# Mathematics Stage 5 – unit of learning – prisms and cylinders



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## Rationale

The NSW Department of Education publishes a range of curriculum support materials, including samples of lesson sequences, scope and sequences, assessment tasks, examinations, student and teacher resource booklets, and curriculum planning and curriculum evaluation templates. The samples are not exhaustive and do not represent the only way to complete or engage in each of these processes. Curriculum design and implementation is a dynamic and contextually-specific process. While the mandatory components of syllabus implementation must be met by all schools, it is important that the approach taken by teachers is reflective of their needs and faculty/school processes.

NESA defines [programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) as the process of ‘selecting and sequencing learning experiences which enable students to engage with syllabus outcomes and develop subject specific skills and knowledge’ ([NESA](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming) 2022). A program is developed collaboratively within a faculty. It differs from a unit in important ways, as outlined by NESA on their [advice on units](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming/advice-on-units) page. A unit is a contextually-specific plan for the intended teaching and learning for a particular class for a particular period. The organisation of the content in a unit is flexible and it may vary according to the school, the teacher, the class, and the learning space. They should be working documents that reflect the thoughtful planning and reflection that takes place during the teaching and learning cycle. There are mandatory components of programming and unit development, and this template provides one option for the delivery of these requirements. The NESA and department guidelines that have influenced this template are elaborated upon at the end of the document.

This resource has been developed to assist teachers in NSW Department of Education schools to create learning that is contextualised to their classroom. It can be used as a basis for the teacher’s own program, assessment, or scope and sequence, or be used as an example of how the new curriculum could be implemented. The resource has suggested timeframes that may need to be adjusted by the teacher to meet the needs of their students.

## Overview

**Description:** this program of learning addresses content from the focus areas of Area and surface area A, Volume A, Algebraic techniques A, Equations A, Numbers of any magnitude, as well as Path focus areas Area and surface area B, Volume B and Equations C. The lessons and sequences in this program of learning are designed to allow students to tie together the big ideas across algebra, number and geometry and measurement and will build on student knowledge and understanding of area to develop and apply formulas for the surface area of prisms and cylinders.

**Duration:** this program of learning is designed to be completed over a period of approximately 7 weeks, but can be adapted to suit the school context.

**Explicit teaching:** suggested learning intentions and success criteria are available for some lessons provided. Learning intentions and success criteria are most effective when they are contextualised to meet the needs of students in the class. The examples provided in this document are generalised to demonstrate how learning intentions and success criteria could be created.

## Outcomes

### Core

A student:

* develops understanding and fluency in mathematics through exploring and connecting mathematical concepts, choosing and applying mathematical techniques to solve problems, and communicating their thinking and reasoning coherently and clearly
**MAO-WM-01**
* simplifies algebraic fractions with numerical denominators and expands algebraic expressions **MA5-ALG-C-01**
* solves linear equations of up to 3 steps, limited to one algebraic fraction **MA5-EQU-C-01**
* solves measurement problems by using scientific notation to represent numbers and rounding to a given number of significant figures **MA5-MAG-C-01**
* solves problems involving the surface area of right prisms and practical problems involving the area of composite shapes and solids **MA5-ARE-C-01**
* solves problems involving the volume of composite solids consisting of right prisms and cylinders **MA5-VOL-C-01**

### Path

A student:

* solves linear equations of more than 3 steps, monic and non-monic quadratic equations, and linear simultaneous equations
**MA5-EQU-P-02**
* applies knowledge of the surface area of right pyramids and cones, spheres and composite solids to solve problems
**MA5-ARE-P-01**
* applies knowledge of the volume of right pyramids, cones and spheres to solve problems involving related composite solids
**MA5-VOL-P-01**

### Related Life Skills outcomes

The identified Life Skills outcomes that relate to this unit are **MALS-ARE-01** – measures and uses area in everyday contexts,
**MALS-VOL-01** – measures and uses volume, capacity and mass in everyday contexts, **MALS-PAT-01** – recognises and applies patterns in everyday contexts, **MALS-ADS-01** – uses strategies for addition and subtraction, and **MALS-MDI-01** – uses strategies for multiplication and division.

[Mathematics K–10 Syllabus](https://curriculum.nsw.edu.au/syllabuses/mathematics-k-10-2022) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2022.

**Prior to planning for teaching and learning, please consider the following:**

**Engagement**

* How will I provide authentic, relevant learning opportunities for students to personally connect with lesson content?
* How will I support every student to grow in independence, confidence, and self-regulation?
* How will I facilitate every student to have high expectations for themselves?
* How will I identify and provide the support each student needs to sustain their learning efforts?

**Representation**

* What are some different ways I can present content to enable every student to access and understand it?
* How will I identify and address language and/or cultural considerations that may limit access to content for students?
* How will I make lesson content and learning materials more accessible?
* How will I plan learning experiences that are relevant and challenging for the full range of students in the classroom?

**Expression**

* How will I provide multiple ways for students to respond and express what they know?
* What tools and resources can students use to demonstrate their understanding?
* How will I know every student has understood the concepts and language presented in each lesson?
* How will I monitor if every student has achieved the learning outcomes and learning growth?

## Lesson sequence and details

### Learning episode 1 – visualising nets

#### Teaching and learning activity

Students explore nets by both visualising and constructing 3D shapes to establish which face would become the base, as well as determining which nets become open cubes.

#### Syllabus content

* Identify the edge lengths and the faces making up the surface area of prisms
* Recognise and justify whether a diagram represents a net of a right prism
* Create and rearrange nets of right prisms

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Visualising nets](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-01-visualising-nets.docx)Duration: 1–2 lessonsLearning intentions* To be able to visualise open cubes from nets.
* To be able to determine if a net represents a given prism.

Success criteria* I can visualise an open cube from its net.
* I can justify whether a diagram represents the net of a prism.
* I can determine which face of an open cube net will become the base.
* I can identify nets that will not form prisms.
 | * Class set of Appendix A, enlarged on A3 paper
* 5 squares from a tangram set, or 5 flats from a Base 10 block set, or 5 plastic squares or virtual manipulatives such as Polypad
* Scissors
* Class set of Appendix B
* Half class set of Appendix C, optional to enlarge on A3 paper
* [*Visualising nets*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-01-visualising-nets.pptx) PowerPoint
* Devices with access to the internet (optional)
 |  |

### Learning episode 2 – leftovers challenge

#### Teaching and learning activity

Students will investigate the size of different food containers and how their volumes compare, to fit in leftover food. Following this, students investigate which net would form a box with the largest volume.

#### Syllabus content

* Create and rearrange nets of right prisms
* Find the surface areas of prisms, given their nets, excluding curved surfaces
* Find the volumes of composite right prisms with uniform cross-sections that may be dissected into triangles and quadrilaterals

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Leftovers challenge](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-02-leftovers-challenge.docx)Duration: 1 lessonLearning intentions* To be able to construct prisms with differing volumes.
* To be able to compare prisms with differing volumes.

Success criteria* I can compare the volume of prisms of similar size.
* I can create a net that makes a rectangular prism.
* I can determine the volume of a rectangular prism.
* I can justify my strategy for determining the maximum volumes.
 | * 3–5 food containers of similar size
* Water, rice or centicubes
* Class set of Appendix A
* Class set of Appendix B
* Grid paper or spreadsheet software.mat
* Device per pair of students (optional)
 |  |

### Learning episode 3 – cube houses

#### Teaching and learning activity

Students investigate the surface area of prisms by comparing different house designs made from 4 cubes.

#### Syllabus content

* Solve practical problems involving the areas of composite shapes
* Find the surface areas of prisms, given their nets, excluding curved surfaces
* Solve problems involving surface areas of prisms, excluding curved surfaces
* Expand and simplify algebraic expressions by removing grouping symbols and collecting like terms where appropriate

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Cube houses](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-03-cube-houses.docx)Duration: 1–2 lessonsLearning intention* To be able to calculate the surface area of prisms.

Success criteria* I can compare the size and shape of 2 prisms.
* I can determine the area of the faces of a prism.
* I can calculate the surface area of a rectangular prism.
* I can calculate the surface area of a triangle prism.
 | * 4 centicubes per student or students will need individual devices
* Isometric paper
* Class set of Appendix B, C and D
* [*Cube houses*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-03-cube-houses.pptx) PowerPoint
 |  |

### Learning episode 4 – beyond the surface

#### Teaching and learning activity

In the previous lesson it was determined that solids can have the same volume but a different surface area. In this lesson, students discover that some solids can have the same surface area but a different volume by constructing solids with centicubes.

#### Syllabus content

* Solve problems involving surface areas of prisms, excluding curved surfaces
* Find the volumes of composite right prisms with uniform cross-sections that may be dissected into triangles and quadrilaterals

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Beyond the surface](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-04-beyond-the-surface.docx)Duration: 1 lessonLearning intention* To understand the relationship between volume and surface area.

Success criteria* I can compare and create 2 objects that have an equal surface area and different volume.
* I can compare and create 2 objects that have an equal volume and different surface area.
 | * 2 sheets of A4 paper per student
* Centicubes, at least 6 per student, or individual student devices are required
 |  |

### Learning episode 5 – A4 cylinders

#### Teaching and learning activity

Students investigate the 2 cylinders formed by curling an A4 sheet of paper in 2 different ways. They compare the volume of each cylinder and deduce and apply strategies for finding the surface area of cylinders under a variety of conditions.

#### Syllabus content

* Recognise the curved surface of a cylinder as a rectangle and apply this knowledge to calculate the area of the curved surface
* Develop and apply the formula to find the surface area of a closed cylinder: $A = 2πr^{2} +2πrh$, where $r$ is the length of the radius and $h$ is the perpendicular height
* Solve linear equations arising from substitution into formulas
* Examine the effect that truncating or rounding during calculations has on the accuracy of the results

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [A4 cylinders](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-05-a4-cylinders.docx)Duration: 1–2 lessonsLearning intentions* To be able to develop the formula to find the surface area of a cylinder.
* To be able to apply the formula to find the surface area of a cylinder.

Success criteria* I can compare the size and shape of 2 cylinders.
* I can determine the net formed from cylinders, both closed and open.
* I can use the formula to find the surface area of a cylinder.
* I can explain how to develop the formula for the surface area of a cylinder.
 | * 4–6 cylindrical items of similar size
* 1–2 A4 sheets of paper per student
* Rulers (optional)
* [*A4 cylinders*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-05-a4-cylinders.pptx) PowerPoint
 |  |

### Learning episode 6 – margin for error

#### Teaching and learning activity

Students explore errors that can occur when different measuring instruments are used, and values are rounded. Students use a variety of measuring instruments to calculate the dimensions of a space. They compare their results and observe the effect that rounding a value or an error with a value will have when further calculations are performed.

#### Syllabus content

* Identify and describe the meaning of common prefixes, such as *milli*, *centi* and *kilo*
* Establish the meaning of prefixes for very small or very large measurement units
* Determine the precision of a measuring instrument by finding the smallest division on the instrument
* Find the absolute error of measuring instruments ($absolute error =\frac{1}{2}×precision$)
* Calculate the percentage error of a given measurement by applying the formula: $percentage error=\frac{absolute error}{measurement}×100\%$
* Examine the effect that truncating or rounding during calculations has on the accuracy of the results

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Margin for error](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-06-margin-for-error.docx)Duration: 1–2 lessonsLearning intentions* To be aware of the different types of errors present in measurements.
* To be able to calculate the absolute and percentage error.
* To understand the effect that truncating or rounding during calculations has on the accuracy of the results.

Success criteria* I can explain why errors in measurements occur.
* I can determine the precision of a measuring instrument.
* I can calculate the percentage error of a given measurement.
* I can explain the effect that rounding initial measurements may have on the accuracy of further calculations.
* I can explain when errors in values do or do not have an impact.
 | * A range of measuring instruments which could include trundle wheels, one metre rulers, measuring tapes and 30 cm rulers
* [*Margin for error*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-06-margin-for-error.pptx) PowerPoint
* Class set of Appendix A
 |  |

### Learning episode 7 – under pressure

#### Teaching and learning activity

Students explore the shape and dimension of columns through an investigation. This lesson allows for a highly differentiated exploration. Students could be extended into engineering basics such as buckling and critical load.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Calculate volumes of composite solids consisting of right prisms and cylinders

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Under pressure](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-07-under-pressure.docx)Duration: 1 lessonLearning intentions* To be able to test a hypothesis by conducting an experiment.
* To be able to examine the relationships between surface area, volume and strength.

Success criteria* I can substitute into the formula for surface area of a cylinder.
* I can solve problems involving surface areas of cylinders.
* I can identify the individual solids that make up a composite solid.
* I can identify the cross-section or base of a right prism or cylinder.
* I can calculate volumes of composite solids consisting of right prisms and cylinders.
 | * Weights or thin books
* Lots of scrap paper
* Piece of thin carboard
* Tape
* Straw
* Soft drink can
* Individual devices (optional)
 |  |

### Learning episode 8 – how do animals keep cool?

#### Teaching and learning activity

Students explore how the surface area and volume of an animal can affect how they lose heat from their bodies. Students firstly explore how different positions of an animal may determine if they are trying to warm up or cool down, before exploring the ratio of volume to surface area and how this affects heat loss in animals.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Calculate volumes of composite solids consisting of right prisms and cylinders

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [How do animals keep cool?](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-08-how-do-animals-keep-cool.docx)Duration: 1 lessonLearning intentions* To understand the relationship between surface area and volume.
* To be able to compare and contrast the ratio of volume to surface area.

Success criteria* I can identify the different shapes that make up a 3D object.
* I can calculate the surface area of cylinders and prisms.
* I can calculate the volume of cylinders and prisms.
* I can explain the relationship between the surface area and volume of solids.
* I can justify the most effective solid to model an animal.
 | * Class set of Appendix A
 |  |

### Learning episode 9 – deep dive

#### Teaching and learning activity

Students explore the design of a variety of pools with a range of depths. Each pool is a composite solid and students compare the pools in terms of volume, capacity and surface.

#### Syllabus content

* Solve practical problems involving the areas of composite shapes
* Find the volumes of composite right prisms with uniform cross-sections that may be dissected into triangles and quadrilaterals
* Find the volumes of right prisms that have uniform cross-sections in the form of sectors, semicircles and quadrants
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Deep dive](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-09-deep-dive.docx)Duration: 1–2 lessonsLearning intentions* To be able to dissect a composite solid into known solids.
* To be able to calculate the volume of a composite solid.

Success criteria* I can identify the solids that make up a composite solid.
* I can calculate the volume of a composite solid.
* I can calculate the capacity of a composite solid.
 | * Mini whiteboards (optional)
* Class set of Appendix C
* [*Deep dive*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-09-deep-dive.pptx) PowerPoint
 |  |

### Learning episode 10 – exploring unknowns

#### Teaching and learning activity

Students explore problems where they need to work backwards. They are given either the area, volume or surface area of a solid and they need to find a missing dimension. Students use their algebraic techniques by solving a range of linear equations.

#### Syllabus content

* Solve practical problems involving the areas of composite shapes
* Find the volumes of composite right prisms with uniform cross-sections that may be dissected into triangles and quadrilaterals
* Solve linear equations using algebraic techniques involving up to 3 steps
* Solve linear equations arising from substitution into formulas
* Solve linear equations involving more than 3 steps
* Change the subject of a formula

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Exploring unknowns](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-10-exploring-unknowns.docx)Duration: 1 lessonLearning intention* To be able to use algebraic techniques to find the missing sides of a solid.

Success criteria* I can determine the missing side of a solid by trial and error.
* I can determine the missing side of a solid using algebraic techniques.
* I can rearrange a formula to change the subject of the equation.
 | * Class set of Appendix A
* [*Exploring unknowns*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-10-exploring-unknowns.pptx) PowerPoint
 |  |

### Learning episode 11 – the secrets of pyramids

#### Teaching and learning activity

Students investigate the volume and surface area of pyramids through the construction of yangma nets. Students will derive the volume of a pyramid formula by joining 3 yangma, explore how the surface area of a pyramid is found and apply this knowledge to solve problems.

#### Syllabus content

* Identify the perpendicular heights and slant heights of right pyramids and right cones (Path)
* Apply Pythagoras’ theorem to find the slant heights, base lengths and perpendicular heights of right pyramids and right cones (Path)
* Solve problems involving the surface areas of right pyramids and compare methods of solution (Path)
* Apply the formula to find the curved surface area of right cones: $A=πrl$, where $r$ is the length of the radius and $l$ is the slant height (Path)
* Find the volume of right pyramids and right cones by using an appropriate formula: volume of pyramid or cone$ V=\frac{1}{3}Ah$, where $A$ is the base area and $h$ is the perpendicular height (Path)

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [The secrets of pyramids](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-11-the-secrets-of-pyramids.docx)Duration: 1 lessonLearning intentions* To be able to calculate the volume of a pyramid.
* To be able to calculate the surface area of a pyramid.

Success criteria* I can describe how the volume of a pyramid formula is derived.
* I can calculate the volume of a pyramid using the formula.
* I can explain how to calculate the surface area of a pyramid.
* I can solve problems involving pyramids and composite solids.
 | * Class set of Appendix A, B and C
 |  |

### Learning episode 12 – sphere’s the thing

#### Teaching and learning activity

Students show that the surface area of a sphere is 4 times the area of a circle with the same diameter through an exploration involving an orange. Students then explore a mix of routine and non-routine questions to apply the formulas for surface area and volume of spheres.

#### Syllabus content

* Apply the formula to find the surface area of spheres: $A=4πr^{2}$, where $r$ is the length of the radius (Path)
* Find the volume of spheres by using an appropriate formula: volume of sphere $V=\frac{4}{3}πr^{3}$, where $r$ is the length of the radius (Path)

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Sphere’s the thing](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-12-spheres-the-thing.docx)Duration: 1 lessonLearning intention* To be able to solve problems involving the surface area and volume of spheres.

Success criteria* I can calculate the volume of spheres.
* I can calculate the surface area of spheres.
* I can solve routine and non-routine problems involving spheres.
 | * one orange per group of 3 students
* one sheet of paper per group of 3 students
* one protractor and ruler per group of 3 students
* Hemispheres and water (optional)
* [*Sphere’s the thing*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-12-spheres-the-thing.pptx) PowerPoint
* Class set of Appendix A
 |  |

### Learning episode 13 – cup or cone?

#### Teaching and learning activity

Students explore finding the volume and surface area of cones through a debate of cup or cone for ice-cream. Students also explore a range of solids, comparing their volume and surface area.

#### Syllabus content

* Solve problems involving the surface area of solids in a variety of contexts including composite solids (Path)
* Apply knowledge of right pyramids, right cones and hemispheres to solve problems involving composite solids (Path)
* Solve practical problems related to the volumes and capacities of solids including right pyramids, right cones and spheres (Path)

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Cup or cone?](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-13-cup-or-cone.docx)Duration: 1 lessonLearning intention* To be able to solve problems involving the surface area and volume of cones.

Success criteria* I can calculate the volume of cones.
* I can calculate the surface area of cones.
* I can identify the shapes that make up the surface area of a cone.
* I can calculate the volume and surface area of composite solids.
 | * [*Cup or cone?*](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-13-cup-or-cone.pptx) PowerPoint
* Class set of Appendix A
 |  |

### Learning episode 14 – concrete dreams

#### Teaching and learning activity

Students explore volume and surface area of composite solids through the design of a new skate park.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Concrete dreams](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-14-concrete-dreams.docx)Duration: 1–2 lessonsLearning intentions* To be able to find the volume and surface area of composite solids.
* To be able to solve problems involving composite solids.

Success criteria* I can name the solids that form a composite solid.
* I can find the volume of composite solids.
* I can find the surface area of composite solids.
* I can solve problems involving composite solids.
 | * Class set of Appendix A
* Student devices (optional)
 |  |

### Learning episode 15 – perfect packaging

#### Teaching and learning activity

Students explore different ways to package 5 mineral water cans while investigating the differing surface area of the packaging and the volume taken up within each package.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Perfect packaging](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-15-perfect-packaging.docx)Duration: 1–2 lessonsLearning intention* To be able to compare the surface area and volume of different prisms and composite solids.

Success criteria* I can compare different packages containing the same contents.
* I can name the solids that make up a composite solid.
* I can determine the volume of a composite solid.
* I can determine the surface area of a composite solid.
* I can justify my decision on the best packaging.
 | * Wrapping paper
* Core and Path objects (such as packaging, balls, a set of solids)
 |  |

### Learning episode 16 – tank it to the limit

#### Teaching and learning activity

Students explore a range of water tanks of differing shapes and sizes, as well as the best location on a block of land to place the tank. Students make connections between the tank size, the location and the required conditions for the water tank while applying their volume and surface area knowledge to make informed decisions.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Tank it to the limit](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-16-tank-it-to-the-limit.docx)Duration: 1–2 lessonsLearning intentions* To be able to solve problems involving volumes of composite solids consisting of right prisms and cylinders.
* To be able to solve problems involving surface area of composite solids consisting of right prisms and cylinders.

Success criteria* I can identify and name the solids that make up a composite solid.
* I can calculate the volume of composite solids consisting of right prisms and cylinders.
* I can calculate the surface area of composite solids consisting of right prisms and cylinders.
* I can justify my decisions when solving surface area and volume problems.
 | * Class set of Appendix A and B
 |  |

### Learning episode 17 – icing on the cake

#### Teaching and learning activity

Students explore volume and surface area through the trend of transforming a basic cake into a new design. The purpose of this lesson is to allow students to apply their knowledge of volume and surface area to a variety of solids they have explored throughout this unit.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [Icing on the cake](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-17-icing-on-the-cake.docx)Duration: 1 lessonLearning intention* To be able to solve practical problems related to the volume and surface areas of composite solids.

Success criteria* I can name and identify solids that make up a composite solid.
* I can apply my knowledge of volume to solve practical problems.
* I can apply my knowledge of surface area to solve practical problems.
 | * Modelling clay (optional)
* Ruler (optional)
* Individual student devices (optional)
 |  |

### Learning episode 18 – to the beat of your own drum

#### Teaching and learning activity

Students build drums from various containers to explore the relationship between surface area, volume and sound. Throughout this lesson, opportunities are embedded for engaging with Aboriginal and/or Torres Strait Islander communities and cultures.

#### Syllabus content

* Solve problems involving surface areas of cylinders and related composite solids
* Solve practical problems related to the volumes and capacities of composite solids

Table – lesson details

|  |  |  |
| --- | --- | --- |
| Visible learning | Required resources | Registration, adjustments and evaluation notes |
| [To the beat of your own drum](https://education.nsw.gov.au/content/dam/main-education/en/home/schooling/curriculum/mathematics/mathematics-s5-unit-03-lesson-18-to-the-beat-of-your-own-drum.docx)Duration: 1 lessonLearning intentions* To explore the relationship between volume, surface area and sound.
* To calculate the volume and surface area of cylinders and composite solids.

Success criteria* I can calculate volume and surface area of cylinders.
* I can describe the relationship between volume, surface area and sound.
 | * At least 2 tin cans (variety of shapes and sizes) for each group
* Scissors
* At least 2 balloons per group
* At least 2 corks per group
* At least 2 wooden skewers per group
* At least 2 elastic bands or sticky tape per group
 |  |

## References

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NESA (NSW Education Standards Authority) (2022) ‘[Programming](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/understanding-the-curriculum/programming)’, Understanding the curriculum, NESA website, accessed 31 May 2023.

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