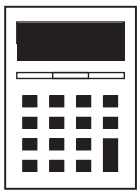
GCSE MATHEMATICS

Density



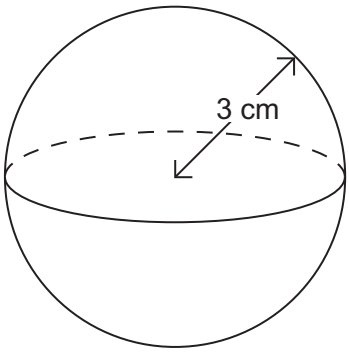
These questions have been taken or modified from previous AQA GCSE Mathematics Papers.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The quality of your written communication is specifically assessed in questions that are indicated with an asterisk (*).

Advice
- Read each question carefully before you start to answer it.
- In all calculations, show clearly how you work out your answer.
- Use the number of marks for the question as a guide to the amount of time you need to spend.
- Look at previous parts of the question, e.g. a), b), c) i) as there may be information there you need to answer later parts.
- Check your answer is realistic and appropriate.
- For calculator decimal numbers always write your full calculator display in the working out area and then, if you need to, round the answer on the answer line.

1 The diagram shows a sphere made of wood.



The radius of the sphere is 3 cm
The mass of the sphere is 85 grams.

Work out the density of the wood.

[3 marks]

.....

.....

.....

.....

.....

.....

Answer ..... grams / cm^3

2 A solid statue has volume 720 cm^3 and mass 2.5 **kilograms**.
The density of bronze is 8 **grams** per cm^3.

Is the statue made of bronze?
Show how you decide.

.....

.....

.....

(3 marks)

3 Three items were bought at a car boot sale.

Item A	Item B	Item C
Mass = 9.5 grams Volume = 2 cm^3	Mass = 57 grams Volume = 3 cm^3	Mass = 76 grams Volume = 4 cm^3

The density of gold is **approximately** 19 grams per cm^3.

Which item or items **cannot** be gold?
You **must** show your working.

.....

.....

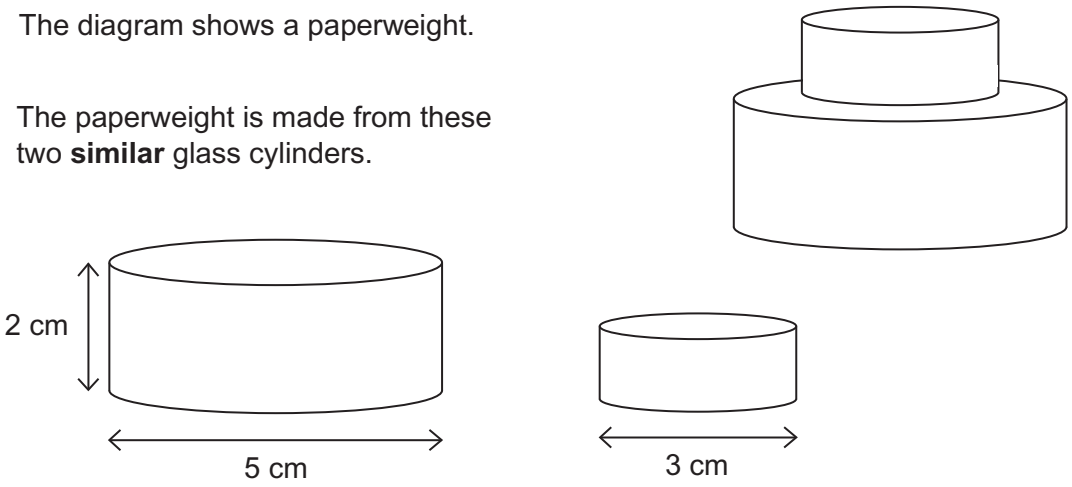
.....

.....

Answer ..... *(4 marks)*

4 The diagram shows a paperweight.

The paperweight is made from these two **similar** glass cylinders.



The density of the glass is 2.6 g per cm^3

Work out the mass of the paperweight in grams. **[5 marks]**

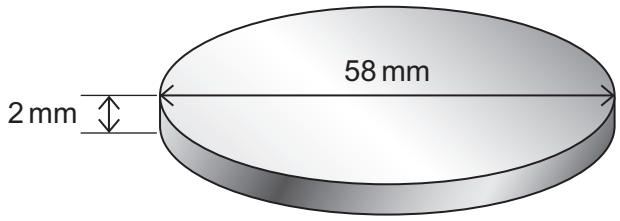
.....

.....

.....

Answer ..... g

5 All the runners who finish the Great North Run get a medal.
The medal can be modelled as a metal cylinder with diameter 58 mm and height 2 mm



The density of the metal is 0.00852 grams per cubic millimetre.
Last year, 56 000 medals were made.

Work out how many **kilograms** of metal were used.

[4 marks]

.....

.....

.....

.....

.....

.....

.....

.....

Answer ..... kg

***6 (a)** The table shows the masses of planets in the form $a \times 10^{24}$ kg

Planet	Mass (kg)
Mercury	0.330×10^{24}
Venus	4.87×10^{24}
Mars	0.642×10^{24}
Jupiter	1900×10^{24}
Saturn	568×10^{24}

Write the mass of Jupiter in kilograms.
Give your answer in standard form.

[1 mark]

.....

Answer ..... kg

6 (b) The mass of the Earth is 5.97×10^{24} kg

The volume of the Earth is 1.08×10^{21} m^3

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Calculate the density of the Earth.
Give your answer to an appropriate degree of accuracy.

[3 marks]

.....

.....

.....

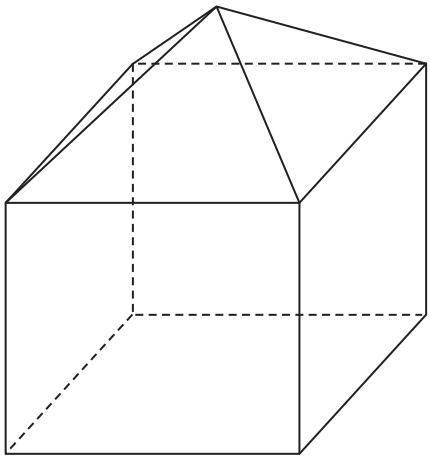
.....

Answer ..... kg / m^3

7 A cube and a pyramid are joined to make a small, solid metal paperweight.

The cube has edge 4 cm

The pyramid has a square base of side 4 cm and a vertical height of 2.5 cm



7 (a) Volume of a pyramid = $\frac{1}{3} \times$ area of base $\times$ height

Show that the volume of the paperweight is $77\frac{1}{3}\,\text{cm}^3$

[3 marks]

7 (b) All the dimensions of the small paperweight are increased by a scale factor of x.

This makes a larger, similar solid paperweight.

The same type of metal is used in both paperweights.

- The larger paperweight has mass 1.827 kilograms.
- The density of the metal is 7 grams per cubic centimetre.

Work out the value of x.

[4 marks]

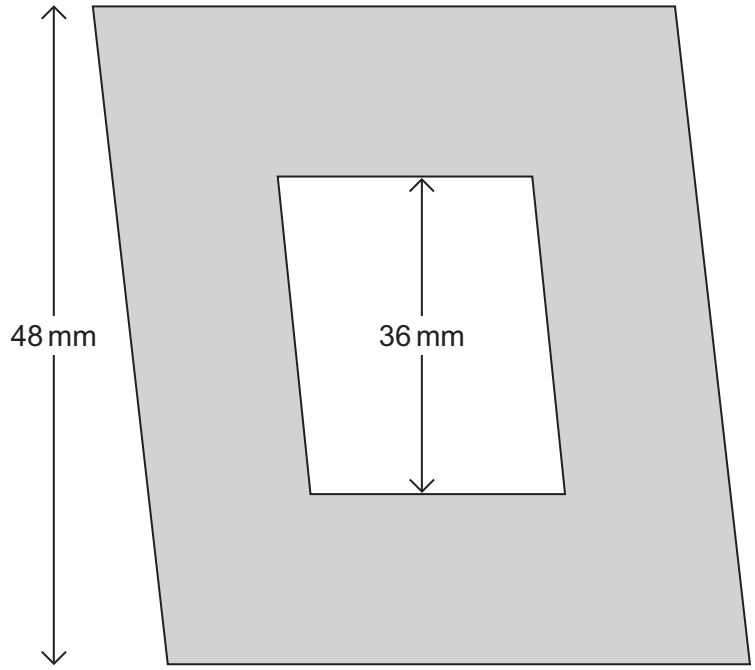
Answer _____

8 A piece of jewellery is made from a sheet of silver.

A parallelogram is cut from the sheet and a smaller, **similar** parallelogram is removed.

The larger parallelogram has perpendicular height 48 mm

The smaller parallelogram has perpendicular height 36 mm



Not drawn accurately

8 (a) The area of the smaller parallelogram is 756 mm^2

Show that the shaded area is 588 mm^2

[3 marks]

.....

.....

.....

.....

.....

.....

.....

.....

8 (b) The piece of jewellery is 4 mm thick.

The density of silver is 0.0105 g/mm^3

Work out the mass of the piece of jewellery.

[3 marks]

.....

.....

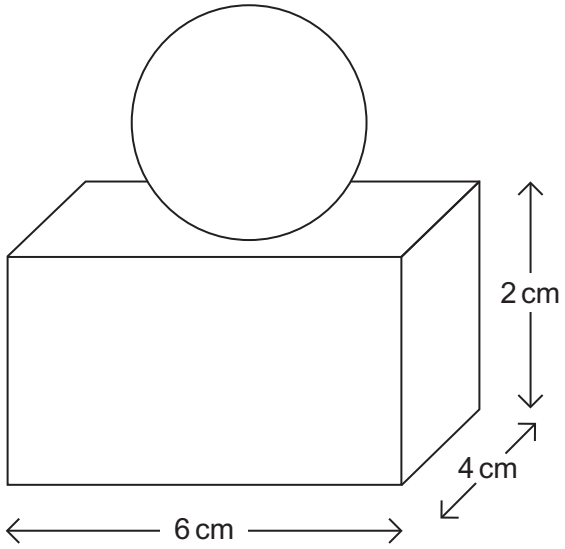
.....

.....

.....

Answer ..... g

9 Alex has a solid paperweight made from a cuboid and a sphere as shown.



The diameter of the sphere is 3 cm.

9 (a) Show that the volume of the paperweight is 62.1 cm^3 to 3 significant figures.

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

9 (b) Alex thinks the paperweight is made of lead.

He knows that

- the mass of the paperweight is 540 grams
- the density of lead is 11.3 grams per cm^3.

Is the paperweight made of lead?
You **must** show your working.

.....

.....

.....

.....

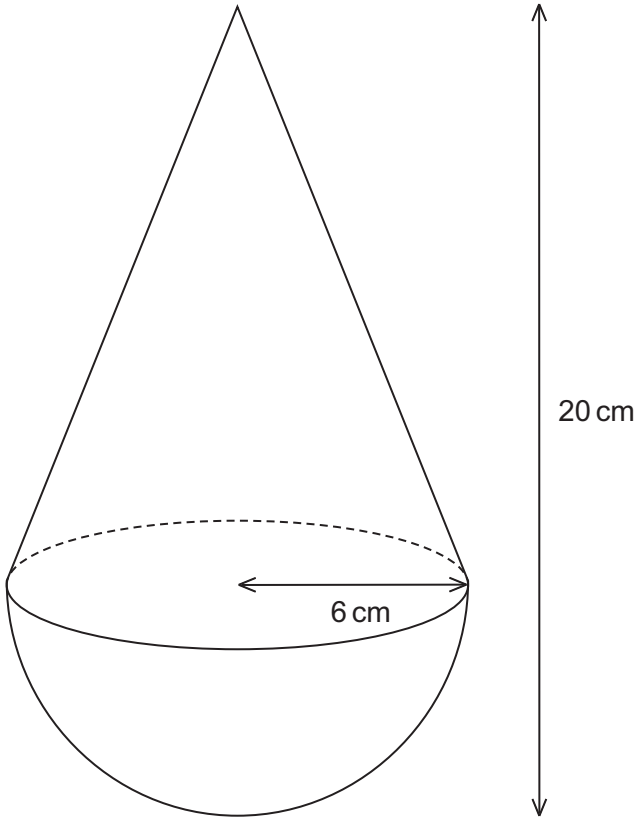
.....

.....

.....

(3 marks)

10 A small toy is made by joining a solid cone and a solid hemisphere together.
The cone and hemisphere each have radius 6 cm.



10 (a) Show that the volume of the toy is $312\pi\,\text{cm}^3$.

.....

.....

.....

.....

.....

.....

.....

(4 marks)

10 (b) A larger version of the toy is made that has

- dimensions twice the size of the small toy
- mass 1.5 kilograms.

The toy is made from foam.

Work out the density of the foam.
Give your answer in grams per cubic centimetre.

.....

.....

.....

.....

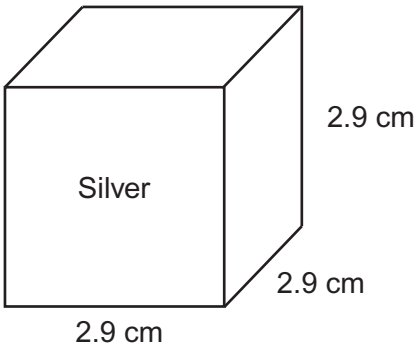
.....

.....

.....

Answer ..... g per cm^3 *(4 marks)*

11 This silver cube has mass 256 grams.



11 (a) Work out the density of the silver.
Give your answer to 1 decimal place.

[3 marks]

Answer _____ g per cm^3

11 (b) The volume of a gold bar is 13.2 cm^3
The density of gold is 19.3 g per cm^3

Is the gold bar heavier than the silver cube?
You **must** show your working.

[2 marks]

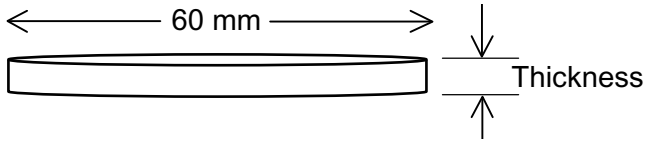
12 A company buys 100 kg of bronze to make some medals.
The bronze has a density of 8 g/cm^3

12 (a) Work out the volume of the 100 kg of bronze in cubic centimetres.

[2 marks]

Answer _____ cm^3

12 (b) The medals can be modelled as a cylinder with diameter 60 mm



The company wants to make

- at least 700 medals
- the thickness of each medal a whole number of millimetres
- the medals as thick as possible.

What thickness should the medals be?
You **must** show your working

[4 marks]

Answer _____ mm