

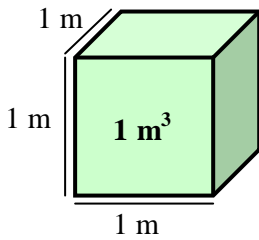
Volume

Information Sheet

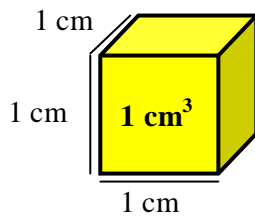
The **volume** of an object is the **amount of space** it fills.

Large volumes are measured in **cubic metres** (m^3).

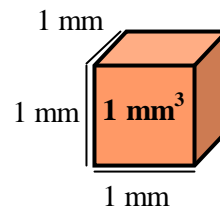
Smaller volumes are measured in **cubic centimetres** (cm^3) or **cubic millimetres** (mm^3).



1 cubic metre



1 cubic centimetre

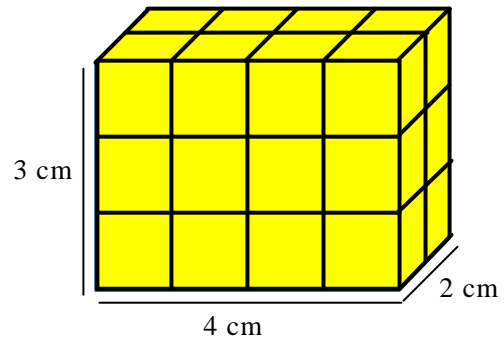


1 cubic millimetre

In this cuboid there are 3 layers of cubes.
There are 2 rows of 4 cubes in each layer.

The total number of cubes = $4 \times 2 \times 3$

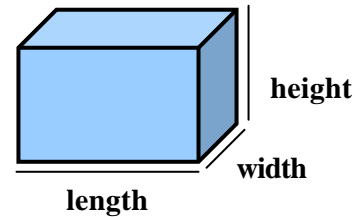
The volume of the cuboid = $4 \times 2 \times 3 = 24 \text{ cm}^3$



For any cuboid:

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

$$\text{or } \text{Volume} = \text{area of cross-section} \times \text{length}$$



The volume of liquids is usually measured in **litres** or **millilitres**.

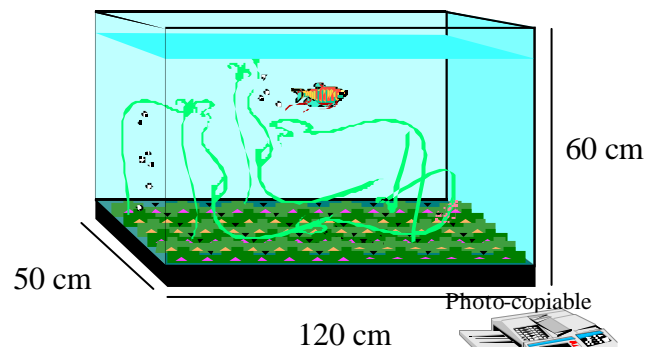
$$\begin{array}{l} \mathbf{1 \text{ litre} = 1000 \text{ ml}} \quad \text{and} \quad \mathbf{1 \text{ ml} = 1 \text{ cm}^3} \\ \mathbf{1 \text{ litre} = 1000 \text{ cm}^3} \quad \text{and} \quad \mathbf{1 \text{ m}^3 = 1000 \text{ litres}} \end{array}$$

Example

$$\begin{aligned} \text{Volume of fish tank} &= 120 \times 50 \times 60 \\ &= 120 \times 3000 \\ &= 360\,000 \text{ cm}^3 \end{aligned}$$

$$\text{Volume of fish tank} = \mathbf{360 \text{ litres.}}$$

(Check the calculation on your calculator.)



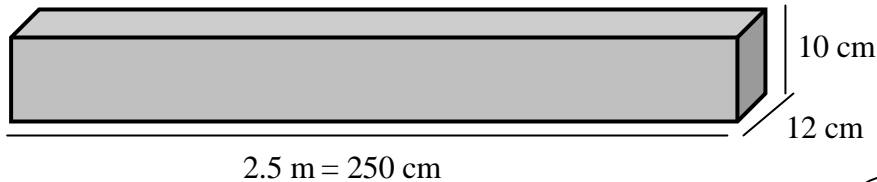
Note the volume of a container for liquids is often called its **capacity**.



It is important that the dimensions of the cuboid are in the same units.

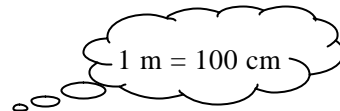
Example

Find the volume of a concrete block that is 2.5 metres long, 12 centimetres wide and 10 centimetres high.



Two of the dimensions, the width and height are in centimetres.

Converting the length to centimetres: $2.5 \text{ m} = 2.5 \times 100 = 250 \text{ cm}$



$$\begin{aligned} \text{Volume of concrete block} &= 250 \times 12 \times 10 \\ &= 2500 \times 12 \end{aligned}$$

(Check the calculation on your calculator.)

$$\text{Volume of concrete block} = \mathbf{30\,000 \text{ cm}^3}$$

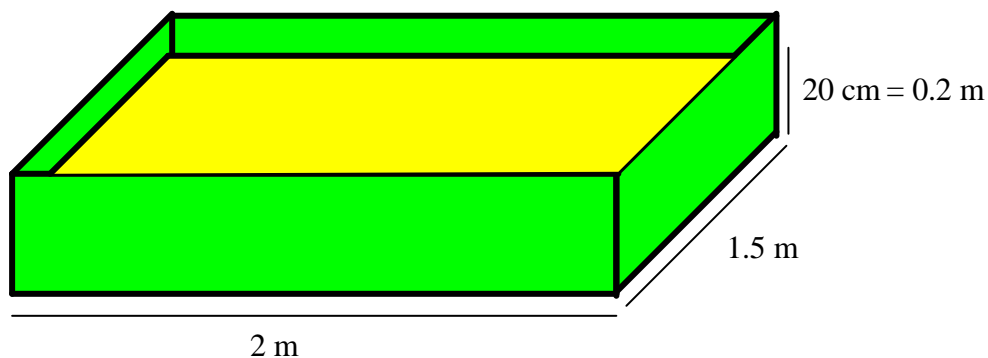
Example

A sand pit is 2 metres long and 1.5 metres wide.

How much sand will it take to fill the sandpit to a depth of 20 centimetres?

In this case, two of the dimensions, the length and width, are in metres.

Converting the height to metres: $20 \text{ cm} = 20 \div 100 = 0.2 \text{ m}$



$$\begin{aligned} \text{Volume of sand needed} &= 2 \times 1.5 \times 0.2 \\ &= 3 \times 0.2 \end{aligned}$$

(Check the calculation on your calculator.)

$$\text{Volume of sand needed} = \mathbf{0.6 \text{ m}^3}$$

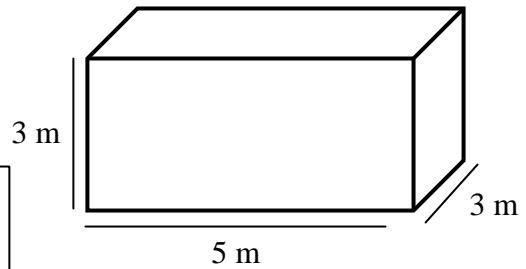


Volume

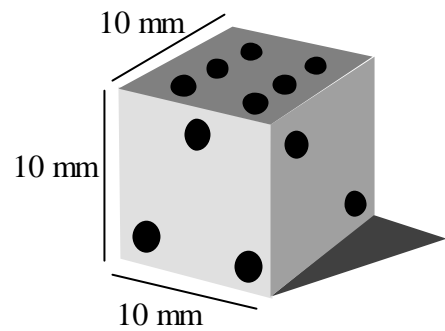
Worksheet

Work out your answer for each question in the box.

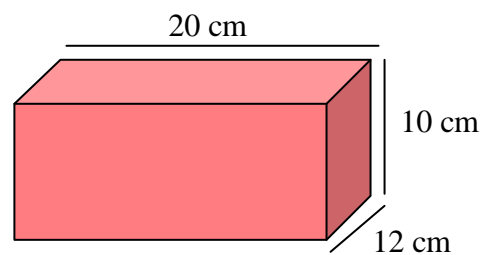
- 1 A heating engineer needs to work out the volume of this room.
What is its volume?



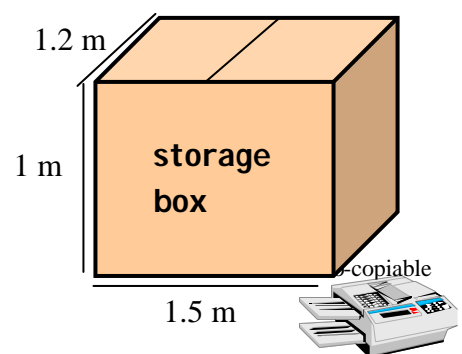
- 2 All the edges of this dice are 10 mm long.
What is its volume?



- 3 A brick is 20 cm long, 12 cm wide and 10 cm high.
What is its volume?

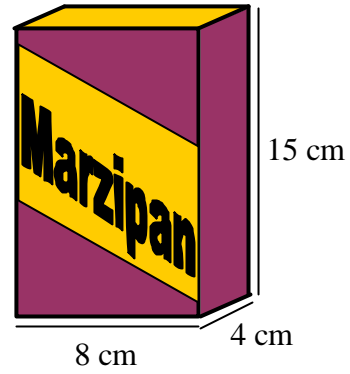


- 4 A storage box is 1.5 m long, 1.2 m wide and 1 m high.
Find its volume.

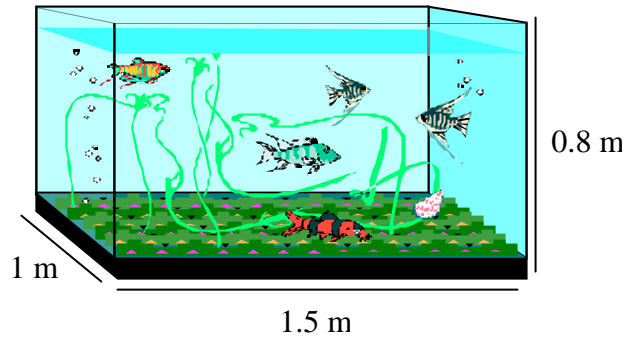




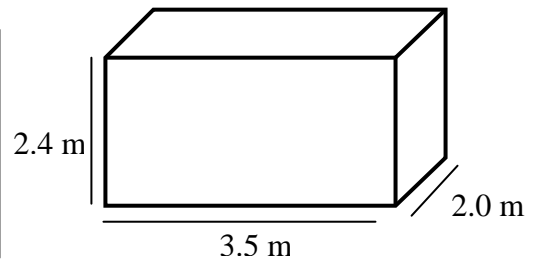
- 5 The diagram shows a packet of Marzipan.
What is its volume?



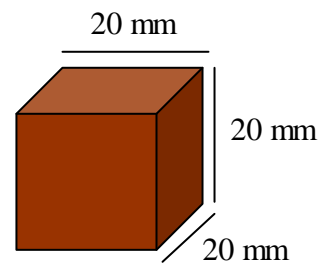
- 6 The diagram shows the dimensions of a fish tank.
Find its volume (capacity) in cubic metres.



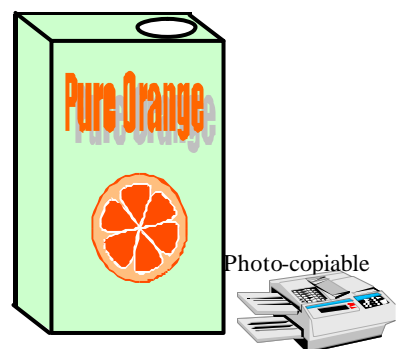
- 7 The diagram shows the dimensions of a waste disposal container. What is its volume?



- 8 A stock cube is 20 mm long, 20 mm wide and 20 mm high.
Calculate its volume.

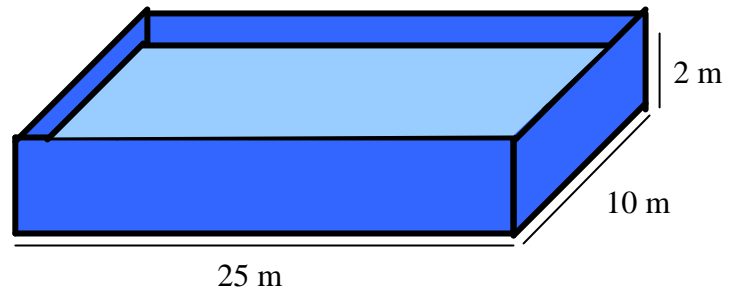
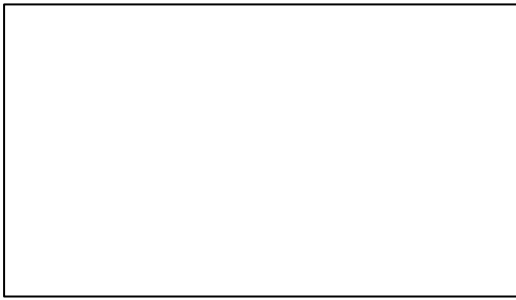


- 9 A carton of orange juice measures 9 cm by 6 cm by 19.5 cm.
Show that its volume is just over 1 litre.

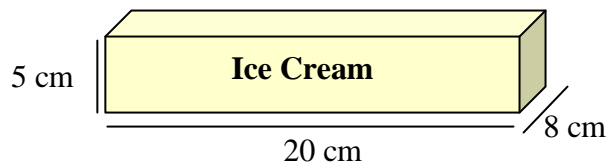




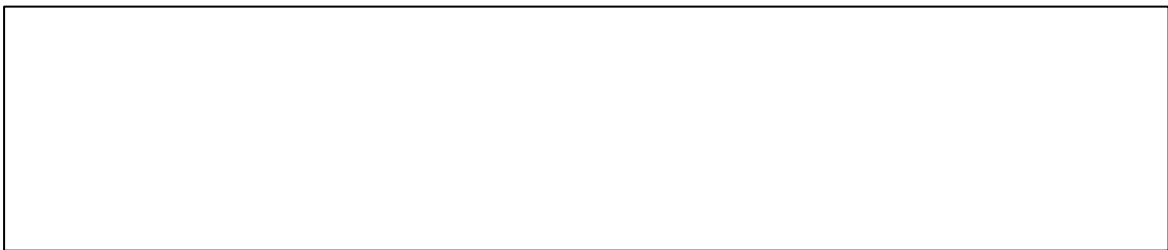
- 10 A rectangular swimming pool is 25 m long and 10 m wide.
How many litres of water do you need to fill it to a depth of 2 m?



- 11 Ice cream mixture is poured into a container to make a block of ice cream 20 cm long, 8 cm wide and 5 cm high.



- a) Find the volume of the block.
b) How many blocks can you make with 4 litres of ice cream mixture?



- 12 A builder plans a tarmac drive for a new house. The drive is in the shape of a rectangle 12 metres long and 3 metres wide. The tarmac needs to be 20 cm thick.

What volume of tarmac does the builder need?



- 13 A rectangular paddling pool is 2.5 m long and 2 m wide.

How many litres of water do you need to fill it to a depth of 40 cm?



- 14 What volume of concrete is needed for a path that is 80 metres long, 1.5 metres wide and 150 mm deep?



Teacher Notes

Unit Foundation Level, Working in 2 and 3 dimensions

Notes

Pages 1 and 2 are information sheets that show how to find the volume of a cuboid, including some examples.

The formulae:

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

and
$$\text{Volume} = \text{area of cross-section} \times \text{length}$$

are both included – if you prefer to use just one of these, the other can be removed.

Note that some of the examples require the conversion of units (including the use of litres). You may wish to simplify these examples if you are using this as an introduction with less able students.

An accompanying Powerpoint presentation with the same name includes the same examples. It can be used as an introduction to volume calculations or for revision at the end of the course.

The worksheets include examples from real life contexts. If possible, use a problem from a real context that is familiar to your students to introduce this topic and make it more meaningful.

It is also recommended that you include work of a more practical nature.

Some examples are given below.

- Estimate the volume of a variety of boxes and other cuboids (eg the room), then measure their dimensions and work it out.
- Estimate the quantity of liquid in a variety of bottles (eg squash, shampoo) with the contents removed from the label.
- Estimate the amount of water in a variety of containers and then measure it.
- Share the water from a one or two litre bottle equally between a number of identical cups, measure how much is in each cup and check by calculation.

Answers to worksheets

- 1 45 m³
- 2 1000 mm³
- 3 2400 cm³
- 4 1.8 m³
- 5 480 cm³
- 6 1.2 m³
- 7 16.8 m³
- 8 8000 mm³
- 9 1053 cm³
- 10 500 000 litres
- 11 a) 800 cm³ b) 5 blocks
- 12 7.2 m³
- 13 2000 litres
- 14 18 m³

