# Fish in captivity

Students investigate different-sized fish tanks and the amount of water required to keep fish alive in captivity. In doing so students will convert between volume and capacity. No fish were harmed during the construction or execution of this lesson.

## Visible learning

### Learning intention

* To be able to convert between metric units of volume and capacity.

### Success criteria

* I can convert between and .
* I can convert between and mL.
* I can convert between and L.

### Syllabus outcomes

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**
* applies knowledge of volume and capacity to solve problems involving right prisms and cylinders **MA4-VOL-C-01**

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## Activity structure

Please use the associated PowerPoint *Fish in captivity* to display images in this lesson.

### Launch

1. Watch the video ‘A Goldfish Will Live for 15 YEARS If You Do This (10:04)**’** ([bit.ly/oldgoldfish](https://bit.ly/oldgoldfish)) up to 2:22.
2. Conduct a class discussion on factors that students think could determine how many goldfish a tank holds.

Suggestions could include the size of the fish, oxygen level in the water, excrement in the water, surface area of the water and amount of water.

### Explore

1. Assign students to visibly random groups of 3 ([bit.ly/visiblegroups](https://bit.ly/visiblegroups)) and distribute Appendix A ‘Different size fish tanks’ to each group.
2. On vertical non-permanent surfaces ([bit.ly/VNPSstrategy](https://bit.ly/VNPSstrategy)), ask students to find the volume of the first 2 fish tanks.
3. Initiate a sharing of ideas and reasoning using the Pose-Pause-Pounce-Bounce question strategy (PDF 557 KB) ([bit.ly/posepausepouncebounce](https://bit.ly/posepausepouncebounce)). The following questions may be useful:
* What do you notice about the size of each fish tank?
* If one fish tank was empty and I tipped the contents of the other tank into it, what would happen?
* What do you notice about the measurements of the tanks?
1. Display slide 3 of the PowerPoint Fish in captivity which shows the conversion between cm3 and mm3.
2. Ask students to record a list of things they notice and wonder ([bit.ly/noticewonderstrategy](https://bit.ly/noticewonderstrategy)).

The following question prompts may be useful:

* How do we know the shapes are cubes?
* How do we calculate the volume of each cube?
* How do we know the volume of the cubes are equal?
1. Ask students to draw 2 new fish tanks with the same dimensions, with one represented in centimetres and the other represented in millimetres.
2. Ask students to calculate the volume of each of the tanks and compare the answers.
3. Students are to do a gallery walk ([bit.ly/DLSgallerywalk](https://bit.ly/DLSgallerywalk)) of each group’s new tank examples. Students should notice that for each group the volume of the tanks has a multiplicative relationship of 1000.
4. Display slide 4 of the PowerPoint Fish in captivity and pose the question: How many 2.5 cm fish can we fit in fish tank 1 from Appendix A? Allow students to work in their groups to answer this question.

Students may need to be reminded of the conversion 1 cm3 = 1 mL developed in Lesson 6 – Volume and capacity.

The fish tank contains 31.450 L meaning that 6 fish can fit in the tank.

1. Allow students to do a gallery walk and provide feedback using two stars and a wish ([bit.ly/2starwish](https://bit.ly/2starwish)).
2. Bring students back together and, by choosing random non-volunteers, ask students to share either a star or a wish that they gave or received.
3. Still in their random groups of 3, ask students to calculate the volume of fish tank 3 from Appendix A ‘Different size fish tanks’.
4. Display slide 5 of the PowerPoint Fish in captivity and ask students to find how many big fish could be contained in fish tank 3.

Students might find the number of fish by converting metres to centimetres or millimetres and use 1 cm3 = 1 mL to convert.

1. Display slide 6 of the PowerPoint Fish in captivity and ask students to consider a metre cube.
2. In a Think-Pair-Share, students are to consider the following questions:
* How can we determine the number of litres which fit into a cubic metre?
* How can we use the diagram to construct a link between a cubic metre and a litre?
* How can we use the diagram to construct a link between a cubic metre and a kilolitre?
1. Slide 7 of the PowerPoint Fish in captivity contains the conversion from m3 to L.
2. Pose the question, how many 1 m long fish can we fit in fish tank 3 from Appendix A. Remind students that a 1 metre fish requires 8000 litres of water.

The volume of fish tank 3 is 72 m3. This equals 72000 L meaning 9 one metre fish can fit in this tank.

### Summarise

By continuing to work in their same visibly random groups of 3, students are to complete [four quadrant notes (DOCX 319 KB)](https://education.nsw.gov.au/content/dam/main-education/documents/teaching-and-learning/curriculum/mathematics/mathematics-s4-supporting-strategies-four-quadrant-notes.docx) from Appendix B ‘Four-quadrant notes’.

### Apply

1. Distribute Appendix C ‘How many fish?’ to each student. The appendix contains a table with the dimensions of the tank, the advertised capacity of the tank and how many 2.5 cm fish that the capacity would allow in the tank.
2. Students must determine if the advertised capacity is correct or how many 2.5 cm fish can fit in the tank.

A 2.5 cm fish needs 5 L of water, as seen on slide 4 of the PowerPoint *Fish in captivity.*

1. On completion, ask students to complete a gallery walk, comparing results.

## Assessment and differentiation

### Suggested opportunities for differentiation

**Explore**

* Students may have difficulty visualising the size of a cubic metre. Have students model a metre cubed using concrete material such as rulers, cardboard and sticks.
* Students could use index laws to prove .
* The measurements in this lesson are the dimensions of actual fish tanks. These dimensions could be modified to assist low-readiness students.
* Visual representations are used to assist students with their understanding when comparing volume with capacity.

**Apply**

* Students could find the volume of different-shaped fish tanks or find the dimensions of fish tanks when given a specific volume.
* Each activity in this lesson could be modified to provide the area of the cross-section to find volume or simplify the volume so that students’ focus is on converting.
* Different-shaped tanks could be used to extend students.

### Suggested opportunities for assessment

**Launch**

* A Think-Pair-Share provides students with the opportunity to reflect on their understanding.
* When placed in groups of 3, students provide and receive peer feedback on their understanding.
* The teacher could monitor students’ responses during classroom discussions.

**Summarise**

* The teacher could collect the notes to future self to check their understanding of conversions.

**Apply**

* The response to Appendix C ‘How many fish?’ could be collected and form part of the formative assessment for this unit.
* Teachers could create an exit ticket using a different-sized fish tank.

## Appendix A

### Different size fish tanks

Find the volume of each of the different fish tanks.

Figure 1: fish tank 1



Figure 2: fish tank 2



Figure 3: fish tank 3



## Appendix B

### Four-quadrant notes

|  |  |
| --- | --- |
| **Example 1**A fish tank has a volume of 143 800 cm3. How many mL, L and kL is this?  | **Example 2**A fish tank has a volume of 25 m3. How many mL, L and kL is this? |
| **Things to remember** | **Example 3** |

## Appendix C

### How many fish?

The following fish tanks were advertised to have a certain capacity. Can you verify if the capacity advertised is a correct representation of the amount of water contained in the fish tanks?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tank | Length | Breadth | Width | Capacity | Number of fish |
| Tank 1 | 37 cm | 33.5 cm | 25 cm | 20 L | 4 |
| Tank 2 | 58.5 cm | 38.5 cm | 32 cm | 54 L | 10 |
| Tank 3 | 58 cm | 49.5 cm | 32 cm | 70 L | 14 |
| Tank 4 | 1220 mm | 380 mm | 450 mm | 430 L | 86 |
| Tank 5  | 1.4 m | 1.6 m | 40 cm | 1 kL | 200 |

**Tank 6**



**Tank 7**



## Sample solutions

### Appendix A – different size fish tanks

### Appendix B – four-quadrant notes

|  |  |
| --- | --- |
| **Example 1**A fish tank has a volume of 143 800 cm3. How many mL, L and kL is this? | **Example 2**A fish tank has a volume of 25 m3. How many mL, L and kL is this? |
| **Things to remember** | **Example 3**A fish tank has a volume of 12.5 m3. How many mL, L and kL is this? |

### Appendix C – How many fish?

**Tank 1**

The advertised capacity of 20 L will fit into the 31 L, however the fish tank will only be full. The tank could hold another 10 L, and still have room at the top so it doesn’t overflow and could hold 6 fish.

**Tank 2**

The advertised capacity of 54 L will fit into the 72 L, however the fish tank will only be approximately full. The tank could hold maybe 72 L and could fit 14 fish.

**Tank 3**

The advertised capacity of 70 L will fit into the 92 L, however the fish tank will only be about ¾ full. The tank could hold maybe 72 L and could fit 18 fish.

**Tank 4**

The advertised 430 L will not fit in this tank. The tank can only hold 41 fish.

**Tank 5**

The advertised 1 kL will not fit in this tank. The tank can only hold 179 fish.

**Tank 6**

The advertised capacity of 300 L will not fit into the 30 L tank. The tank can only hold 6 fish.

**Tank 7**

The advertised capacity of 16.2 L will fit into the 21.6 L tank. The tank can hold 4 fish.

## References

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