

Converting Compound and Area-Volume Units

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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)

Change 5 m^3 into cm^3

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

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

$$5 \times 1\,000\,000 = 5\,000\,000 \text{ cm}^3$$

Answer: 5 000 000

Tip: For volume units, cube the length conversion: 100^3 , not 100.

2 (2 marks)

Change 0.6 m^2 into mm^2

$$1 \text{ m} = 1000 \text{ mm}$$

$$1 \text{ m}^2 = 1000 \times 1000 = 1\,000\,000 \text{ mm}^2$$

$$0.6 \times 1\,000\,000 = 600\,000 \text{ mm}^2$$

Answer: 600 000

Marks: 1 mark for 1000^2 (or 1 000 000). 1 mark for 600 000.

3 (4 marks)

- (a) Change 0.035 m^3 to cm^3

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

$$0.035 \times 1\,000\,000 = 35\,000 \text{ cm}^3$$

Answer: 35 000

- (b) A garden snail moves at a constant speed of 0.8 cm per second.
Work out the speed of the snail in metres per hour.

$$1 \text{ hour} = 60 \times 60 = 3600 \text{ seconds}$$

$$\text{Distance in 1 hour: } 0.8 \times 3600 = 2880 \text{ cm}$$

$$\text{Change cm to m: } 2880 \div 100 = 28.8 \text{ m}$$

So the speed is 28.8 metres per hour

Answer: 28.8

Tip: The snail goes further in an hour than in a second, so multiply by 3600. Then divide by 100 to change cm to m.

Marks: 1 mark for $\times 3600$. 1 mark for $\div 100$. 1 mark for 28.8.

4 (2 marks)

The pressure on a surface is 2.5 N/cm^2

Convert this to N/m^2

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

$$2.5 \text{ N acts on each cm}^2, \text{ so on } 1 \text{ m}^2 \text{ the force is } 2.5 \times 10\,000 = 25\,000 \text{ N}$$

So the pressure is $25\,000 \text{ N/m}^2$

Answer: 25 000

Marks: 1 mark for $\times 10\,000$ (or $\times 100^2$). 1 mark for 25 000.

5 (2 marks)

A box rests on a floor.

The box exerts a pressure of 1500 newtons/m² on the floor.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The area of the base of the box is 800 cm²

Work out the force exerted by the box on the floor.

Give your answer in newtons.

Change the area to m². 1 m² = 10 000 cm²

$$800 \text{ cm}^2 = 800 \div 10\,000 = 0.08 \text{ m}^2$$

Force = pressure × area

$$\text{Force} = 1500 \times 0.08 = 120 \text{ newtons}$$

Answer: 120

Tip: To change cm² to m², divide by 10 000 (that is 100²), not by 100.

Marks: 1 mark for 0.08 m² (or 0.15 N/cm²). 1 mark for 120.

6 (2 marks)

A pipe delivers water at 150 litres per minute.

Work out the rate in cm³ per second.

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$150 \text{ litres} = 150 \times 1000 = 150\,000 \text{ cm}^3 \text{ each minute}$$

$$1 \text{ minute} = 60 \text{ seconds}$$

$$150\,000 \div 60 = 2500 \text{ cm}^3 \text{ each second}$$

Answer: 2500

Marks: 1 mark for 150 000 or ÷60. 1 mark for 2500.

7 (2 marks)

A car uses fuel at a rate of 6.5 litres per 100 km.
Convert this to millilitres per kilometre.

$$6.5 \text{ litres} = 6.5 \times 1000 = 6500 \text{ ml}$$

So the car uses 6500 ml per 100 km.

$$\text{Per 1 km: } 6500 \div 100 = 65 \text{ ml}$$

Answer: 65

Marks: 1 mark for 6500 or $\div 100$. 1 mark for 65.

8 (4 marks)

A fish tank is in the shape of a cuboid.

The tank is 80 cm long, 35 cm wide and 40 cm high.

The tank is empty.

Water is poured into the tank at a rate of 0.2 litres per second, until the water is 5 cm below the top of the tank.

Work out how long this takes.

Give your answer in minutes and seconds.

You must show all your working.

$$\text{Depth of water: } 40 - 5 = 35 \text{ cm}$$

$$\text{Volume of water} = 80 \times 35 \times 35 = 98\,000 \text{ cm}^3$$

$$1 \text{ litre} = 1000 \text{ cm}^3, \text{ so the volume is } 98\,000 \div 1000 = 98 \text{ litres}$$

$$\text{Time} = 98 \div 0.2 = 490 \text{ seconds}$$

$$490 = 8 \times 60 + 10, \text{ so the time is 8 minutes 10 seconds}$$

Answer: 8 minutes 10 seconds

Tip: 490 seconds is not 4.9 minutes or 8.1 minutes. Divide by 60: 8 whole minutes use 480 seconds, leaving 10 seconds.

Marks: 1 mark for the volume $80 \times 35 \times 35$. 1 mark for changing cm^3 to litres (or 0.2 litres to 200 cm^3). 1 mark for 490 seconds. 1 mark for 8 minutes 10 seconds.

9 (4 marks)

An office uses an average of 150 litres of drinking water each month.
There are two ways the office can buy its water.

Option A: water cooler Rent of £24 per month plus £6.50 for each 15-litre bottle of water	Option B: bottled water Packs of 24 bottles Each bottle holds 500 ml £5.40 for each pack
--	--

The office can only buy whole bottles for the cooler and whole packs of bottled water.
Which option is cheaper for the office each month?

You must show all your working.

Option A: $150 \div 15 = 10$ bottles

Cost of A = $24 + 10 \times 6.50 = 24 + 65 = £89$

Option B: one pack holds $24 \times 500 = 12\,000$ ml = 12 litres

$150 \div 12 = 12.5$, so the office needs 13 packs.

Cost of B = $13 \times 5.40 = £70.20$

$£70.20 < £89$, so Option B is cheaper.

Answer: Option B (£70.20 compared with £89)

Tip: Change 500 ml into litres before comparing: 500 ml = 0.5 litres. The office cannot buy half a pack, so round 12.5 up to 13.

Marks: 1 mark for £89. 1 mark for 12 litres per pack (or 300 bottles). 1 mark for £70.20 (or £67.50). 1 mark for Option B with both costs.