Volume and Capacity 2

Stage 3 Outcome

A student:	Language: Students should be able to communicate using the following language: capacity, container, litre, millilitre, volume, **dimensions**, **length**, **width**, **height**, layers, cubic centimetre, cubic metre.
› describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM › selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations MA3-2WM › gives a valid reason for supporting one possible solution over another MA3-3WM › selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity MA3-11MG	

Teaching and Learning Activities	Notes/ Future Directions/Evaluation	Date/ LAC Icons
Ignition Activity Get a 2L ice cream container filled with water and frozen. Allow it to melt completely and pour into a measuring jug. Students discuss the findings. Pose Question: How much ice cream are we really getting?		Literacy
Explicit Teaching Teachers need to explain and use the relationship between the size of a unit and the number of units needed to assist in determining whether multiplication or division is required when converting between units, eg 'Fewer litres than millilitres will be needed to measure the same capacity, and so to convert from millilitres to litres, I need to divide' Students will need to use repeated addition to find the volumes of rectangular prisms, eg 'My rectangle has 3 layers of 6 cubes, so the total number of cubes is 6 plus 6 plus 6, or 18' Ensure that students establish the relationship between the number of cubes in one layer, the number of layers, and the volume of a rectangular prism and are able to explain that the volume of a rectangular prism can be found by finding the number of cubes in one layer and multiplying by the number of layers.		Literacy

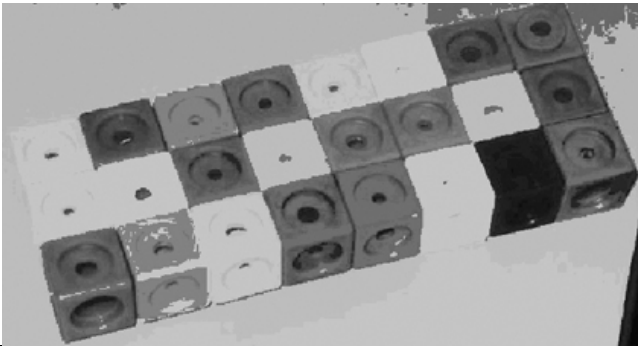|		
Whole Class Teaching and Learning Activities Complete the following activities to ensure that students connect volume and capacity and their units of measurement: • demonstrate that a cube of side 10 cm will displace 1 litre of water http://www.curriculumsupport.education.nsw.gov.au/primary/mathematics/assets/pdf/stage3/what wentin.pdf • demonstrate, by using a medicine cup, that a cube of side 1 cm will displace 1 mL of water • equate 1 cubic centimetre to 1 millilitre and 1000 cubic centimetres to 1 litre Students use the above strategies to find the volumes of irregular solids in cubic centimetres using the displacement strategy.		
Volume of Prisms Students are given a collection of interlocking cubes (centicubes). Ask: *How long is the side of each cube?* *What is the volume of each cube? How did you know?* Students make a rectangular prism using 24 cubes and record the dimensions (length, breadth, height). Determine the volume is 24 cubic units. Look at the relationship between the volume, length, breadth and height. *What is the volume of each prism?* 24 cubic units/cubic centimetres *How can we calculate the volume using the length, breadth and height of the prism?* *Can you make other rectangular prisms with a volume of 24 cubic units?* 		Literacy Critical and creative thinking

Students attempt to make other prisms, record the results and describe what they notice.
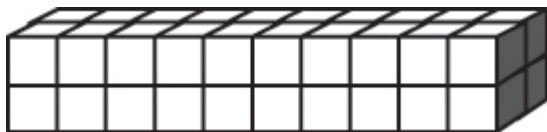Discuss:
How is your second prism different from your first prism?
How is your second prism similar to your first prism?
What is the length, breadth and height of each prism?
What generalisations can you make?
How do know that you have made all the possible prisms?

Students draw some of the models they have made.

Students use centicubes to construct a rectangular prism which is 3 cm long, 2 cm wide and 1 cm high. Students add more cubes to the prism by following the steps below. After each step they must add the details to the table.

- What is the volume of the prism? Complete row a) of the table.
- Add another layer to this prism so the height is now 2 cm. Complete row b) of the table.
- Add another layer to this prism so the height is now 3 cm. Complete row c) of the table.
- Repeat with a height of 4 cm. Complete row d) of the table.
- Repeat with a height of 5 cm. Complete row e) of the table.
- Students choose their own measurement for the height and complete row f).

|	Length	Breadth	Height	Volume (cm³)
a	3 cm	2 cm	1 cm	
b	3 cm	2 cm	2 cm	
c	3 cm	2 cm	3 cm	
d	3 cm	2 cm	4 cm	
e	3 cm	2 cm	5 cm	
f	3 cm	2 cm		

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Students complete similar tables where they are given two dimensions and the volume of a prism. Students have to calculate the missing dimension, e.g.

Length	Breadth	Height	Volume (cm³)
-	5 cm	2 cm	80 cm³

Rectangular Prisms

Provide students with drawings of a variety of rectangular prisms which have the dimensions labelled. Students have to determine the volume of each prism and give reasons for their answer.

1 cm

4 cm   1 cm

2 cm

5 cm   2 cm

3 cm

4 cm   3 cm

Diagrams not to scale
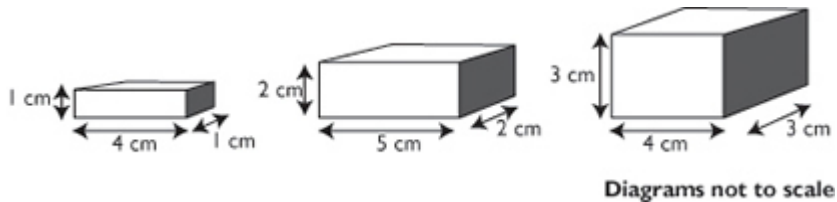
Problem Solving

Pose this problem. Imagine a box which is 1 metre long, 1 metre wide and 1 metre high. Ask:

- *What is the volume of the box in cubic metres?*
- *What is the volume of the box in cubic centimetres?*
- *How did you work out this answer?*
- *How many centicubes would be needed to fill the box?*

http://www.schools.nsw.edu.au/learning/7-12assessments/naplan/teachstrategies/yr2010/index.php?id=numeracy/nn_meas/nn_meas_s3e_10
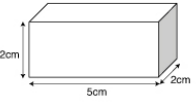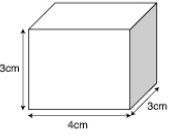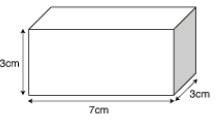
Challenge

Students collect a handful of centicubes and a stopwatch. Within a time limit of 20 seconds the students have to construct the biggest prism that they can. They report back to the class by answering these questions:

- *How many centicubes did you use?*
- *How high is your prism?*
- *How wide is your prism?*
- *How long is your prism?*
- *What was the volume of your prism in cubic centimetres?*

Tell students to use the same number of centicubes to build a different prism. It will have the same volume because the students used the same number of cubes.

Students draw this prism and write the length, width and height in centimetres and note that it has the same volume.

Construct these solid rectangular prisms using centicubes. Record how many centicubes were needed to build each prism.

	Number of centicubes	Volume
1cm 4cm 1cm		
2cm 5cm 2cm		
3cm 4cm 3cm		
3cm 7cm 3cm		

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Calculating volume

Provide students with a copy of the table

a) Students use centicubes to construct a rectangular prism which is 3 cm long, 2 cm wide and 1 cm high.

Discuss:

- *How many centicubes did you use?*
- *What is the volume?*
- Complete the details in row (i) of the table. See below.

b) Add another layer to this prism so the height is now 2 cm. Complete row (ii) in the table.
c) Add another layer to this prism so the height is now 3 cm. Complete row (iii) in the table.
d) Repeat with a height of 4 cm.
e) Repeat with a height of 5 cm.
f) Choose your own measurement for the height and complete (vi).

Calculating volume

	Length	Breadth	Height	Number of Centicubes	Volume in cm^3
i)	3 cm	2 cm	1 cm		
ii)	3 cm	2 cm	2 cm		
iii)	3 cm	2 cm	3 cm		
iv)	3 cm	2 cm	4 cm		
v)	3 cm	2 cm	5 cm		
vi)	3 cm	2 cm			

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Students look at the information in their table. Ask:

- *Can you see a relationship between the length, breadth, height and volume of your prisms?*
- *What happened to the volume when you increased the height of the prism?*

Students write what they have discovered about the volume of prisms. Include information about length, breadth, height and cubic centimetres.

Students complete this statement:

To find the volume of a rectangular prism, multiply the l_____, by the b_____, by the h_____.

Students use the fact, volume = length x breadth x height, to calculate the missing measurements and complete the table.

|	Length	Breadth	Height	Volume
i)	4 cm	3 cm		24 cm^3
ii)		5 cm	2 cm	80 cm^3
iii)	3 cm		3 cm	27 cm^3
iv)	6 cm	2 cm	4 cm	

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Students find a box and study the dimensions, its length, breadth and height. Students estimate its volume in cm³. They explain to the class the procedure they used to estimate the volume. Students check how accurate their estimations were by measuring the box and working out the volume. They may use a calculator

1x1x1

Students imagine a box 1 metre long, 1 metre wide and 1 metre high.
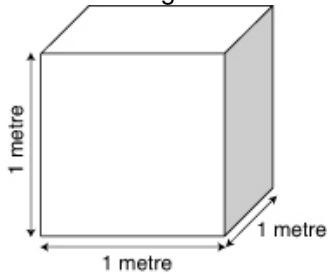
Use a calculator to work out the volume of the box.

Discuss:
- *How many centicubes would it take to fill this box?*
- *Would you be able to lift the box when it was full?*

Literacy
Critical and creative thinking