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| **C:\Users\NELBATOORY\Desktop\2353_NSWED_STEM_LOGO.png**  **The Canobolas Rural Technology High School**  Stage 4 Integrated STEM Program  **Year 7 Unit 1:** Clean the drink **Duration**: 10 weeks (4 x 53 min lessons per cycle, 5 cycles) **Technology area of study:** Products  **Timetable model:** STEM periods are timetabled lessons. One period each from allocated Science and Mathematics. Two lessons taken from the Stage 4 Agriculture program. STEM runs as a semester course, in rotation with Stage 4 Agriculture.  **Context / Summary:**  In rural communities, water plays an important role in the wellbeing animals, plants and humans. Access to clean water is essential for life, and for producing food for all to eat. In times of disaster like drought, fire or flood, sources of water can be polluted, wasting valuable resource.  When  water is drawn from a river or dam for town water services it goes through a rigorous filtration process to make it safe for human use.  Students will investigate methods of cleaning water through filtration and apply their findings to prototype a portable water cleaner (product) for use in times of emergency for stock watering.  This unit is aligned with the Living World topic from Year 7 Science. Its purpose is to provide additional experience and context working within the nominated outcomes (below) to enhance engagement and understanding. Addressing specific content will occur directly in mainstream Science lessons and assessment. |
| **Background/Prior knowledge:**  This unit is sequenced in Term 1, the first term at high school for Year 7. Students will have different levels of prior knowledge as they come from a range of Partner Primary schools from both in and around Orange. It is assumed that students can describe some physical conditions of the environment and how these affect the growth and survival of things (ST3-11LW). This includes being able to identify physical conditions of their local environment (for this task, water) and use gathered data to develop explanations. |
| **Developed by: Jude Bertolin, Nicky Nealon, Matt Scott and Sulaiman Siddiqui**  Note: This program is to be used in conjunction with student handbook. Each task has a worksheet to be completed to be added to the students’ portfolio. |

| **Specific Outcomes –** addressed directly within the unit. | | |
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| **KLA** | **Outcome** | **Content** |
| Science | SC4-17CW - Explains how scientific understanding of, and discoveries about the properties of elements, compounds and mixtures relate to their uses in everyday life | CW3-Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques.  d. describe aqueous mixtures in terms of solute, solvent and solution  c. relate a range of techniques used to separate the components of some common mixtures to the physical principles involved in each process, including filtration  d. investigate the application of a physical separation technique used in everyday situations or industrial processes, e.g. water filtering. |
| Science | SC4-8WS - Selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems | WS8 a. Describe different strategies to solve an identified problem with a scientific component  WS8 d. Using cause and effect relationships to explain ideas and findings. |
| Science | SC4-9WS - presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations | WS9 a. Presenting ideas, findings and solutions to problems using scientific language  WS 9e.Constructing and using appropriate type of graph to express relationships |
| Science | SC4-2VA - Shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures. |  |
| Mathematics | MA4-2WM – applies appropriate mathematical techniques to solve problems | Computation with integers   * Compare, order, add and subtract integers |
| Mathematics | MA4-5NA - Operates with fractions, decimals and percentages | - express one quantity as a fraction of another  - convert fractions to decimals (terminating and recurring) and percentages |
| Mathematics | MA4-7NA - operates with ratios and rates, and explores their graphical representation | - solve a variety of real-life problems involving ratios |
| Mathematics | MA4-1WM Communicates and connects mathematical ideas using appropriate terminology, diagrams and symbols | Measurement and Geometry   * + Draw different views of prisms and solids formed from combinations of prisms * - draw (in two dimensions) prisms, and solids formed from combinations of prisms, from different views, including top, side, front and back views |
| Technology Mandatory | 4.1.1 applies design processes that respond to needs and opportunities in each design project | Students learn about   * 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 |
| Technology Mandatory | 4.3.2- demonstrates responsible and safe use of a range of tools, materials and techniques in each design project | Students learn about   * risk management strategies * responsible behaviour in working environments * Occupational Health and Safety practices * the safe and responsible use of materials, tools and techniques in each design project * maintenance of tools and equipment |
| Technology Mandatory | 4.5.2- produces quality solutions that respond to identified needs and opportunities in each design project | Students learn about   * suitable materials, tools and techniques for design projects * skill development and refinement * construction steps that contribute to a quality solution * relationship of quality solutions to needs and opportunities and the criteria for success for each design project |

| **KLA** | **Outcome** | **Content** |
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| Technology Mandatory | 4.6.1- applies appropriate evaluation techniques throughout each design Project | Students learn about   * 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 |

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| **Must** | water | | design | pollution | | dissolve | **cone** | | mixture | | light | | dirty |
| **Should** | insoluble | | solvent | soluble | | criteria | cylinder | | evaluate | | solution | | solute |
| **Could** | turbidity | | clarity | lumen | | potable |  | |  | |  | | ratio |
|  | | | | | | | | | | | | | |
| **Learning across the curriculum included in this unit:** | | Cross-Curriculum priorities | | | Aboriginal and Torres Strait Islander histories and cultures Aboriginal and Torres Strait Islander histories and cultures | | | | | | | | |
| General Capabilities | | | Critical and creative thinking Critical and creative thinking | | | | | Ethical understanding Ethical Understanding | | | |
|  | | | Intercultural understanding Intercultural Understanding | | | | | Literacy Literacy | | | |
|  | | | Numeracy Numeracy | | | | | Personal and social capability Personal and socail capability | | | |
| **8 Ways Strategies included in this unit:** | | Story Sharing | | | Non-Verbal | | | Land Links | | | |  | |
| Learning Maps | | | Symbols and images | | |  | | | |  | |
| **Assessment:**  Assessment by portfolio of tasks. Marking rubric attached. | | | | | | | | | | | | | |

**Vocabulary to be developed:**

**Syllabus Outcomes:**

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/>

**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

**Teaching Program Details**

| **Lesson** | **Science**  **Maths**  **TAS** | **Syllabus Outcomes and Content**  **A student:** | **Evidence of  Learning**  **Students:** | **Learning Activities**  **See student handbook** | **Resources/Strategies  -**  **See teacher handbook** | **Reg'n** |
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| 1 |  |  | * Complete first worksheet on STEM, Thinkerspace, Makerspace and explorerspace. * recognise symbols for STEM and resources | * **Task 1** – worksheet * **Class discussion and brainstorming** * What is STEM?   What is STEM at Canobolas about? – Students thinking, exploring and making. * Introduction to STEM Centre, Thinkerspace, Makerspace, Explorerspace and rules for the class. STEM workbook and portfolio. | * Student handbook * Task 1 sheet |  |
| 2 | **Science**  **TAS** | SC4-8WS –selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Completed water tower mini STEM activity project | * Mini STEM activity – Water tower storage * Complete **Task 2** on worksheet * Display a local example of a water tower on the projector screen. Explain to student the concept of gravity water pressure for potable water supply. * In groups of three, students create a 300mm high tower from the materials supplied to hold a foam cup of water without falling. The cup then must gravity feed the water through a small pipe to another foam cup 300mm from the base of the tower. **Critical and creative thinking** | * Activity teacher worksheet   - Class materials: water, large plastic container for testing, foam cup with small pipe to drain water.   * - Student Team Materials: paper cups, straws, paper clips, tape, string, foil, popsicle sticks, toothpicks, pens, pencils, paper, and other items available in the makerspace. |  |
| 3 | **Science** | SC4-2VA –shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures. | * Identify some main pollutants of water * Identify why water pollution is a problem * Identify a way to measure the clarity of water * Discuss the importance of water clarity * **Ethical Understanding** | * **Jigsaw activity**   Students sit in groups of 3. Each person is numbered 1, 2 or 3. Each person is given a post it note – each number has a different colour. Answer the following question on the post it note for the number you have been given.  1. Why is water important?  2. Name 5 organisms that need water  3. Why do you think dirty water a problem?  Collate post it notes on whiteboard and discuss.   * **Water pollution simulation activity** -Complete Murray-Darling Water pollution activity – student handbook. Students allocated various scripts and given bags of “pollutants” * Use **Cause and effect activity** to highlight what the consequences are of using dirty water. E.g. Cause – oil, causes less Oxygen getting into the water and the effect is less fish can live in the water * **Task 3**: **Worksheet** Why is water important? Identify common water pollutants. Why pollutants are a problem? How can we measure how clear water is? * **Use light meter** to show we can measure of water clarity and compare clean water verses dirty water. No need to record measurements at this stage. Just show difference in the measurement. | * Water “pollutants” as per handbook * Large tub of water * Light meter * Cause and effect template * Murray- Darling activity <http://goo.gl/86wnaW> |  |
| 4 | **TAS**  **Maths** | 4.1.1 applies design processes that respond to needs and opportunities in each design project   * - analysing needs, problems and opportunities * - Establishing criteria for success   MA4-5NA –operates with fractions, decimals and percentages | * Describe what happens in each of the steps in the PRIME design process * Calculate % clarity for a water sample * Can identify that a design process can be used to produce a solution to a problem. * Completed PRIME scaffold in student folio. | * **Present design brief** – PRIME - **Task 4** - **real world context**. Drought has hit our local community hard, and greatly impacting the survival of farming animals. What water is available is stagnate and its quality is falling. You have been employed by a company to come up with a cheap way to make dirty water clearer. Specifically to get the dirty sample as close as possible to 100% clarity   **Class discussion**   * P.R.I.M.E. explored as a design process. * Design brief handed out. * Teacher directs students through analysis of brief in collaboration using PRIME to complete individual worksheets for folios. * **Buzz group activity –** divide class into 5 groups. Allocate one of the P.R.I.M.E. areas for each group to draft for the class. Then present to whole class. * **Task 5** - **Light meter readings taken** of clear water and dirty water – students use guided mathematics to a % of clarity i.e. Dirty reading/clear reading x100   **NumeracyComplete maths calculations** | * Light meter * Dirty water sample |  |

| **Lesson** | **KLA:**  **ScienceMaths**  **TAS** | **Syllabus Outcome/Content** | **Evidence of  Learning**  **Students:** | **Suggested Learning Activities**  **See student handbook** | **Resources/Strategies  -**  **See teacher handbook** | **Reg'n** |
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| **5** | **Scienc**e | SC4-17CW / CW3  Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques.  CW3b. describe aqueous mixtures in terms of solute, solvent and solution | * Use the following terms appropriately in conversation and text –soluble, insoluble, dissolve, solute, solvent, solution, * Can identify if substances are soluble or insoluble | **Task 6** – **Practical investigation into solubility**  Practical- Investigate trying to dissolve different substances – Students identify the substance as insoluble and soluble. Test sugar, coffee, salt, sand, flour, jelly crystals,   * Introduce the words soluble and insoluble, mixture and dissolve. * - Complete Aim together as a class * - Go through the steps of the method * - Demonstrate how to complete the results table * - Complete practical * - Write conclusion – complete close passage with words soluble, insoluble, dissolve, mixture * **OR** – simulation trying to dissolve substances  - Watch YouTube - Solution Solvent Solute - Definition and Difference 6.5 mins  * - Teachers explicitly teach the terms solute, solvent and solution using the substances just tested * - Students use the terms solute, solvent and solution in sentences to show they understand their meaning * **Extension** – animations to show what happens when something dissolves | * Explicitly use Metalanguage in conversation throughout the lesson - soluble, insoluble, dissolve, solute, solvent, mixture * Clear plastic cups, plastic spoons, sugar, salt, coffee, sand, flour, jelly crystals, * <https://www.youtube.com/watch?v=e-2EoyDYamg>   Dissolving simulation activity  <http://www.sciencekids.co.nz/gamesactivities/reversiblechanges.html>  Extension animations:  <http://www.phschool.com/atschool/phsciexp/active_art/table_salt_dissolving_H2O/salt_solution.swf> |  |

| **Lesson** | **KLA:**  **Science**  **Maths**  **TAS** | **Syllabus Outcomes and Content**  **A student:** | | **Evidence of  Learning**  **Students:** | **Suggested Learning Activities**  **See student handbook** | **Resources/Strategies  -**  **See teacher handbook** | **Reg'n** |
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| **6** | **TAS** | 4.1.1 applies design processes that respond to needs and opportunities in each design project  - researching | | * Effectively locate a suitable website using Google * Record a website appropriately * Complete a PMI analysis | * **Task 7** – **research solutions** * **Think Pair Share activity** - Each student researches one way that dirty water can be cleaned * Think, pair, share of ideas to clean water * Complete **a PMI analysis** for one of the methods – **Task 8** | * Laptops |  |
| **7** | **Science** | SC4-2VA - shows a willingness to engage in finding solutions to science-related personal, social and global issues, including shaping sustainable futures. | | * Complete Y chart for portfolio * Complete poster for portfolio   **Ethical Understanding****Intercultural Understanding** | * Global water cleaning ideas   Task 9  Show video clips of drought ravaged location. **Use Y chart** (feel, see, hear) diagram to record present reflections on the people they have seen   * Poster – pairs – create a poster about a way people solve water cleaning issues overseas or camping etc. – poster to be colour copies so each student can put into their portfolio. Poster can be created on line or with traditional pencils, Texta etc. | * Resource material pack of sheets about global water quality issues and ways countries around the world clean their water * Y-chart |  |
| **8** | **TAS**  **Science** | 4.1.1 applies design processes that respond to needs and opportunities in each design project   * - generating creative ideas   SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems | | * Completed criteria for success scaffold in student portfolio * Generate ideas and materials that could be used | **Establish criteria**  -   **Task 10 -** Class revisits design brief and Teacher directs students through establishment of the criteria for success by questioning and class discussion   * Idea generation **– Task 11** students sketch ideas that they think you might work. Mind mapping list of recycled materials they could use. Further research if needed. |  |  |
| **9** | **Maths** | MA4-7NA operates with ratios and rates, and explores their graphical representation  Draw different views of prisms and solids formed from combinations of | | * + students produce a 2D drawing of a cylinder and a cone to create a drawing of bottle from different views including side and top | **Scaled drawings**   * + **Task 12 -** students will look at projects already drawn on Sketch up and look at the object from top, side front and Back views to know what 2D is and what different views look like   + teachers guide students will create views on grid paper of simple drawings  - cylinder and cone to create a bottle   + grid paper drawing to go in portfolio   **Extension** – create a 3D CAD drawing of a basic PET bottle on Sketchup. Use the rotation of views to demonstrate that 2D shapes exist within 3D shapes. 3D print the shapes. | * 1 grid paper * pencil * rulers * set squares      * CAD lab computers * 3D printer |  |
| **10** | **TAS**  **Science** | 4.1.1 applies design processes that respond to needs and opportunities in each design project  SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems | | * Completed SWOT scaffold in their portfolio * Completed mini STEM activity project | **Task 13**   * Students decide on the specific solution they will use to clean the water * Students complete a SWOT analysis for this design   Mini STEM maker activity to keep students engaged in STEM, develop critical and creative thinking skills. The water raft – how many washers can yours hold? Students are to make and test a raft from aluminium foil and a limited amount of other materials. | * Aluminium foil 300mm sq. * 3 drinking straws * 100mm tape |  |
| **11** |  | MA4-7NA operates with ratios and rates, and explores their graphical representation | | * Draw a 2D front view drawing of bottle to scale | **Task 14 – drawing scaled diagrams**   * Students draw scaled diagram of final design including materials to be used. Scale 1:2. Using 2D model of front view. |  |  |
| **Lesson** | **KLA:**  **Science**  **Maths**  **TAS** | | **Syllabus Outcome/Content**  **A student:** | **Evidence of  Learning**  **Students:** | **Suggested Learning Activities**  **See student handbook** | **Resources/Strategies  -**  **See teacher handbook** | **Reg'n** |
| **12** | **TAS** | | 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Completed written safety test for student portfolio * Water cleaner project commenced | **Task 15** - **Workshop safety** – students complete workshop safety sheet after lesson on safety.  Teacher demonstrates the safe use of equipment supplied in the makerspace. Individual machine written safety tests if advised in ESiS.  Begin making process. | Equipment Safety in Schools (ESiS) <https://online.det.nsw.edu.au/esis/teacher/>(DoE intranet link for staff advice)    DoE Curriculum Support 'Learning to work safely <http://www.curriculumsupport.education.nsw.gov.au/secondary/technology/safety/student_activities/index.htm> |  |
| **13** | **TAS** | | 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Water cleaner project continues | **Task 16**  Making and testing | * Makerspace materials * Light meter * Water supply and test container |  |
| **14** | **TAS** | | 4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Water cleaner project completed | **Task 16**  Making and testing | * Makerspace materials * Light meter * Water supply and test container |  |
| **15** | **TAS** | | 4.6.1 applies appropriate evaluation techniques throughout each design Project  4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Completed individual evaluation scaffold in portfolios. | Testing and collecting data day, evaluation **Task 17** – photo of finished product  **LiteracyTask 18 – Evaluation sheet -** Students think/pair/share final evaluation of the success of their filter. Based on the criteria established at the commencement of the activity. | * Makerspace materials * Light meter * Water supply and test container |  |
| **16** | **TAS** | | 4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project | * Flowchart sketch of code program. * Screen capture of LEGO EV3 code for design portfolios. * Digital photo of light sensor being used in design portfolio. * Results of light meter testing recorded. | **Extension** - In their groups, students construct and code a LEGO EV3 light meter. Students individually start with a teacher driven brainstorming to product a code concept flowchart. Students in groups produce code using Lego EV3 software / build light meter data logger.  Working Light meter used to compare the amount of light emitted through different mixtures.   Students predict the difference between light, light through clear water, light through their cleaned water. | * Lego EV3 kits, with light sensor. * STEM computer lab. * Data logging software.   Flowchart / Data results scaffold. |  |
| **17** | **TAS** | | 4.6.1 applies appropriate evaluation techniques throughout each design Project | * Completed individual evaluation scaffold in portfolios. | **Extension** - Students test water cleaner for ability to clean dirty water. LEGO EV3 light meter used to data log light passing through mixture before and after cleaning and compared to clean water.    Teacher revisits criteria for success established at the start of the process, and how to complete an evaluation against set criteria.      Students complete individual evaluation of water cleaner based on T/P/S activity and personal opinion. | Student water cleaners.    Dirty water for testing, clean water for a control.      Project evaluation scaffold in portfolio. |  |
| **18** | **TAS** | | 4.5.2- produces quality solutions that respond to identified needs and opportunities in each design project | * Produce a 3D printed component for their water cleaner | **Extension** - Teacher introduces 3D printing and revisits CAD using Sketchup. Teacher leads students through simple CAD task, like straw joiners. Students create and 3D print a part to use on their water cleaner.  For students with CAD experience, a design challenge to design and 3D print a water release valve for their water cleaning device. Valve can be two parts, or printed as one. | * CAD lap computers * 3D printers |  |
| **19** | **ALL** | | Aboriginal and Torres Strait Islander histories and culture | * Can identify and describe tools used by Australian Indigenous people * Can identify and describe how Australian Indigenous people use water   **Aboriginal and Torres Strait Islander histories and cultures** | **Optional**  Students brainstorm list of tools and equipment used in makerspace. Record list on the board. Students visit website on Indigenous tools and technology. List traditional tools on the board. Link traditional tools with modern tools used for similar tasks.  View YouTube clip on the Aboriginal Water Initiative to investigate how Indigenous people filtered water and for what purpose using low-tech methods. | <http://www.australia.gov.au/about-australia/australian-story/austn-indigenous-tools-and-technology>  <https://www.youtube.com/watch?v=JCAtW8zlBPw> Brad Moggridge - Cultural Value of Water and the Aboriginal Water Initiative [6:26- 7:36 min Aboriginal uses] |  |