



PRIMARY LEVELS
Year 4 - Year 5

PHOTOCOPY
MASTERS

STEM

Book

2



Science

Technology

Engineering

Maths



By Leonie Westenberg

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Teachers' Notes

The Australian government's initiative to foster STEM education in schools is aimed at 'ensuring [that] Australia's young adults are equipped with the necessary skills for the economy of the future' (Aust. Govt, Dept of Education & Training, December 2015). Programmes targeted by the STEM initiative include inquiry-based learning and teaching in mathematics education and the introduction of coding activities in ICT across all year levels of Australian schools (DET, 2015).

This book provides classroom teachers with the means to approach both the targets of inquiry-based mathematics learning and the introduction of coding, alongside science inquiry skills and content, use of engineering processes, and design and digital technologies. The activity sheets also emphasise literacy skills, given that the Australian Curriculum defines literacy as one of the General Capabilities across all curriculum areas, noting that 'Success in any learning area depends on being able to use the significant, identifiable and distinctive literacy that is important for learning and representative of the content of that learning area' (AC, v. 8.3, Literacy, Introduction).

This book is divided into 5 sections. *Section 1: House Construction* provides activities that encourage students to develop critical thinking skills and mathematical problem-solving abilities through practical worksheets to test brick construction, scale and map drawing, and geometric shape. Students explore concepts of stability and instability.

Section 2: Bridges fosters group and team participation through worksheets involving challenges in constructing bridges with a variety of different materials within design limitations. This section has a focus on design technologies while building mathematical and writing skills.

Section 3: Domes continues the focus on the exploration and understanding of engineering and spatial concepts within the science, mathematics and technologies areas of the Australian Curriculum. Students work in small groups to research geodesic domes and construct domes with practical uses, hypothesising and testing the domes for stability.

Section 4: Pyramids begins with historical inquiry and activities that represent the geometric and spatial awareness outcomes of the mathematics area in the Australian Curriculum. Students are also guided in planning, designing, implementing and evaluating scientific inquiries with engineering challenges and hypotheses.

Section 5: Coding introduces students to coding for practical purposes (such as making games and apps) using free online tools. The process of initiating, designing, testing and evaluating digital technologies is experienced in guided worksheets before, during and after use of online coding tools. Students are introduced to design journals as a tool used in design and digital technologies and undergo an evaluative process that informs further work in both formative and summative assessment. Individual activities suggest a choice of tools to allow for differentiation of students and multimodal learning styles within the classroom.

Land Uses 1 - Page 9

Curriculum Focus

HASS

The importance of environments, including natural vegetation, to animals and people (Year 4: ACHASSK088)

Land Uses 2 - Page 10

Curriculum Focus

MATHEMATICS

Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (Year 4: ACMMG084)

Land Uses 3 & 4 - Page 11 and Page 12

Curriculum Focus

MATHEMATICS

Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (Year 4: ACMMG084)

Describe and interpret different data sets in context (Year 5: ACMGP120)

- Elaboration: Using and comparing data representations for different data sets to help decision making

HASS

The environmental and human influences on the location and characteristics of a place and the management of spaces within them (Year 5: ACHASSK113)

Homes And Habitats - Page 13

Curriculum Focus

HASS

The environmental and human influences on the location and characteristics of a place and the management of spaces within them (Year 5: ACHASSK113)

Floor Plans - Page 14

Curriculum Focus

MATHEMATICS

Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (Year 4: ACMMG084)

HASS

The environmental and human influences on the location and characteristics of a place and the management of spaces within them (Year 5: ACHASSK113)

Building A Floor Plan 1 & 2 - Page 15 and Page 16

Curriculum Focus

SCIENCE

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (Year 5: ACSIS093)

Imagine that you are looking for some land on which to settle. Look at the list below which outlines what would make a place liveable.



Location:

near water (along a river) or on a trade route - where people will pass by with goods.



Security:

protection against animals or other groups of people.



Geography:

some flat land with soil that could grow food crops.



Resources:

a variety of building materials are available: stone, trees for wood, rocks, etc.



Climate:

mild weather, protected against strong winds and storms.

- Use the list above to sketch some ideal land on which to live. Label your sketch using the words above and other words that you know.



Sample

How much do you know about homes and habitats? Complete the activities and tasks on this page to find out.

1. What is a home?

Think by myself	Share in a pair	Share in a group

2. Who needs homes?

Think by myself	Share in a pair	Share in a group

3. Read more about homes. Highlight any information that you did not think about.

About Homes

A home is not only a place where people live. Animals also live in homes. For many animals, a home is not inside, but is outside in places like the bush, underground, inside tree barks and under rocks. This is called a *habitat*.

An animal's habitat must include all of the food, water, shelter, and space that the animal will need.

For people, homes are shelters. People build or buy houses, apartments, caravans, houseboats, and other kinds of places for them and their families to live in.



Bridges 1 and 2 - Page 27 and Page 28

Suggested Answers - Bridges 1

1. Design weakness; natural forces such as earthquakes or floods; fire; impact of train or boat crashes; accidents during construction; problems with the materials used; poor maintenance
2. Environmental: height; nearby trees; type of soil; type of rock; in an earthquake zone; flooding history; local weather; availability of materials.

Natural forces: wind; sun; rain; rapid temperature changes; storms; extremely high or low temperatures

Suggested Answers - Bridges 2

3. choice of materials; type of foundation; type of bridge; using triangular support; using natural materials; combining materials; adding extra support in sections or in the base; adding an arch or covering

Curriculum Focus

SCIENCE

Science involves making predictions and describing patterns and relationships (Year 4: ACSHE061)

Science knowledge helps people to understand the effect of their actions (Year 4: ACSHE062)

Scientific knowledge is used to solve problems and inform personal and community decisions (Year 5: ACSHE083)

Bridge Building Challenge 1 & 2 - Page 29 and 30

Curriculum Focus

SCIENCE

Forces can be exerted by one object on another through direct contact or from a distance (Year 4: ACSSU076)

Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (Year 4: ACSIS066)

Reflect on investigations, including whether a test was fair or not (Year 4: ACSIS069)

Compare data with predictions and use as evidence in developing explanations (Year 5: ACSIS218)

Reflect on and suggest improvements to scientific investigations (Year 5: ACSIS091)

Marshmallow Challenge 1, 2 & 3 - Page 31, Page 32 and Page 33

Curriculum Focus

MATHEMATICS

Create symmetrical patterns, pictures and shapes with and without digital technologies (Year 4: ACMMG091)

Describe and interpret different data sets in context (Year 5: ACMSP120)

SCIENCE

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (Year 4: ACSIS065)

Communicate ideas, explanations and processes using scientific representations in a variety of ways, including multi-modal texts (Year 5: ACSIS093)

DESIGN TECHNOLOGIES

Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques (Year 4: ACTDEP015)

Negotiate criteria for success that include sustainability to evaluate design ideas, processes and solutions (Year 5: ACTDEP027)

Begin making your bridge based on the planning on the previous page. You may have to make changes to your design as you construct it. After its construction complete the steps and questions below.

Test:

- Test your bridge for strength by placing a 1 kg weight on the bridge. Think about where on the bridge you will place the weight.

Questions:

1. Did your bridge pass or fail the strength test? Describe what happened to the bridge when you put the 1 kg weight on your model.

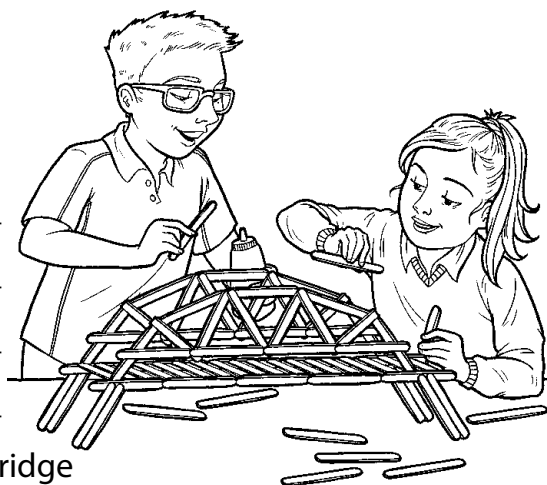
2. If you had to give your bridge marks out of 10 for stability what would you give it?

3. Did you make changes to your design as you worked on its construction to make it more sturdy? Describe these changes.

Reflect:

4. How do you think you could have made your bridge sturdier/stronger?

5. Do you think you would have made a better bridge on your own, instead of making a bridge in a group? Why?



Your Task:

- A geodesic dome is formed by putting triangles together. Your goal is to build a geodesic dome using the template provided (P39) and investigate the structure. Follow the steps below to do this.

Steps:

1. Back the template (P39) on thick paper or thin cardboard.
2. With your partner, cut out the template.
3. Try to assemble (put together) the dome structure.

Hints: some lines will need to be folded; experiment with folding the template before you use glue or tape to hold it together; some sides will need to be glued or taped together.

- When you have assembled your dome, write your own instructions on how to make a dome below.

Sample

Extra Activity

Watch this PBS video on domes made from gum drops and toothpicks:
<http://www.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zgumdrop/triangles-testing-the-strength-of-a-gumdrop-dome/>

Copy the activity and make the dome. How did you go?



Pyramids 1 - Page 44

Curriculum Focus

MATHEMATICS

Compare the areas of regular and irregular shapes by informal means (Year 4: ACMMG087)

Compare and describe two dimensional shapes that result from combining and splitting common shapes, with and without the use of digital technologies (Year 4: ACMMG088)

- Elaborations: Creating two-dimensional shapes from verbal or written instructions; Identifying common two-dimensional shapes that are part of a composite shape by re-creating it from these shapes

DESIGN TECHNOLOGIES

Recognise the role of people in design and technologies occupations and explore factors, including sustainability that impact on the design of products, services and environments to meet community needs (Year 4: ACTDEK010)

- Elaborations: Exploring, playing with and testing materials for their appropriateness; Exploring and testing factors that impact on design decisions; Critiquing designed products, services and environments to establish the factors that influence the design and use of common technologies

Select and use materials, components, tools, equipment and technique and use safe work practices to make designed solutions (Year 4: ACTDEP016)

- Elaborations: Using appropriate technologies terms to confidently describe and share with others procedures and techniques for making, for example cutting and joining materials; Exploring ways of joining, connecting and assembling components that ensure success, and the impact digital technologies have had on these processes; Using tools and equipment accurately when measuring, marking and cutting; and explaining the importance of accuracy when designing and making, for example creating a template

Plan a sequence of production steps when making designed solutions individually and collaboratively (Year 4: ACTDEP018)

- Elaborations: Managing time and resource allocation throughout production, for example materials, tools, equipment and people; Sequencing steps to collaboratively produce a designed solution

Pyramids 2 - Page 45

Suggested Answers

Pyramids are strong because: they use the strength of the triangle and each triangular face meets at the top to form a stable focus (vertex).

Pyramids are stable because: they are built on a triangular shape, with weight shared evenly on each side.

True; False.

Curriculum Focus

MATHEMATICS

Use scaled instruments to measure and compare lengths (Year 4: ACMMG084)

- Elaboration: Reading and interpreting the graduated scales on a range of measuring instruments to the nearest graduation

SCIENCE

Science involves making predictions and describing patterns and relationships (Year 4: ACSHE061)

- Elaboration: Exploring ways in which scientists gather evidence for their ideas and develop explanations