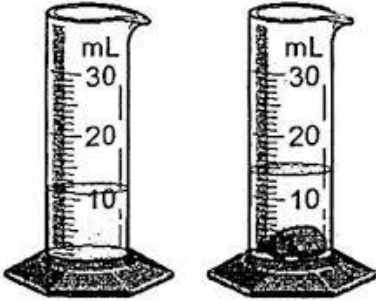


Goals



Weekly Goals: Mass, Volume and Capacity

- use metric units of mass, their abbreviations, conversions between them, and appropriate choices of units (EMA24)
- estimate the mass of different objects (EMA25)
- use metric units of volume, their abbreviations, conversions between them, and appropriate choices of units (EMA26)
- understand the relationship between volume and capacity (EMA27)
- estimate volume and capacity of various objects (EMA28)
- calculate the volume of objects, such as cubes and rectangular and triangular prisms (EMA29)

Theoretical components

Resources:

PDF file - Week 14 Notes and Exercises and Mathspace.co

Knowledge Checklist

- Units of mass
- Estimating mass
- Converting between units of mass
- Volumes in cm^3 of rectangular prisms
- Volume of rectangular prisms and as area of cross section \times height
- Application to irregular shapes
- Converting units of volume
- Relation between volume and capacity

Order

1. Work through the Week 14 notes and view any videos or solutions posted by your teacher
2. Complete the Exercises
3. Do any mathspace.co task by the due date
4. Complete the Portfolio Task and submit on Google Classroom by the due date
5. Do any Google Forms required by the due date
6. Email your teacher if you have any questions or specific concerns and join the Google Meets as invited

Practical components

There are 6 Exercises in this week's booklet. Read any notes and worked examples before you begin.

It is not necessary to print the booklet as you can record your answers on the Google document that will be uploaded.

A weekly Google form (Quiz) and mathspace.co task(s) **may** also both be used to check your engagement and progress each week.

Remember to check regularly Google Classrooms and mathspace.co

No mathspace.co tasks assigned for this week.

Portfolio Task

The Portfolio Task may be found at the end of the Notes and Exercises Google document

	Knowledge, Comprehension and Application				
CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work of the brief to an acceptable standard set by the teacher.	2	3		/6
Portfolio Task	Student completes the portfolio task of the brief to an acceptable standard set by the teacher.	2	2		/4
	Analysis, Synthesis and Evaluation	SUB TOTAL			/10
Written Communication	Student responses clearly demonstrate evidence of logical and comprehensive processes and thought.	4	-		/4
Evidence of Working	Student submitted task effectively uses the material learned in class to describe and complete the assigned task.	4	-		/4
	Submission Guidelines	SUB TOTAL			/8
Timeliness	Student submits the assignment by the set deadline. See scoring guidelines for specific details.	2	-		/2
		SUB TOTAL			/2
				FINAL	/20

WEEK 14 NOTES AND EXERCISES

MEASURING MASS

In everyday language we talk about how much things weigh when we really mean mass. Weight depends on gravity and thus changes depending on how far you are from the centre of the Earth – you have much less weight on the moon, hence those giant ‘moon steps’. When Louise said she weighed 85 kg she should have said she has a mass of 85 kg.

Metric Units for Mass

In the metric system, the gram is the basic unit for mass and all other units are based on grams. This table shows the common mass units in the metric system.

Unit	Abbreviation	
milligram	mg	one-thousandth of a gram
gram	g	
kilogram	kg	1 kg is equivalent to 1000 g
tonne	t	1 tonne is equivalent to 1000 kg

Estimating Mass

This table shows some common items and their approximate mass.

Mass	Items with approximate mass
1 mg	A grain of sand A tiny insect like a sand-fly
2 g	A 5c coin
100 g	An iPhone without a case
1 kg	A litre of milk 5 medium sized oranges
50 kg	A Year 7 student
100 kg	A tall solid/muscular man

Exercise 1

Q1. Which unit of mass would be most appropriate for:

- a) a pencil b) your Maths folder c) a postage stamp
- d) a car e) your shoe f) a Big Mac
- g) a hair from your head h) a full bag of groceries i) a new born baby

Converting Units of Mass

Larger to smaller

t to kg multiply by 1000

kg to g multiply by 1000

g to mg multiply by 1000

Smaller to larger

mg to g divide by 1000

g to kg divide by 1000

kg to t divide by 1000

Exercise 2

Q1. Convert these units

a) 3kg	g
b) 12t	kg
c) 1500g	kg
d) 2400kg	t
e) 2.5g	mg
f) 500mg	g

Q2. A hospital pharmacist ordered 2000 tablets. Each tablet has a mass of 5 mg.

a) Calculate the total mass of the tablets in mg.

b) What is the total mass in grams?

Q3. Vitamin C powder contains $\frac{9}{10}$ ascorbic acid and $\frac{1}{10}$ calcium.

a) How many milligrams of calcium are in 40 milligrams of vitamin C?

b) How many milligrams of ascorbic acid are in 60 milligrams of vitamin C?

Q4. A standard house brick has a mass of 2.7 kg.

a) A pallet of standard house bricks contains 500 bricks. Calculate the mass of 1 pallet of normal house bricks. Express your answer in kilograms.

b) A truck has a load of 8 pallets of standard house bricks. Calculate the weight of the load in tonnes.

Q5. List three items whose mass you would measure in:

a) tonnes

b) kilograms

c) grams

d) milligrams

Q6. Germany has the highest rate of chocolate consumption in the world. The population of 83 million eat an average of 3.03 kg of chocolate each per year. How many tonnes of chocolate are eaten in Germany per year?

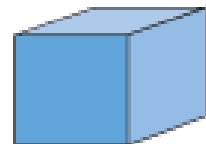
MEASURING VOLUME

The amount of wheat a silo can hold, the quantity of sand in a truck and the amount of concrete required for a driveway are applications of **volume**.



Volume measures the space inside a solid shape. **Cubic units** are used for volume. The diagram shows a cube with sides of 1 cm. Its volume is 1 cm³.

Motorbikes are often described by the size of the cylinders in their engine. The cylinders in the engine in a 750 cc bike have a volume of 750 cm³.



Volumes of Rectangular Prisms

An object's volume is a measure of the space an object occupies. The formula for the volume of a rectangular prism is:

$$V = L \times D \times H$$

Where L = length, D = depth and H = height.

Example

Mia keeps her gardening tools in a box which is the shape of a rectangular prism.

a) Calculate the volume of the box in:

- (i) cubic centimetres
- (ii) cubic metres.



Solution

The formula for the volume is

$$V = L \cdot D \cdot H$$

a) (i) If you want the volume in cubic centimetres, make all the measurements centimetres before you substitute them into the formula.

$$V = 110 \cdot 45 \cdot 40 \text{ cm}^3 = 198\,000 \text{ cm}^3$$

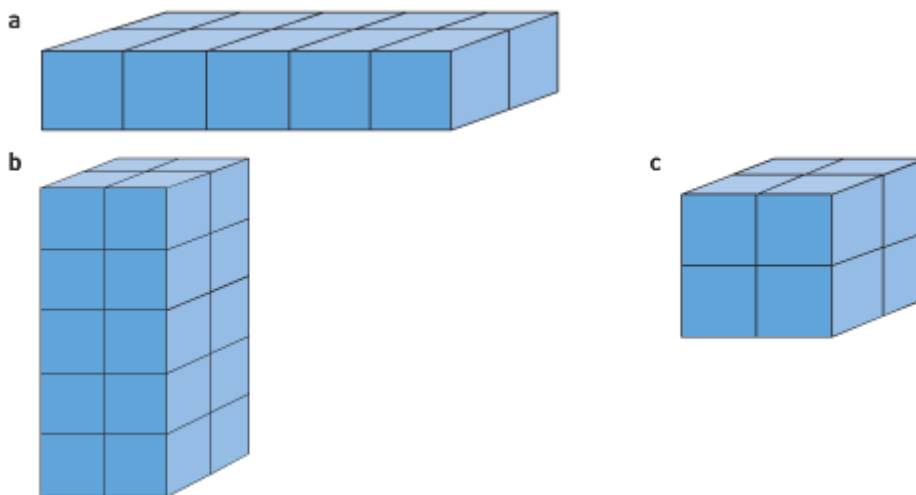
(ii) If you want the volume in cubic metres, make all the measurements metres before you substitute them into the formula.

$$V = 1.1 \cdot 0.45 \cdot 0.40 \text{ m}^3 = 0.198 \text{ m}^3$$

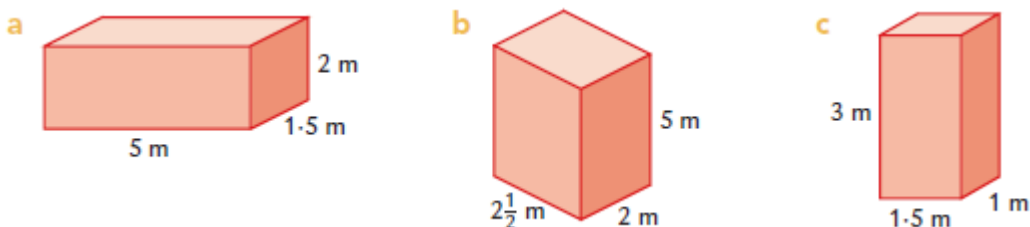
Exercise 3

Determine the volume of each of the following prisms, constructed from 1 cm^3 blocks.

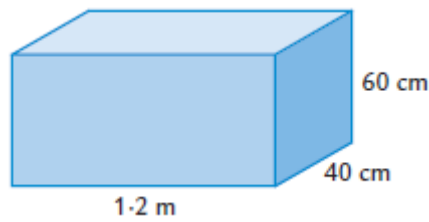
Q1.



Q2. Calculate the volumes of these rectangular prisms in cubic metres.



Q3. Calculate the volume of this rectangular prism in cubic centimetres and cubic metres.



Volumes of regular prisms

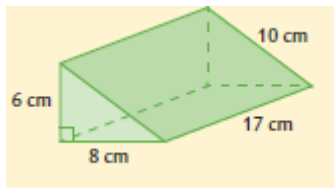
The volume of a prism can be calculated with the formula:

$$V = A \times H$$

where A = area of the cross-section
 H = height at right angles to the cross-section.

Example

Calculate the volume of this triangular prism.



Solution

The cross-section of the prism is a triangle.

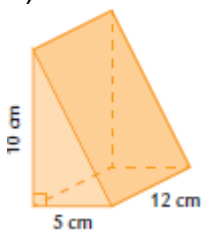
$$\text{Area of triangle} = \frac{1}{2}bh = 0.5 \times 6 \times 8 \text{ cm}^2 = 24 \text{ cm}^2$$

$$\text{Volume} = \text{area of triangle} \times \text{height} = 24 \times 17 \text{ cm}^3 = 408 \text{ cm}^3$$

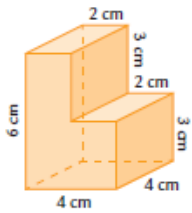
Exercise 4

Calculate the volume of these solids.

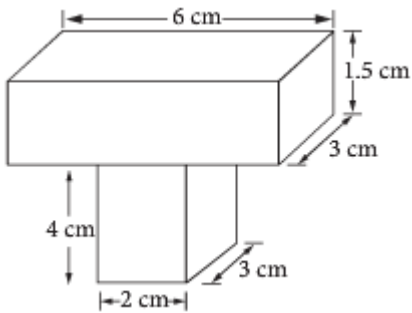
a)



b)

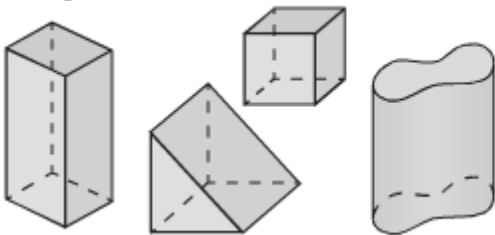


c)

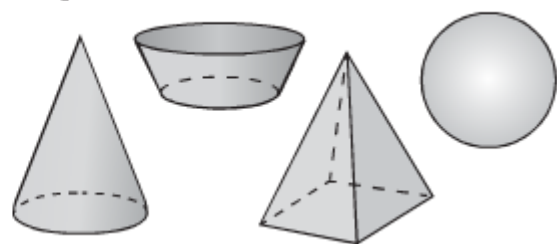


Volumes of Irregular Shapes

Examples of solids with identical ends



Examples of solids that don't have identical ends



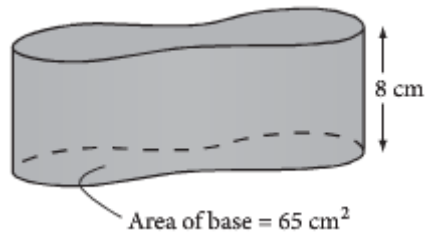
The diagrams show some solids that have identical shapes at either end. Thus they have the same cross-section throughout. The other shapes do not have identical ends or cross sections. A solid with flat sides and identical ends is called a **prism**.

The volume of a solid with identical ends = $A \times h$

where A is the area of the end or base and h is the height.

Example

The area of the base of this solid is 65 cm^2 . What is the volume of the solid?



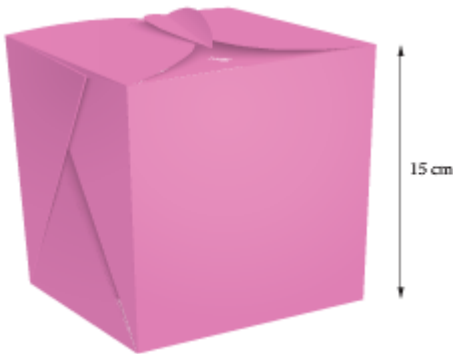
Solution

Both ends of the solid are identical, so we can use the formula $V = A \times h$

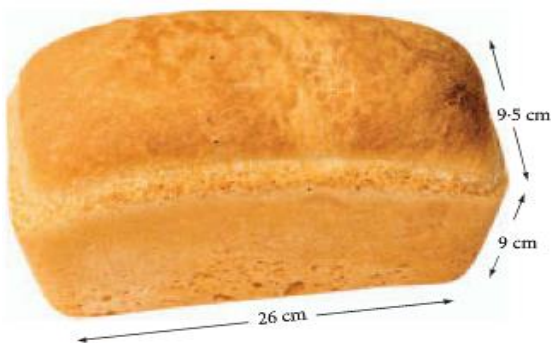
$$V = A \times h = 65 \times 8 = 520 \text{ cm}^3$$

Exercise 5

Q1. The area of the food box base is 300 cm^2 . Calculate the volume of the box.



Q2. The end of this loaf of bread is a rectangle 9 by 9.5 cm.



a) What is the area of the end of the loaf of bread?

b) The loaf is 26 cm long. What is the volume of the loaf of bread?

c) The loaf of bread can be cut into 22 slices. Calculate the volume of each slice of bread to the nearest cm^3 .

Converting Units

$$1 \text{ cm}^3 = 10 \times 10 \times 10 \text{ mm} = 1000 \text{ mm}^3$$

$$1 \text{ m}^3 = 100 \times 100 \times 100 = 1000000 \text{ cm}^3$$

Large to small

m^3 to cm^3 multiply by 1000000

cm^3 to mm^3 multiply by 1000

Small to large

cm^3 to m^3 divide by 1000000

Mm^3 to cm^3 divide by 1000

Exercise 6

Q1. Complete the statements.

a) $5 \text{ cm}^3 =$ mm^3 b) $2 \text{ m}^3 =$ cm^3

c) $500 \text{ mm}^3 =$ cm^3 d) $0.25 \text{ m}^3 =$ cm^3

e) $24000 \text{ cm}^3 =$ m^3 f) $36000 \text{ mm}^3 =$ cm^3

Q2. If you were to measure the volume of the following items what units would you use; mm^3 , cm^3 or m^3 ?

- a Your calculator.
- c An EFTPOS card
- e A mobile phone

- b Your maths classroom
- d A glass of water
- f The contents of a box of breakfast cereal.

Question 1

Joanne only has a small area where she can use to grow vegetables. She digs out a garden 3 m long by 55 cm deep and 45 cm wide. She plans to replace the old soil with compost.

a) What is the volume of soil she needs to remove? Give your answer in cubic metres.

b) If she takes this soil away in a wheelbarrow that holds 60 litres, how many barrow loads will she take away? Given that 1 cubic metre holds 1000 litres.

c) How many litres of compost will she need?

d) The compost is available in 50 litre bags. How many bags will she need to buy?

e) She plans to line the edge of the garden with timber. What length of timber will she need?

Question 2

The diagram shows a rectangular box (a cuboid).
The areas of the faces are 3, 12 and 25 square centimetres.
What is the volume of the box?

