CHAPTER 11: FURTHER MEASUREMENT

## 11A   VOLUME

> **REMINDER**
>
> The **volume** of a three-dimensional object is the amount of space it occupies. This space is measured in **cubic units**.

**1** Find the number of cubic units in each of the following solids:

a

b
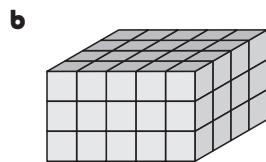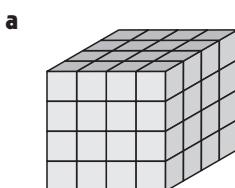
2 Give the units of volume that would be most suitable for measuring the space occupied by:

   a a sand dune   **b** a pumpkin seed

   c a calculator   **d** a pebble

   e a garden shed   **f** a novel

> **REMINDER**
>
> $$m^3 \xrightarrow{\times 1\,000\,000} cm^3 \xrightarrow{\times 1000} mm^3$$
> $$m^3 \xleftarrow{\div 1\,000\,000} cm^3 \xleftarrow{\div 1000} mm^3$$
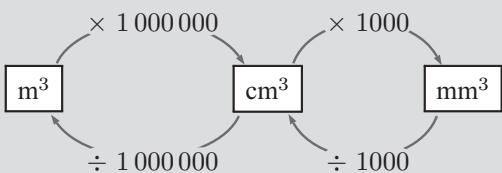
3 Convert:

   a 25 cm^3 to mm^3

   b 0.35 m^3 to cm^3

   c 700 000 000 mm^3 to m^3

   d 48 000 000 cm^3 to m^3

   e 0.000 000 075 m^3 to mm^3

   f 27 mm^3 to cm^3

4 A house brick has a volume of 1936 cm^3. 500 bricks are put on a pallet. What is the total volume of the bricks in cubic metres?

5 A small pond has a volume of 1.35 m^3. Mark fills the pond with buckets of water, which have volume 9000 cm^3. How many buckets of water will it take to completely fill the pond?

11B   VOLUME FORMULAE

> **REMINDER**
>
> Volume of a rectangular prism
>
> $$V = l \times w \times h$$

**1** Find the number of cubic units in each of the following solids:

a

b
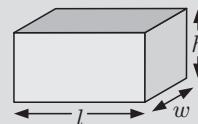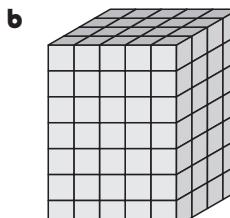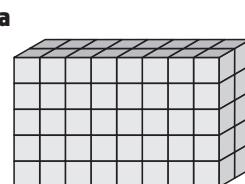
2 Find the volumes of the following prisms:

**a**

3 cm

6 cm   2 cm

b

10 mm   4 mm
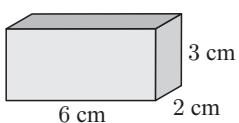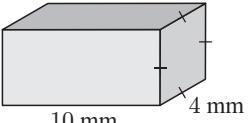
3 Find the volume of air in a rectangular tank measuring 40 cm by 40 cm by 1.5 m.

REMINDER

Volume of a prism = area of end × length

4 Find the volumes of the following solids:

a

16 cm

area of end = 6 cm^2

b

3 m

area of end = 90 m^2
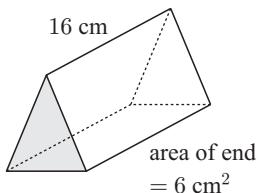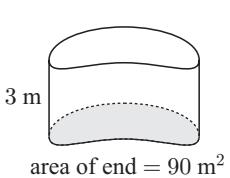
5 Find the volumes of the following solids:

a

1.5 m

8 m

4 m

b

7 cm

5 cm   20 cm

9 cm
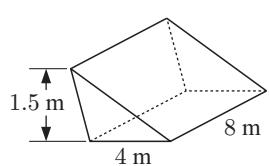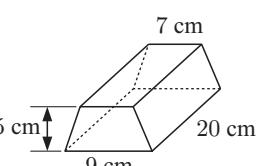
6 A log of uniform cross-section has end area 200 cm^2 and volume 50 000 cm^3. How long is the log?

REMINDER

Volume of a cylinder

$$V = \pi r^2 h$$

h

r
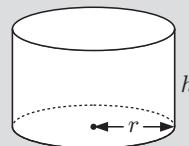
7 Find, correct to 1 decimal place, the volume of each solid:

a

6 cm

12 cm

b

7 mm

50 mm
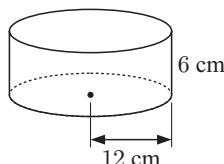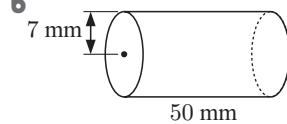
11C CAPACITY

REMINDER

The **capacity** of a container is a measure of the volume it can hold. We can think of it as the space within the container.

1 A wine bottle would most likely have a capacity of:
   A 700 mL   **B** 70 L
   C 70 mL   **D** 7 kL
   E 7 L

2 A reservoir would most likely have a capacity of:
   A 270 000 mL   **B** 270 L
   C 27 kL   **D** 270 ML
   E 2700 mL

3 A medicine cup would most likely have a capacity of:
   A 0.0003 L   **B** 0.3 kL
   C 3 ML   **D** 30 L
   E 30 mL

REMINDER

× 1000   × 1000   × 1000

ML   kL   L   mL

÷ 1000   ÷ 1000   ÷ 1000
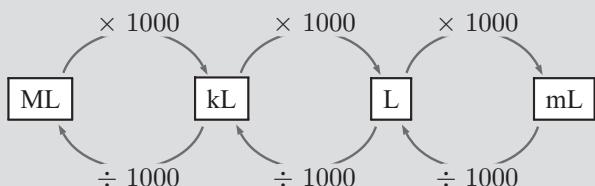
4 Convert:

   a 3 kL to L

   b 7900 mL to L

   c 0.5 ML to L

   d 2 600 000 mL to kL

   e 48 200 000 L to ML

   f 0.0025 L to mL

5 How many 1.2 L drink bottles can be filled from a 2.4 kL container?

6 As part of the grocery shopping, Allie buys two 375 mL tubs of cream each week. How many litres of cream will Allie buy in one year?

11D   CONNECTING VOLUME AND CAPACITY

REMINDER

1 cm^3 has capacity 1 mL
1000 cm^3 has capacity 1 L
1 m^3 has capacity 1 kL

1 A container is 60 cm by 50 cm by 70 cm. Find:

   a the volume of space in the container, in cm^3

   b the capacity of the container, in mL

   c the capacity of the container, in litres.

2 A rectangular food container has dimensions 8 cm by 10 cm by 6 cm. Find its capacity in L.

3 A laundry sink has dimensions 45 cm by 60 cm by 40 cm. How many litres of water can it hold?

4 A section of gutter has the dimensions shown:
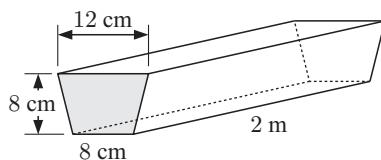
Find:

   a the area of the end, in cm^2

   b the volume of space in the gutter, in cm^3

   c the capacity of the gutter in:
     i millilitres   **ii** litres.

5 A saucepan has a base area of 700 cm^2. 8.4 litres of soup are poured into the saucepan. What height will the soup reach?

11E   MASS

REMINDER

The **mass** of an object is the amount of matter it contains.
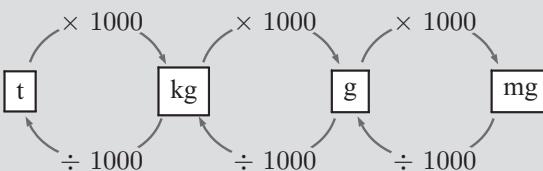
1 Give the units you would use to measure the mass of:
  a a grain of rice   **b** a cat

  c a potato   **d** a car

2 Convert the following to grams:
  a 2000 mg

  b 2.1 kg

  c 0.25 mg

  d 0.006 t

3 Express in kilograms:
  a 0.6 t

  b 20 g

  c 800 t

  d 2 900 000 mg

4 A mine train has 11 carriages, each of which carries 950 kg of iron ore. Find the total mass of iron ore in tonnes.

5 A carton of milk weighs 1.25 kg. A supermarket receives a 1.5 t shipment of milk. How many cartons did they order?

6 Find the total mass of 3500 Easter eggs, each with mass 39 g. Give your answer in kilograms.

7 The total mass of a pile of 18 000 oranges is 4.5 tonnes. Find the average weight of one orange.

11F   THE RELATIONSHIP BETWEEN UNITS

REMINDER

1000 cm^3 or 1 L of pure water at 4°C has a mass of 1 kg.

1 cm^3 or 1 mL of pure water at 4°C has a mass of 1 g.

1 Find the mass of 5 L of pure water at 4°C.

2 Find the mass of 27 mL of pure water at 4°C.

3 A drink bottle has mass 125 g. Find the total mass of the drink bottle when it is filled with 1.5 L of water.

4 A fish tank has internal measurements of 70 cm by 50 cm by 35 cm.
  a What is the capacity of the fish tank?

  b What mass of water is needed to completely fill the fish tank?

  c The fish tank itself has a mass of 13.3 kg. If it is filled with water to a level 5 cm from the top, what is the total mass?

11G   TIME

REMINDER

> 1 minute $= 60$ seconds
>
> 1 hour $= 60$ minutes $= 3600$ seconds
>
> 1 day $= 24$ hours
>
> 1 week $= 7$ days
>
> 1 year $= 365\frac{1}{4}$ days

1 Convert to minutes:
- **a** 3 hours

- **b** 330 seconds

- **c** 1 day

- **d** 2 hours 57 minutes

2 Convert to days:
- **a** 144 hours

- **b** 12 960 minutes

- **c** 6 years

- **d** 28 weeks

3 Convert to seconds:
- **a** 35 minutes

- **b** 8 hours

- **c** 3 hours 16 minutes

4 Which time period is shorter, 257 200 seconds or 3 days?

5 Tony has spent 11 minutes in the shower every day for the past 8 years. Calculate the total amount of time Tony has spent in the shower. Give your answer to the nearest day.

11H   TIME CALCULATIONS

1 Find the time difference between:
- **a** 8:02 am and 11:47 am

- **b** 10:39 am and 8:50 pm

- **c** 6:05 pm and 7 am the next day.

2 A play started at 8:10 pm and finished at 10:19 pm. How long was the play?

3 Kate went to sleep at 11:15 pm and woke up at 7:20 am the next morning.
- **a** For how long did she sleep?

- **b** Kate needs to leave home at 8:15 am to get to work on time. How long does she have to get ready?

4 A soccer match started at 7 pm. The first half lasted 47 minutes, the half-time break was 30 minutes, and the second half went for 48 minutes. At what time did the game finish?

5 Consider the following timetable for a London tourist bus service:

Stops	Bus A	Bus B	Bus C	Bus D
Kensington Palace	8:15	8:55	9:35	10:15
Natural History Museum	8:25	9:05	9:45	10:25
Science Museum	8:35	9:15	9:55	10:35
Victoria & Albert Museum	8:40	9:20	10:00	10:40
Harrods	8:45	9:25	10:05	10:45
Harvey Nichols	8:50	9:30	10:10	10:50
Ritz Hotel	9:00	9:40	10:20	11:00
Piccadilly Circus	9:10	9:50	10:30	11:10
British Museum	9:20	10:00	10:40	11:20
Royal Albert Hall	9:30	10:10	10:50	11:30
Albert Memorial	9:35	10:15	10:55	11:35
Princess Diana Memorial	9:45	10:25	11:05	11:45
Arr. at Kensington Palace	9:50	10:30	11:10	11:50

a What is the earliest departure time?

b How long does a complete trip last?

c If you wanted to be at the British Museum no later than 10:30 am, which buses could you take?

d How long does it take between arrivals at the Science Museum and Piccadilly Circus?

6 Calculate the time:

a 5 hours after 11:32 am

b $3\frac{1}{2}$ hours before 11:29 pm

7 May-Li is flying from Perth to Singapore. She leaves Perth at 9:35 pm, and arrives in Singapore at 2:50 am the next day. How long was the flight?

8 Fiona is flying from Melbourne to Wagga Wagga. The flight takes 1 hour 10 minutes, and arrives in Wagga Wagga at 7:45 pm. At what time did it leave Melbourne?

11I   **24-HOUR TIME**

1 Change to 24-hour time:

a 4:30 am   **b** 9:25 am

c 5:15 pm   **d** 1:47 pm

e 12:16 am

2 Change to 12-hour time:

a 0622   **b** 1158

c 1811   **d** 0056

e 1647

3 Find the time difference between:

a 0710 and 1035   **b** 0955 and 1312

c 1419 and 2129   **d** 2222 and 0016 the next day

4 Yesterday, high tide was at 0758 and low tide was at 1354. How long was it between high tide and low tide?

5 Consider the schedule of departures from Cairns Airport:

DEPARTURES		
Flight	*Destination*	*Departure time*
PX93	Port Moresby	1200
NZ7244	Brisbane	1240
QF925	Sydney	1323
QF2313	Townsville	1429
JL5080	Tokyo	1327
MU8424	Melbourne	1353
Q686	Kowanyama	1530
JQ965	Adelaide	1650
QF1944	Gove	1820
QF1874	Darwin	1910
JQ291	Auckland	2300

a How many of the listed flights depart:
    i before 2:00 pm   **ii** after 5:00 pm?

b How long after the Townsville flight departs will the Adelaide flight depart?

c Martin arrived at 1:00 pm to board the flight to Melbourne. How long is it before the flight leaves?

d The flight to Tokyo was delayed by $1\frac{1}{2}$ hours. At what time did the flight depart?

REVIEW OF CHAPTER 11

1 Convert:

   a 3760 mL to L

   b 0.062 m³ to cm³

   c 2 days 8 hours to minutes

   d 4.6 kL to L

   e 0.13 t to g

   f $1\frac{1}{2}$ years to days

2 Find the volume of:

   a

   6 mm, 25 mm, 13 mm

   b

   1.1 m, 1.6 m, 3 m, 1.5 m

   c

   30 cm, 16 cm, 7 cm

3 Bill is flying from Cairns to Melbourne. He leaves Cairns at 8:15 pm, and arrives in Melbourne at 11:40 pm. How long was the flight?

4 Calculate the time:

   a $3\frac{1}{4}$ hours after 10:30 am

   b $2\frac{1}{2}$ hours before 1:20 am
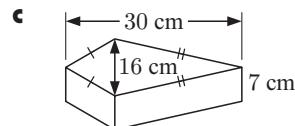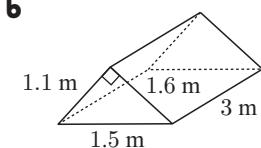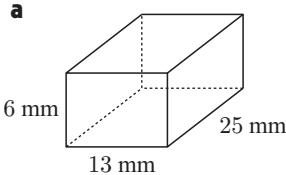
5 Find the total mass of 1240 bicycles, each with weight 9.1 kg.

6 A rainwater tank with base 80 cm by 160 cm and 125 cm high is filled with water. Calculate the capacity of the tank in kL.

7 A swimming pool has the dimensions shown.

   9 m, 15 m, 2.2 m, 1.2 m
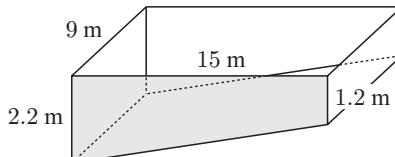
   a What is the area of the side?

   b Find the volume (in m³) of the pool.

   c How many litres of water are needed to completely fill the pool?

   d The pool is completely filled with water at 4°C. What is the water's mass?