and long-term consequences of design in the design process * identify needs and opportunities that require solutions | Big Idea: Introduce Red Bull Billy Cart Challenge, in Centennial Park Sydney  <https://www.youtube.com/watch?v=TzMSqRl9q3w>  <https://www.youtube.com/watch?v=6S0bqUxTE44>  - There are many videos available to watch.  Introduce (or revise) the design process. Identify main steps. Discuss cyclical nature of design process, no definitive entry/exit points, documentation, design modification and development in response to research and testing, ongoing evaluation.  Identify the need/problem – the need to work collaboratively to design and construct a vehicle using recycled materials. (Discuss human form and safety)  Introduction to Workshop. Students work through a series of exercises to develop skills in the manipulation of tools and techniques to produce a vehicle.  **Introduce design brief – to design and construct a vehicle to carry one person that steers and stops.**  Students begin by sketching ideas for their vehicle. Begin by researching push powered vehicles. Students create a series of thumbnail sketches exploring how one variable may be changed showing design development and modification. Develop 3 ideas. Create full sized models using paddle pop sticks and small wheels. |
| 4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources | * experimentation and testing of design ideas * relationship of * experimentation to success criteria * research methods * needs analysis | * apply the results of experimentation to designing and making when developing each design project * identify, interpret and evaluate data from a variety of sources * use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project | Make connections with activities conducted in mathematics about the shape of vehicle, the angle of body and wheel size.  Draw upon the experiments conducted in science to make informed decisions about variables:   * wheel sizes * vehicle material * vehicle chassis * braking configuration * steering configuration * manufacturing techniques * set up of vehicle * human form * speed * safety   Make connection with investigations conducted in science – list variables for Newtons Law of motion, recall results and conclusions, predict how changing the vehicle by modifying one or more design variable will impact on the speed of the vehicle. |
| 4.6.1 applies appropriate evaluation techniques throughout each design project | * developing criteria for success as a tool for assessing design development and production * ongoing evaluation of design ideas and decisions * final evaluation considering * design process used * design solutions * reflection on learning | * apply criteria for success in decision making during the development of each design project * use criteria for success to reflect on the design process used and the solutions * evaluate prior to, during and at completion of each design solution * self-assess and peer-assess design solutions |
| 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) | Materials/components   * types and functions of common electronic components such as diodes, resistors, capacitors, switches and batteries * Tools * specific tools relating to electronics technologies * Techniques * techniques such as soldering, drilling, cutting | * select and use electronic components for a design project * select and correctly use tools of technology for a design project * set out and construct simple | Discuss method of creating steering and braking system considering method to test.  Discuss method of testing using Newton’s laws.  Develop test and allow students to test their modified designs.  Make test steering and braking system configuration. Controlled variable: Use same location, driver and distance. Test different designs. Select best design.  Introduction to WHS. What is risk management? How does it work? What is it used for?  Ethical materials. Where do they fit in the design of products-models, prototypes, testing ideas and concepts, end product. Different vehicle materials, students examine range of recycled objects.  Students create:  A safety instruction and a test to ensure safe use of their vehicle. |
| 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project | * risk management strategies * responsible behaviour in working environments * Work Health and Safety practices * the safe and responsible use of materials, tools and techniques in each design project * maintenance of tools and equipment | * manage risk when developing design projects * use tools, materials and techniques in a responsible and safe manner in each design project. * maintain tools and equipment including computer equipment |
| 4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * skill development and refinement * relationship of quality solutions to needs and opportunities and the criteria for success | * practice and refine skills * apply a design process that responds to needs and opportunities * produce solutions reflecting quality standards appropriate to each design project | Part 2 of Design Brief- students discuss ways of demonstrating the function of their vehicles. Relate to science lessons – resource use and management. What have they learned, how could this be applied to the design and construction of this device?  Consider: resource use and management -   * steering * braking * movement   Teacher directed discussion and exploration of possibilities- levels of design complexity, degree of difficulty – encourage differentiation, challenge ability.  Students sketch initial design ideas based on the above.  Class activity – develop criteria to evaluate success (eg. Must show steering, braking and movement/speed, must be repeatable, durable, consistent). As a group create a list of criteria that are considered essential to demonstrate the success of the developed product. In individual groups, students then add their specific criteria that relate to their design. Consider both aesthetic and functional criteria.  Students continue to work collaboratively to modify and refine design ideas in response to knowledge gained through testing and experimentation in science lessons.  Safety issues – consideration of safe work practice using a range of tools, materials and techniques. Discuss safety when designing and developing their vehicle.  Students test different design ideas, tools, materials and techniques. Record results, evaluate and make informed choices based on **evidence gathered**.  Students create time plan for production. Document in folio.  Students construct device to measure/show speed of their vehicle. Document process in folio.  Class presentation – completed projects are set up for testing. Each group demonstrate their vehicle using fair testing methods. |

| **Stage 4 Mathematics**  **Topics: Rates & Ratios, Angles, Geometrical Figures** | | |
| --- | --- | --- |
| Outcomes | Content | Teaching and Learning Strategies |
| MA4-7NA A student operates with ratios and rates, and explores their graphical representation  MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols  MA4-2WM applies mathematical techniques to solve problems  MA4-3WM recognises and explains mathematical relationships using reasoning | **Content:**  Students solve a range of problems involving ratios and rates, with and without the use of digital technologies   * Interpret and calculate ratios that involve more than two numbers * Solve a variety of real- life problems involving ratios * Convert information into a simplified rate e.g. 150 kilometres travelled in 2hours = 75km/h * Solve a variety of real-life problems involving rates, including problems involving speed which is rate of travel *Critical and creative thinking* | **Big idea: apply the concept of rates to observe, calculate and understand the speed of vehicles**   * Introduce the concept of ratios, rates and speed * Investigate the ratio of the circumference of wheels with width of the wheels * Investigate the rotational speed of wheels, place a black dot on one wheel and find the speed of rotation, the distance travelled by the wheel in one revolution * Investigate the ratio of push power and distance travelled by vehicle * Investigate the speed of all vehicles by creating a start and finish line, students time how long it takes for the vehicles to travel the distance to the finish line |
| MA4-18MG A student identifies and uses angle relationships, including those related to transversals on sets of parallel lines  MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols  MA4-2WM applies mathematical techniques to solve problems  MA4-3WM recognises and explains mathematical relationships using reasoning | **Content:**  Use the language, notation and conventions of geometry   * Define and label angles using common conventions   Recognise the geometrical properties of angles at a point   * complimentary, supplementary and adjacent angles *Literacy* * Identify, name and find straight angles, revolution, vertically opposite and angles embedded in diagrams *Literacy* *Critical and creative thinking* | **Big idea: apply angle properties to design and determine the angle of chassis to maximise speed and generate more power.**  Naming convention and measuring angles    Students practise measuring angles using a protractor by following these steps:   1. Place the protractor over the angle to be measured. 2. Move the protractor so the centre of the baseline is on top of the vertex of the angle. 3. Make sure the baseline is on top of one arm of the angle. 4. Hold the protractor carefully so it does not move. 5. Count forwards from 0° along the scale until you reach the other arm of the angle. 6. The number where this arm crosses the scale tells you the size of the angle in degrees.   Students use GeoGebra to investigate angle relationships. |

| **Stage 4 Science-Year 7 GRANVILLE BOYS HIGH SCHOOL**  **Topics: Working scientifically and Forces**  *Is Thinking Scientifically the way to solve everyday problems?* | | |
| --- | --- | --- |
| Outcomes | Content | Teaching and Learning Strategies |
| 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  SC4-6WS  Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually  SC4-7WS Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions | ***WS4 Students question and predict by:***   1. identifying questions and problems that can be investigated scientifically (ACSIS124, ACSIS139) 2. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139)   **WS5.*1 Students identify data to be collected in an investigation by:***   1. identifying the purpose of an investigation 2. proposing the type of information and data that needs to be collected in a range of investigation types, including first-hand and secondary sources *Numeracy* *Critical and creative thinking* 3. locating possible sources of data and information, including secondary sources, relevant to the investigation *Critical and creative thinking* *Literacy*   ***WS5.2 Students plan first-hand investigations by:***   1. collaboratively and individually planning a range of investigation types, including fieldwork, experiments, surveys and research (ACSIS125, ACSIS140) 2. outlining a logical procedure for undertaking a range of investigations to collect valid first-hand data, including fair tests 3. identifying in fair tests, variables to be controlled (held constant), measured and changed 4. describing safety and ethical guidelines to be addressed *Ethical understanding* *Personal and social capability*     ***WS5.3 Students choose equipment or resources for an investigation by:***   1. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies *Information and communication technology capability* 2. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141) *Information and communication technology capability*   ***WS6 Students conduct investigations by:***   1. collaboratively and individually conducting a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed (ACSIS125, ACSIS140) *Personal and social capability* *Ethical understanding* 2. assembling and using appropriate equipment and resources to perform the investigation, including safety equipment 3. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141) *Information and communication technology capability* 4. following the planned procedure, including in fair tests, measuring and controlling variables (ACSIS126, ACSIS141) *Ethical understanding* *Personal and social capability* 5. recording observations and measurements accurately, using appropriate units for physical quantities *Literacy* 6. performing specific roles safely and responsibly when working collaboratively to complete a task within the timeline *Personal and social capability* 7. assessing the method used and identifying improvements to the method (ACSIS131, ACSIS146) *Critical and creative thinking* Work and enterprise   ***WS7.1 Students process data and information by:***  Students:   1. identify changes that take place when particular forces are acting 2. predict the effect of unbalanced forces acting in everyday situations 3. describe some examples of technological developments that have contributed to finding solutions to reduce the impact of forces in everyday life, e.g. car safety equipment and 4. footwear design *Information and communication technology capability* *Critical and creative thinking* | **Pre Test**  **Post test**  **Science is important**  Name some common electronic devices and explain that science was used to create them all. Discuss some current issues that require an understanding of science.  Explain how science will help students to become able to make informed decisions about important issues.  **The branches of science**  Describe the main branches of science and what they do.  **Teamwork**  Explain that scientists work in teams, and that students will in their practical investigations/first-hand investigations too.  **Some common tasks**  Describe some skills that scientists use, such as observing, measuring, classifying, inferring, predicting, analysing, calculating and making models.  **Safety**  Hand out a list of safety rules in the working environment.  ***Carrying out a first-hand investigation/project:***   * ***Big Question: How to make a vehicle with a steering wheel and wheels that turn and can carry one person?***   **Brainstorm the big idea.** Students work in teams. They come up with the **Scientific method** of carrying out a first- hand investigation. Explain the structure of a typical scientific report and the information covered in each section. In particular stress the aim, hypothesis equipment, diagram, method, observations, results and the conclusion.  **Identifying variables**  Define and explain dependent, independent and controlled variables. Use an example to illustrate their meanings.  **Developing a hypothesis**  Revise what a hypothesis means: it is not a question; it is a statement that says how one variable (the independent variable) will affect the other (the dependent variable). It is an educated guess.  **Developing your procedure**  Explain that the key point of a procedure is to find a way of testing only one independent variable, which will affect the dependent variable. Must change only one variable— e.g. height  **Drawing a scale drawing of their vehicle**  **Taking accurate measurements and scale drawing**  Outline some methods to achieve accurate measurements. Discuss parallax error.  **Constructing different parts of your vehicle for example the wheels**  **Putting your results in a table**  **Students put their vehicle in for testing**  **A teacher drives the vehicle and the students record distance and time and calculate speed and acceleration**  **Your conclusion**  Explain that a conclusion must give a clear statement of what you discovered about the hypothesis. For example is the size of the wheels you decided correct? If not go back and rectify it. In this manner, test each part of your vehicle and modify and correct it and complete making the vehicle by *trial and error.* |
| SC4-8WS  Selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems  SC4-9WS Presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations  SC4-5WS  Collaboratively and individually produces a plan to investigate questions and problems  SC4-6WS  Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually  SC4-7WS  Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions  SC4-9WS  Presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations | ***WS7.2 Students analyse data and information by:***   1. checking the reliability of gathered data and information by comparing with observations or information from other sources *Critical and creative thinking* 2. constructing and using a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129, ACSIS144) *Information and communication technology capability* *Numeracy* *Literacy* 3. identifying data which supports or discounts a question being investigated or a proposed solution to a problem *Critical and creative thinking* 4. using scientific understanding to identify relationships and draw conclusions based on students data or secondary sources (ACSIS130, ACSIS145) 5. proposing inferences based on presented information and observations *Critical and creative thinking* 6. reflecting on the method used to investigate a question or solve a problem, including evaluating the quality of the data collected (ACSIS131, ACSIS146) *Critical and creative thinking*   ***WS8 Students solve problems by:***   1. using identified strategies to suggest possible solutions to a familiar problem *Critical and creative thinking* 2. describing different strategies that could be employed to solve an identified problem with a scientific component *Critical and creative thinking* 3. using scientific knowledge and findings from investigations to evaluate claims (ACSIS132, ACSIS234) *Critical and creative thinking* 4. using cause and effect relationships to explain ideas and findings *Critical and creative thinking* 5. evaluating the appropriateness of different strategies for solving an identified problem *Ethical understanding* *Critical and creative thinking*   ***WS9 Students communicate by:***   1. presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133, ACSIS148) *Literacy* *Information and communication technology capability* 2. using appropriate text types in presentations, including a discussion, explanation, exposition, procedure and recount *Literacy* 3. using a recognised method to acknowledge sources of data and information *Literacy* 4. constructing and using a range of representations to honestly, clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databases *Literacy* *Information and communication technology capability* *Ethical understanding*   constructing and using the appropriate type of graph (histogram, column, sector or line graph) to express relationships clearly and succinctly, employing digital technologies as appropriate *Numeracy* *Information and communication technology capability*  **WS7.1bb**  **Using a range of representations to organise data, including graphs, keys and diagrams** | ***What is force? Students to brainstorm***  ***PW1 Change to an object’s motion is caused by unbalanced forces acting on the object. (ACSSU117)***  Interactive lesson  Class activity: Balanced and unbalanced forces  **Push, pull or twist**  Define a force as a push, pull or twist.  Explain that the unit of measurement of force is the Newton (N).  **What forces do**  You can tell a force has acted on an object if there is a change in motion or shape of that object.  Students should engage in answering – what are the forces by thinking of the changes that take place when their vehicle is stationary and when it is moving. Then they explain what is meant by balanced and unbalanced forces.  **Practical investigation 1: Looking at forces acting on their vehicle**  **Worksheet 7.1: What can forces do?**  **Inertia**  Define inertia as the tendency of an object to remain unchanged in its motion.  **A fun activity** to do at home where students observe that the marble continues doing what it was doing (inertia) before a change.  **Reducing impact force**  Explain how reducing impacts involves ‘cushioning’—to absorb some of the impact force. Give examples of a running shoe, helmet and car safety features (e.g. an investigation of crash test dummies).  **Measuring forces**  Explain how the amount of stretching of a spring can be used to measure the size of a force.  **Skill builder: Drawing forces**  Explain how the length of an arrow in a diagram can represent the size and direction of a force.  ***What is friction? Students to come up with their daily experiences where forces slow down their motion or oppose motion***  Ask “what are the factors that would slow down the motion of their vehicle.” Then explain that friction opposes motion and that friction is a contact force and friction occurs whenever two surfaces are in contact.  An activity to start students thinking about friction—why does the surface get hot?  **What is friction?**  Define *friction* as a force that opposes the movement of one body over another.  Explain that friction depends on:   * how rough the surface is * how hard the surfaces are pressed together.   Conduct a practical investigation on friction and mass.  **Useful friction**  Discuss a situation in which friction is helpful—walking, bike brakes  **Unwanted friction**  Discuss situations where friction is a problem—e.g. moving parts in a car engine, air resistance.  **Reducing friction**  Demonstrate some devices and methods of reducing friction.  **Big question**  **What is a non-contact force?**  **Gravity—a non-contact force**  **Interactive lesson**  **Class activity:** **Gravity, mass and weight**  **What is gravity?**  Define *gravity* as a force of attraction between objects. Larger objects = bigger mass = larger force.  Outline how gravitational force acts through space and holds the planets in orbit around the Sun.  **Comparing mass and weight**  Explain the difference between mass and weight and their units with regard to the vehicle they have made.  Define *terminal velocity*  **Students run their vehicle, tabulate the distance travelled VS time and calculate the speed, acceleration and plot distance time graphs. They analyse the graph and make relevant conclusions .** |

# Design situation:

**Make** It! MOVE

The world is becoming obsessed with innovation and emerging technology and this is having a significant impact on society and the environment. We take for granted new technology to meet the needs of society, but what happens with our waste and health? Can we make people more active and get them away from technology and back to fresh air and using our hands to build something fun?

## Design brief:

GBHS is creating a racing competition in 2016. Your task is to build a suitable vehicle, create a supporting portfolio and present back to the school by the end of term 1. You will be expected to work individually and in groups to achieve this goal.

Working as part of a collaborative team complete the following:

1. Design and produce a timber vehicle with wheels and a seat that can carry one person from the side gate near the school canteen and stop before the big tree. Your task will involve designing your vehicle and exploring variables including:

* wheel sizes
* vehicle material
* vehicle chassis
* braking configuration
* steering configuration
* manufacturing techniques
* set up of vehicle
* human form
* safety
* speed

Students apply knowledge gained through research and experimentation to develop optimum production of a prototype for testing.

Students make decisions and explain principles based on mathematical evidence.

1. Design and construct a course to measure and display the vehicles capabilities

* Students explore variables in the designing and construction of braking and steering configuration.
* Students apply knowledge gained through experimentation to develop a device that demonstrates the output of speed and movement.
* Students explain principles based on mathematical evidence.

1. Use your measuring course to show the success of your prototype.
2. Common assessment:

Each person will produce a design folio documenting design, criteria for success, research, experimentation, production and evaluation.

* Design – sketches, design modification, justification of design decisions and final design.
* Criteria for success – will be established early in the project and be used as an ongoing evaluation tool to monitor progress and determine success.
* Research – renewable and non-renewable resources, braking and steering configuration
* Experimentation – construction, tools, materials and techniques.
* Production – documentation from initial ideas to finished product (video, blogs, wiki, log book, webpage).
* Evaluation – justification of decisions made to meet the need identified in the design brief.

Ongoing assessment criteria to ensure students have fast and effective feedback.

## *Rubric:*

| **Grade** | **Area** | **Criteria** |
| --- | --- | --- |
| **A** | Science | Demonstrates deep knowledge of renewable and non-renewable resources including current innovative technologies and applies this to problem solving.  Demonstrates a deep understanding of the underlying scientific principles relating to renewable and non-renewable resources. Demonstrates a thorough understanding of sustainability and relates this to current examples.  Clearly identifies all components of the scientific method. Analyses data from experiments and clearly presents findings using tables and/graphs.  Clearly justifies decisions made to design and clearly evaluates. |
| Technology | Analyses data from research and experimentation and uses this to justify decisions when following a design process to produce an efficient blade design.  Independently used CAD software to produce an efficient blade design that is produced in a 3D printer.  Demonstrates a deep understanding of the use of a design process to create good design solutions through a well-documented design portfolio. |
| Mathematics | Calculates ratios and rates, solves real- life problems involving ratios and rates, and converts information into a simplified rate. Define and label angles. Recognises the geometrical properties of angles at a point complimentary, supplementary and adjacent angles. Identifies straight angles, revolution, vertically opposite angles. Identifies properties of special quadrilaterals, distinguishes between convex and non-convex, line and rotational symmetry, determine lines of symmetry and the order of rotational symmetry of polygons.  Communicates mathematically, problem solves and reasons when justifying solutions to solve the problem. |
| **B** | Science | Demonstrates good knowledge of renewable and non-renewable resource including current innovative technologies.  Demonstrates a good understanding of the underlying scientific principles relating to renewable and non-renewable resources. Demonstrates a good understanding of sustainability and relates this to current examples.  Clearly identifies most components of the scientific method. Analyses data from experiments and presents findings using tables and/graphs.  Clearly justifies decisions made to design and evaluates. |
| Technology | Evaluates data from research and/or experimentation and justifies decisions when applying this through a design process to produce an efficient blade design.  Effectively used CAD software to produce a blade design that is produced in a 3D printer.  Demonstrates a good understanding of the use of a design process to create design solutions. |
| Mathematics | Calculate ratios and rates, solves some problems involving rates or ratios. Define and label angles. Recognises the geometrical properties of angles at a point complimentary, supplementary and adjacent angles. Identifies straight angles, revolution, vertically opposite and adjacent angles. Identifies properties of special quadrilaterals, distinguishes between convex and non-convex, line and rotational symmetry, determine lines of symmetry and the order of rotational symmetry of polygons.  Communicates mathematically for some strategies and describes solutions to solve the problem. |
| **C** | Science | Demonstrates sound knowledge of renewable and non-renewable resource including a current technology.  Demonstrates sound understanding of the underlying scientific principles relating to renewable and non-renewable resources. Demonstrates sound understanding of sustainability and relates this to current examples.  Identifies some components of the scientific method. Analyses data from experiments and presents findings using tables and/graphs.  Shows some justification of decisions made to design and attempts to evaluate. |
| Technology | Uses data from research or experimentation and identifies reasons for decisions when using a design process to produce an efficient blade design.  Used CAD software to produce a blade design that is produced in a 3D printer.  Demonstrates a sound understanding of the use of a design process to create a design solution. |
| Mathematics | Calculates simple ratios and rates.  Defines and labels angles. Recognises some angle properties.  Identifies straight angles, revolution, vertically opposite and adjacent angles.  Identifies properties of special quadrilaterals. Determine lines of symmetry and the order of rotational symmetry of polygons.  Communicates the strategies used and describes a solution to solve the problem. |
| **D** | Science | Demonstrates a basic knowledge of renewable and non-renewable resource including a current technology.  Demonstrates a basic understanding of the underlying scientific principles relating to renewable and non-renewable resources. Demonstrates a basic understanding of sustainability.  Identifies some components of the scientific method. Attempts to analyse data from experiments and attempts to present findings using tables and/graphs.  Shows basic justification of decisions made to design and shows a basic evaluation. |
| Technology | Uses data and identifies some reasons for decisions when using a design process to produce a blade design.  Used CAD software to produce or modify a basic blade design that is produced in a 3D printer.  Demonstrates a basic understanding of the use of a design process to create a design solution. |
| Mathematics | Calculates some ratios and rates. Defines and labels some angles. Recognises some angle properties. Identifies some angles as straight angles, revolution, vertically opposite and adjacent angles. Identifies properties of some special quadrilaterals. Determine lines of symmetry and the order of rotational symmetry of some polygons.  Communicates some information and shows the mathematics they are using to solve the problem. |
| **E** | Science | Demonstrates a limited knowledge of renewable and non-renewable resource including a current technology.  Demonstrates a limited understanding of the underlying scientific principles relating to renewable and non-renewable resources. Demonstrates a limited understanding of sustainability.  Identifies some components of the scientific method. Shows a limited analysis of data from experiments.  Shows limited justification of decisions made to design. |
| Technology | Produces a basic blade design with limited justification of decisions.  Used CAD software.  Produced limited or no documentation of a design process. |
| Mathematics | Calculates some ratios and rates. Labels some angles. Recognises some angle properties. Identifies some angles as straight angles, revolution, and vertically opposite. Identifies properties of some special quadrilaterals. Determine some lines of symmetry and the order of rotational symmetry of some polygons.  Communicates some information about the strategy used to solve the problem. |