

Converting Compound and Area-Volume Units

Solutions

For AQA GCSE Mathematics (8300) • Higher tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (1 mark)

Circle the number of cm^2 in 1 m^2

Options: 100, 1000, 10 000, 1 000 000

$$1 \text{ m} = 100 \text{ cm}$$

So a 1 m by 1 m square is 100 cm by 100 cm.

$$100 \times 100 = 10\,000 \text{ cm}^2$$

Answer: 10 000

Tip: For area units, square the length conversion: 100^2 , not 100.

2 (2 marks)

Tick one box for each statement.

	True	False
$1 \text{ m}^2 = 100 \text{ cm}^2$		✓
$1 \text{ cm}^3 = 1000 \text{ mm}^3$	✓	
$1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$	✓	
1 litre = 1000 cm^3	✓	
$1 \text{ km}^2 = 1000 \text{ m}^2$		✓

$1 \text{ m}^2 = 100 \times 100 = 10\,000 \text{ cm}^2$, so the first one is false.

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

$1 \text{ m}^3 = 100 \times 100 \times 100 = 1\,000\,000 \text{ cm}^3$ ✓

1 litre = 1000 cm^3 ✓

$1 \text{ km}^2 = 1000 \times 1000 = 1\,000\,000 \text{ m}^2$, so the last one is false.

Answer: False, True, True, True, False

Marks: 2 marks for all five correct. 1 mark for three or four correct.

3 (3 marks)

(a) Convert 3.5 m^2 to cm^2

$$1 \text{ m}^2 = 100^2 = 10\,000 \text{ cm}^2$$

$$3.5 \times 10\,000 = 35\,000 \text{ cm}^2$$

Answer: 35 000

(b) Convert $45\,000 \text{ cm}^3$ to m^3

$$1 \text{ m}^3 = 100^3 = 1\,000\,000 \text{ cm}^3$$

You are changing to a bigger unit, so divide:

$$45\,000 \div 1\,000\,000 = 0.045\text{ m}^3$$

Answer: 0.045

Tip: Check your answer makes sense: a m^3 is much bigger than a cm^3 , so the number of m^3 must be much smaller.

(c) Convert 2.4 cm^3 to mm^3

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

$$2.4 \times 1000 = 2400\text{ mm}^3$$

Answer: 2400

4 (2 marks)

Convert 15 m/s to km/h.

There are $60 \times 60 = 3600$ seconds in one hour.

Distance in one hour: $15 \times 3600 = 54\,000\text{ m}$

Change to km: $54\,000 \div 1000 = 54\text{ km}$

So $15\text{ m/s} = 54\text{ km/h}$

Answer: 54

Tip: You need **both** steps: $\times 3600$ (seconds to hours) and $\div 1000$ (m to km). Answers like 0.9 or 900 mean a step is missing.

Marks: 1 mark for 15×3600 or $\div 1000$. 1 mark for 54.

5 (2 marks)

Water flows out of a pipe at a rate of r litres per minute.

Write an expression, in terms of r , for the rate of flow in cm^3 per second.

$$1\text{ litre} = 1000\text{ cm}^3, \text{ so } r\text{ litres} = 1000r\text{ cm}^3$$

This flows in 1 minute, which is 60 seconds.

In 1 second: $1000r \div 60$

$$= \frac{1000r}{60} = \frac{50r}{3} \text{ cm}^3 \text{ per second}$$

Answer: $\frac{50r}{3}$ (or $\frac{1000r}{60}$)

Tip: Check your expression with a number: if $r = 3$, the pipe gives 3000 cm^3 in 60 seconds, which is 50 cm^3 per second.

Marks: 1 mark for $\times 1000$ or $\div 60$. 1 mark for $\frac{1000r}{60}$ or equivalent.

6 (2 marks)

The density of a type of plastic is 1350 kg/m^3

Convert this to g/cm^3

1350 kg in every 1 m^3

Change kg to g: $1350 \times 1000 = 1350\,000 \text{ g}$

$1 \text{ m}^3 = 100 \times 100 \times 100 = 1\,000\,000 \text{ cm}^3$

So 1 cm^3 has a mass of $1350\,000 \div 1\,000\,000 = 1.35 \text{ g}$

So the density is 1.35 g/cm^3

Answer: 1.35

Tip: Convert the top and the bottom of the unit separately: kg to g, and m^3 to cm^3 . A cubic metre is 100^3 cm^3 , not 100.

Marks: 1 mark for $\times 1000$ or $\div 1\,000\,000$. 1 mark for 1.35.

7 (2 marks)

A tap drips at 3 ml per minute.

How many litres does it drip in one week?

Minutes in a week: $60 \times 24 \times 7 = 10\,080$

Water in a week: $3 \times 10\,080 = 30\,240 \text{ ml}$

1 litre = 1000 ml

$$30\,240 \div 1000 = 30.24 \text{ litres}$$

Answer: 30.24 litres

Marks: 1 mark for $3 \times 60 \times 24 \times 7$. 1 mark for 30.24.

8 (2 marks)

Some oil has

a mass of 684 g

a density of $912\,000 \text{ g/m}^3$

$$1 \text{ m}^3 = 1000 \text{ litres}$$

Work out the volume of the oil.

Give your answer in litres.

Volume = mass $\div$ density

$$\text{Volume} = 684 \div 912\,000 = 0.00075 \text{ m}^3$$

$$1 \text{ m}^3 = 1000 \text{ litres}$$

$$0.00075 \times 1000 = 0.75 \text{ litres}$$

Answer: 0.75 litres

Marks: 1 mark for $684 \div 912\,000$ (or $912\,000 \div 1000 = 912 \text{ g per litre}$). 1 mark for 0.75.

9 (3 marks)

Two delivery drones are tested.

Drone *P* flies 4.5 km in 6 minutes.

Drone *Q* flies at a constant speed of 12 metres per second.

Which drone is faster?

You must show your working.

Work out Drone *P*'s speed in m/s.

$$4.5 \text{ km} = 4500 \text{ m and } 6 \text{ minutes} = 360 \text{ s}$$

$$\text{Speed of } P = 4500 \div 360 = 12.5 \text{ m/s}$$

Speed of $Q = 12 \text{ m/s}$

$12.5 > 12$, so Drone P is faster.

(Or: P flies at $4.5 \times 10 = 45 \text{ km/h}$ and Q flies at $12 \times 3.6 = 43.2 \text{ km/h}$.)

Answer: Drone P (12.5 m/s compared with 12 m/s)

Tip: You must compare speeds in the **same** units. Writing “Drone Q , because 12 is bigger than 4.5” gets no marks.

Marks: 1 mark for changing to matching units (e.g. 4500 m and 360 s). 1 mark for 12.5 m/s (or 45 km/h and 43.2 km/h). 1 mark for Drone P with correct figures.

10 (3 marks)

A tin of paint says it covers 12 square metres per litre.

Convert this rate into square feet per pint.

Use 1 metre = 3.28 feet

and 1 litre = 1.76 pints

Give your answer to 3 significant figures.

$1 \text{ m} = 3.28 \text{ feet}$, so $1 \text{ m}^2 = 3.28 \times 3.28 = 10.7584 \text{ square feet}$

$12 \text{ m}^2 = 12 \times 10.7584 = 129.1008 \text{ square feet}$

So 1 litre covers 129.1008 square feet.

1 litre = 1.76 pints, so 1 pint covers $129.1008 \div 1.76 = 73.35 \dots$ square feet

Answer: 73.4 square feet per pint

Tip: A square metre is 3.28^2 square feet, so multiply by 3.28^2 , not by 3.28.

Marks: 1 mark for $\times 3.28^2$. 1 mark for $\div 1.76$. 1 mark for 73.4.

11 (3 marks)

Town *A* has

a population of 31 200

an area of 5 square miles.

Town *B* has a population density of 2350 people per square kilometre.

$$\text{population density} = \frac{\text{population}}{\text{area}}$$

Which town has the greater population density?

Use 1 square mile = 2.6 square kilometres

Tick a box.

Change Town *A*'s area to km²: $5 \times 2.6 = 13 \text{ km}^2$

Density of *A* = $31\,200 \div 13 = 2400$ people per km²

Density of *B* = 2350 people per km²

$2400 > 2350$, so Town *A* has the greater population density.

Answer: Town *A* (2400 per km²)

Tip: Compare like with like: both densities must be in people per km² before you decide.

Marks: 1 mark for 5×2.6 . 1 mark for $31\,200 \div 13$. 1 mark for Town *A* with 2400.
