



Measures and units

- Converting from one unit to another
- Changing mm^2 to cm^2 , cm^2 to m^2 and m^2 to km^2
- Changing cm^3 to m^3 and the link to ml
- How to solve problems that involve density and speed

Keywords

You should know

explanation 1a

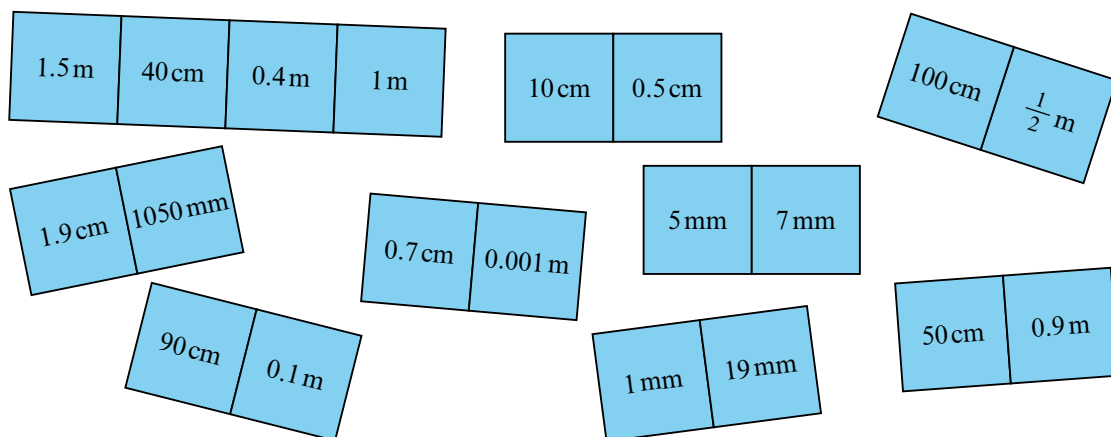
explanation 1b

explanation 1c

explanation 1d

1 The dominoes show lengths in different units.

- a** Match the dominoes with equivalent lengths and copy them in a line.
The first two dominoes have been laid down for you.



- b** Write down the total of the two lengths on the last domino in metres.

2 Look at the boxes.

15	0.74	2.6	2.08	0.3	10.5
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- a** If these were measurements in metres, convert the lengths to centimetres.
b If these were measurements in kilometres, convert the lengths to metres.
c If these were measurements in centimetres, write these lengths in millimetres.
d If these were measurements in kilograms, convert them to grams.
e If these were measurements in litres, convert them to millilitres.

3 Convert these measurements.

- a** 0.5 km to metres **b** 1.7 km to metres **c** 0.85 km to metres
d 1.5 m to centimetres **e** 0.84 m to millimetres **f** 3.15 m to centimetres
g 6.7 kg to grams **h** 0.8 kg to grams **i** 1.28 kg to grams
j 0.6 litres to millilitres **k** 5.2 litres to millilitres **l** 4.5 litres to millilitres

4 Convert these measurements.

- a** 2.5 m to millimetres **b** 605 mm to metres **c** 1157 mm to metres
d 5089 m to kilometres **e** 710 m to kilometres **f** 975 mm to metres
g 600 g to kilograms **h** 4050 g to kilograms **i** 750 g to kilograms
j 500 ml to litres **k** 250 ml to litres **l** 6800 ml to litres

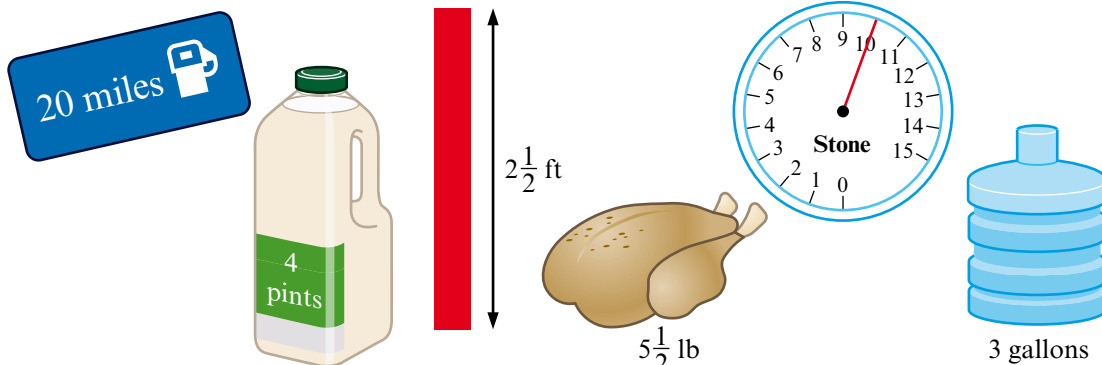
5 Matthew is interested in learning to throw the javelin.

Javelin	Length	Weight
Men's	2605 mm	856 g
Women's	2340 mm	678 g



- a** Copy the table, but convert the lengths to metres and the weights to kilograms.
b Matthew's grandfather has an old javelin at home.
 It is 8 ft 7 in long and weighs 1 lb 12 oz.
 2.5 cm is approximately equal to 1 in and 1 lb is approximately 454 g.
 Convert these measurements to centimetres and grams.
 (1 ft is 12 in and 1 lb is 16 oz.)

6 Convert each of these imperial measurements to a suitable metric measurement.



explanation 2a

explanation 2b

7 Convert these measurements.

a 450 ml to cubic centimetres

c 200 ml to cubic centimetres

e 0.46 litres to cubic centimetres

g 1.62 litres to cubic centimetres

i 6000 cm^3 to litres

k 67 cm^3 to millilitres

b 79 ml to cubic centimetres

d 890 ml to cubic centimetres

f 6 litres to cubic centimetres

h 0.93 litres to cubic centimetres

j 700 cm^3 to litres

l 500 cm^3 to litres

8 Danika is using Archimedes' method to measure the volume of unusual 3-D shapes. She has a model horse, cat and elephant.

She puts them in a large measuring jug that contains 1 litre of water and then notes how much the water level rises.



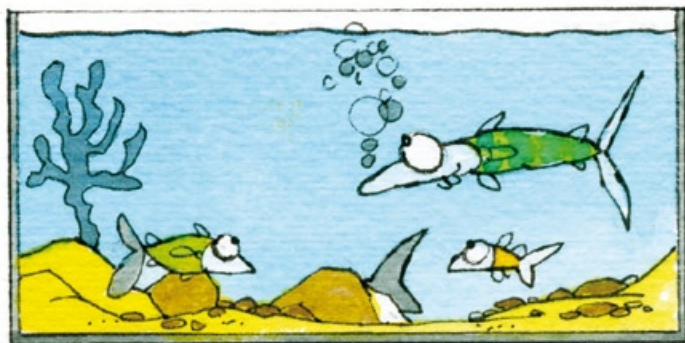
a Explain how Danika can find the volume of each model.

b Write down the volume of each model in cubic centimetres.

- 9** Peter has bought a new fish tank.

The tank is $\frac{1}{2}$ m long, 30 cm wide and 40 cm high.

- a** Find the volume of the tank in cubic centimetres.
- b** Explain how to find the capacity of the tank in litres.



explanation 3a

explanation 3b

- 10** An artist's drawing of a butterfly revealed that the area of one of its wings was 610 mm^2 .

- a** What is the area of its wing in square centimetres?
- b** The area of a leaf is 1125 mm^2 .
What is this in square centimetres?



- 11** The pages in a book are numbered from 1 to 644 and each page is 10.5 cm by 17.7 cm.

- a** Joe says that the book has 322 actual pages. Explain why Joe is correct.
- b** Find the area of one page in square centimetres.
- c** Find the total area of all the pages.
- d** How many square metres of paper are needed to make this book?
Write your answer to 1 decimal place.

- 12** A full-size flag is 0.9 m by 1.5 m.

- a** Find the area of the flag in square metres.
- b** Convert this area to square centimetres.



13 Convert these measurements.

- | | |
|---|--|
| a 0.8 m^2 to square centimetres | b 1.2 m^2 to square centimetres |
| c 5200 cm^2 to square metres | d $2\,000\,000\text{ cm}^2$ to square metres |
| e 0.75 km^2 to square metres | f 2.5 km^2 to square metres |
| g $600\,000\text{ m}^2$ to square kilometres | h $4\,500\,000\text{ m}^2$ to square kilometres |
| i 5.7 cm^2 to square millimetres | j 0.9 cm^2 to square millimetres |
| k 750 mm^2 to square centimetres | l $24\,000\text{ mm}^2$ to square centimetres |

explanation 4a

explanation 4b

14 Convert these measurements.

- | | | |
|--------------------------------------|---------------------------------------|---------------------------------------|
| a 5 m^3 to litres | b 12 m^3 to litres | c 3.5 m^3 to litres |
| d 8 m^3 to litres | e 2.8 m^3 to litres | f 4.9 m^3 to litres |
| g 0.87 m^3 to litres | h 0.238 m^3 to litres | i 0.043 m^3 to litres |

15 Convert these measurements.

- | | |
|---------------------------------------|--------------------------------------|
| a 5800 litres to cubic metres | b 7634 litres to cubic metres |
| c 89000 litres to cubic metres | d 2500 litres to cubic metres |
| e 400 litres to cubic metres | f 325 litres to cubic metres |
| g 650 litres to cubic metres | h 240 litres to cubic metres |

16 Complete this table.

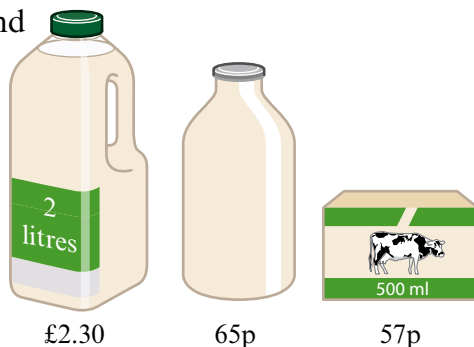
It shows the amount of water held by some garden pond liners.

Pond	m^3	cm^3	litres
Lotus			250
Lily	0.205		
Dragonfly	1.2		
Butterfly		150 000	



- 17** Milk is sold in 2 litre and 500 ml cartons and 1 pint bottles.

- 2.272 litres is equivalent to 4 pints. Express 1 pint of milk in millilitres.
- Find the cost per millilitre for each container of milk.
- Which container is the best value?



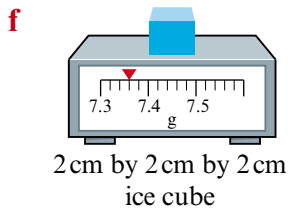
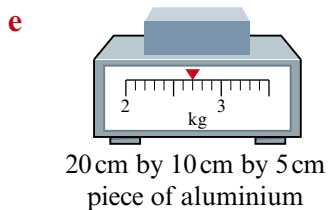
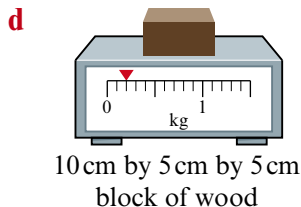
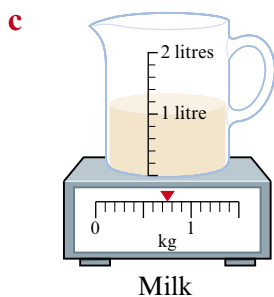
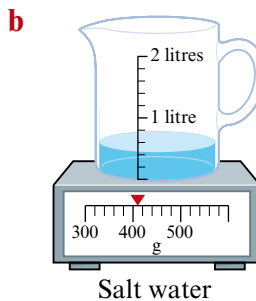
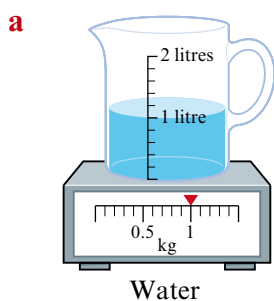
- 18** A teaspoon holds 5 ml of liquid. How many cubic millimetres is this?

explanation 5a

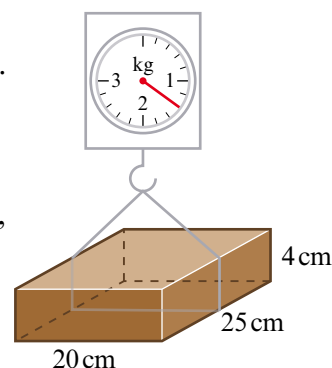
explanation 5b

explanation 5c

- 19** Find the density of these liquids and solids in grams per cubic centimetre (g/cm^3). (The scales were set to zero with the jug on, then the liquid was poured in.)



- 20** When the density of a liquid or solid is less than the density of water it will float. Which of the liquids and solids in question **19** will float?
- 21** A block of steel weighs 156 g. Its volume is 20 cm^3 . What is the density of steel?
- 22** A house brick is 9.5 cm wide, 21 cm long and 6.5 cm high. It weighs 2.386 kg.
- Find the volume of the brick in cubic centimetres.
 - What is the density of the brick in grams per cubic centimetre?
Give your answer to 2 decimal places.
- 23** A square cork mat is 12 cm by 12 cm and it is 1 cm deep. The cork mat weighs 34.5 g.
- Find the volume of the cork mat.
 - What is the density of the cork in grams per cubic centimetre?
Give your answer to 2 decimal places.
- 24** The scale shows a piece of mahogany being weighed.
- Write the mass of the piece of mahogany in grams.
 - Find the density of the mahogany.
 - What would the mass of a piece of wood be if it was the same size but cut from parana pine, which has a density of 0.56 g/cm^3 ?



- 25** The density of gold is 19.3 g/cm^3 .
- Steven says that this means that 1 cm^3 of gold has a mass of 19.3 g.
Is this correct?



- Steven's mum has an expensive gold chain that weighs 65 g.
How many cubic centimetres of gold were used to make this chain?
Give your answer to 2 decimal places.

explanation 6a

explanation 6b

26 Alex takes 30 minutes to get to school, which is 13 miles from his house. What is his average speed in mph? (mph stands for miles per hour.)

27 A coach takes 2 hours and 30 minutes to travel a distance of 160 miles. Find the average speed.

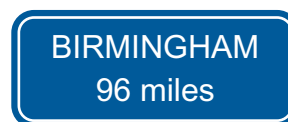
28 Linda met Dave at a service station. It took her 15 minutes to reach the services after seeing this sign.

- a** What was Linda's average speed?
- b** Later, when Dave saw the same sign, there was a speed restriction. It took Dave 36 minutes to reach the service station. What was David's average speed?



29 It took Freda 1 hour and 30 minutes to reach Birmingham after passing this sign.

- a** Find Freda's average speed.
- b** Simon passed the same sign. It took him 1 hour and 12 minutes to reach Birmingham. What was Simon's average speed?



30 The distance from Bolton to Edinburgh is 207 miles. It takes 3 hours and 45 minutes by car.

- a** Find the average speed for the journey.
- b** The journey by train takes 3 hours. What is the average speed of the train?

31 An olympic athlete runs the 100 m in 10.8 seconds. What is her average speed in metres per second?

32 An aircraft flew from Manchester to Turkey in 4 hours 15 minutes. The distance is 3031 km. What was the average speed of the plane in kilometres per hour?