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INTRODUCTION

The *Survival* series uses real-life survival situations to connect theories and approaches from maths technology and science. Students from Years 7–9 will undertake research and conduct experiments relevant to a brief, using combinations of maths and design methods to provic solutions to the design problems. The series is centred around project-based learning, and covers Level 6 VELS in Design, Creativity and Technology, Maths, Science, Interpersonal Development and Personal Learning (http://vels.vcaa.vic.edu.au/vels/level6.html).

Students will use the Engineering Design Process (EDP) for each Design Challenge: defini researching, brainstorming, choosing the best solution, building, testing, communicating a redesigning.

Preparation or “research” for each task involves students interpreting and analysing data fro tables and graphs, answering questions and making predictions. These tasks require studen to use maths processes such as: algebra, problem solving, proportional reasoning, classifyin events as dependent or independent, representing data in graphical forms, and being able t interpret and analyse this data.

While undertaking *Survival* challenges, students will generate a range of possible solutions for each task before selecting the preferred option and explaining how it provides the best solution to the problem. They will make critical decisions on materials and techniques, and will develop a suitable design, taking into account function and performance, costs, and energy requirements. Students will also test their solutions, critically analyse their effectiveness, and redesign them as needed.

In *Survival: Amazon Mission*, students are required to complete three challenges relating to survival in the Amazon: delivering life-saving malaria medicine to a remote village, designi a water-filtration system to filter mercury out of water so that it is not poisonous, and com up with a way to prevent the spread of a new strain of the influenza virus.

To solve each of these problems, students will need to do a combination of the following: interpret line graphs, conduct controlled experiments, record and display data in a table, draw and relate graphs that have two variables, apply the engineering design process, use physical and maths models, and much more.

Many of the tasks in the *Survival* series require students to work in teams, building team negotiation and delegation skills. Following each task, students are also required to assess how well their team worked, and how well they worked individually within the team. This book provides rubrics for each step of the Engineering Design Process, as well as Stud Self-Assessment Rubrics and student work samples.

Name

STUDENT PAGE

1. DEFINE THE PROBLEM: MALARIA MELTDOWN!

In order to get the medicine to the village, you and your classmates will first fly to Manaus, Brazil. From there, you will take a helicopter to a clearing that is approximately 13 kilometres from the Yanomami village. The medicine will remain safe during the flights, stored in a large temperature-controlled refrigerator. However, once you've reached the helicopter landing, you must carry the medicine the rest of the way to the village by foot. The walk to the village will take 2 hours. The Amazon rainforest has an average temperature of 37˚C this time of year. In the heat of the rainforest, medical officials think that their current medicine carrier will not be able to keep the medicine below 30˚C for very long. They fear the medicine will spoil before it reaches the village. The hospital needs your engineering team's help to design a new medicine carrier that can keep the medicine between 15˚C and 30˚C for the entire journey!

ENGINEERING CRITERIA

GOOD INSULATOR →	In an environment that is 37°C, the inside of your model carrier must stay between 15°C and 30°C for 2 hours. ***
LOW COST →	Your model should be as low in cost as possible.
RUGGED AND PROTECTIVE →	You will place an egg inside the carrier, and you will drop the carrier from a height of 1 metre. Both the egg and the carrier must remain intact.

*** Due to time constraints, you will let 1 minute represent 2 hours. Your model will perform to the same level in 1 minute as a carrier that is 11 times thicker would in 2 hours. Therefore, your actual carrier design will be 11 times thicker than your model design.

ENGINEERING CONSTRAINTS

You are limited to the following materials for your carrier design:

- corrugated cardboard
- foam board
- bubble wrap
- aluminium foil

2. RESEARCH THE PROBLEM: MALARIA MELTDOWN!

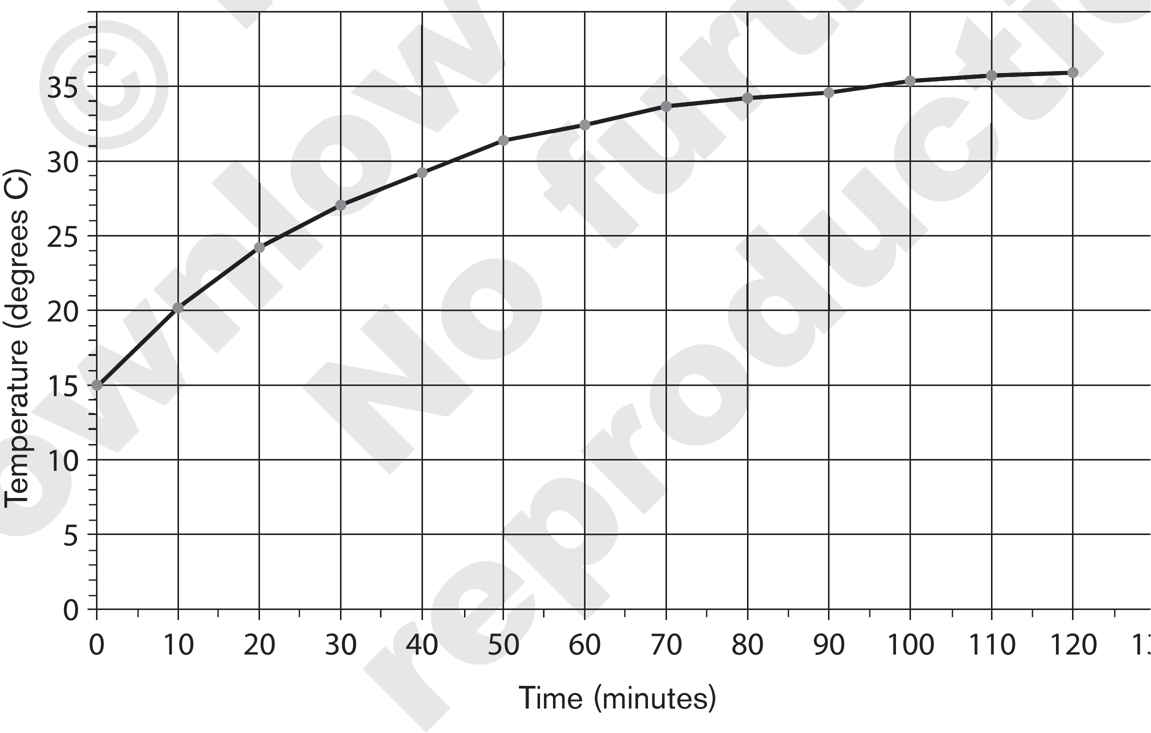
RESEARCH PHASE 1: ANALYSE THE CURRENT MEDICINE CARRIER

A team of engineers has already done some initial testing on the current medicine carrier. The team cooled the medicine to the minimum temperature of 15°C and then placed it inside the carrier. The carrier was then placed in a 37°C laboratory. The team checked the temperature of the medicine every 10 minutes for 2 hours. The results of their test are provided in Table 1.1 and Graph 1.1 below.

Table 1.1: Temperature of Medicine Over Time in Current Container (in 37°C Lab Room)

TIME (MIN)	0	10	20	30C	40	50	60 (1 hr)	70	80	90	100	110	120 (2 hr)
TEMP (°C)	15.0	20.0	24.2	27.2	29.4	31.2	32.5	33.5	34.3	34.8	35.3	35.6	35.9

Graph 1.1: Temperature of Medicine Over Time in Current Container (in 37°C Lab Room)



8. REDESIGN AS NEEDED: MALARIA MELTDOWN!

OBJECTIVE: Students will answer questions to consider how they can redesign their medicine carriers.

1. **TEAMS** Teams should answer questions 1 and 2 to improve their designs based on their classmates' suggestions and their own reflection.

2. **CLASS** **Wrap up the activity.**

   ASK THE CLASS:

   - What maths skills do you use in this activity?

     Possible Answer(s):

     We constructed line graphs to represent data, calculated slope, analysed the graph to obtain useful information to help us design the carrier, drew nets of three-dimensional shapes, calculated surface area and cost of materials, and used measurement tools to construct the medicine carrier.
   - Why is a line graph useful for representing data?

     Possible Answer(s):

     A graph can easily show the relationship (if any) between two sets of data. It can also show trends—whether upwards or downwards. The steepness of the line car show how quickly or slowly the data is changing.
   - How do you determine which variable is dependent and which is independent? Give examples.

     Possible Answer(s):

     The independent variable is the one that you control, such as the number of layer or the time intervals. The dependent variable is the data collected that corresponds with the independent variable, such as the temperature.
   - What does the slope tell us about the graph? Give an example.

     Possible Answer(s):

     The slope can tell us the average rate of change between two points on the graph For instance, if the graph relates time and temperature, the slope can tell us how much the temperature is changing per time unit.