

GCSE Physics (9 – 1)

Density

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/5
2	/14
3	/7
4	/11
5	/8
6	/8
7	/9
Total	/62
%	
Grade	

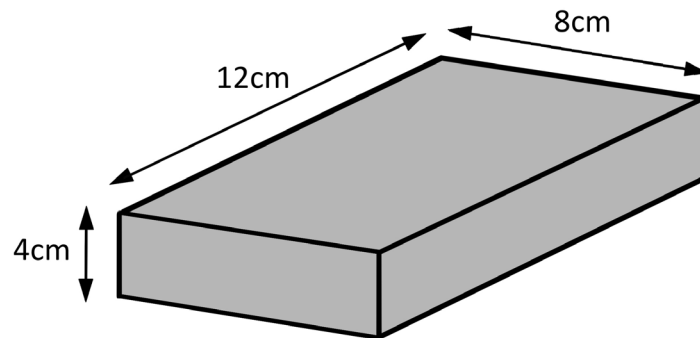
Information

- The maximum mark for this paper is 62 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Density is simply a measure of how tightly packed the atoms or molecules are within a specific amount of space. For each of the following questions **circle** the letter of the correct answer.

a) The figure below shows a metal bar. The mass of the bar is 1500 g.

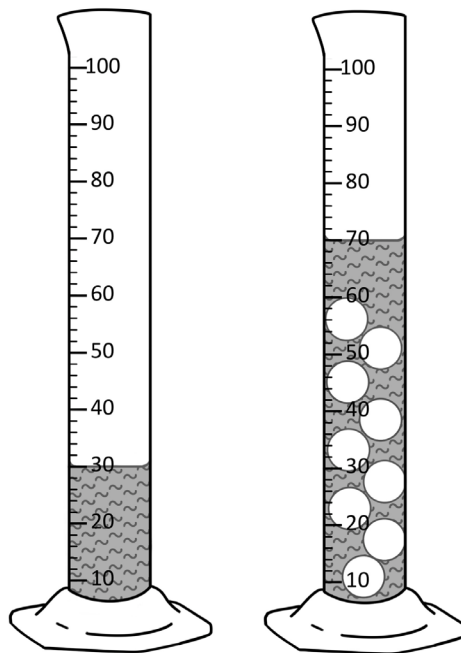


What is the density of the metal bar?

- | | | | |
|------------------------|------------------------|------------------------|------------------------|
| A | B | C | D |
| 4.80 g/cm ³ | 3.89 g/cm ³ | 3.90 g/cm ³ | 4.90 g/cm ³ |

(1 mark)

b) The figure below shows a measuring cylinder containing 40 ml of water before and after 7 identical solid spheres of silver were added.



Each of the spheres of silver have a mass of 20 g.

What is the density of the silver that the spheres are made from?

- | | | | |
|------------------------|------------------------|------------------------|------------------------|
| A | B | C | D |
| 4.00 g/cm ³ | 4.20 g/cm ³ | 4.40 g/cm ³ | 4.50 g/cm ³ |

(1 mark)

- c) The mass of a solid stone is 1800 g. A measuring cylinder contains 150 cm³ of water. The stone is put into the measuring cylinder. The water level rises to 450 cm³ and covers the stone. What is the density of the stone?

A	B	C	D
3.0 g/cm ³	4.0 g/cm ³	6.0 g/cm ³	12.0 g/cm ³

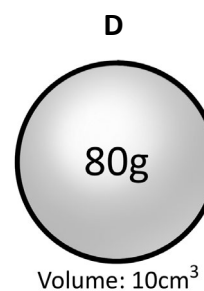
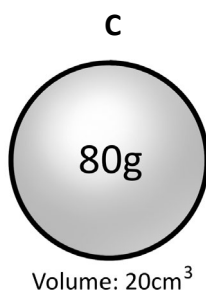
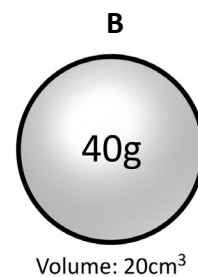
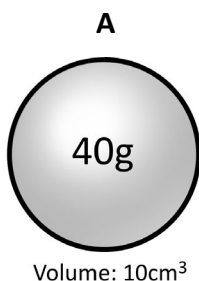
(1 mark)

- d) The table provides the masses and volumes of four different objects. Which **one** of the four objects has the greatest density?

	Mass (g)	Volume (cm ³)
A	8.50	1.00
B	20.00	4.00
C	27.00	3.00
D	32.00	8.00

(1 mark)

- e) The figures below show four spheres, A, B, C and D that are made from the same material. The mass of each sphere is given. Which **two** spheres have the same density.



A	B	C	D
A and B	A and C	C and B	B and D

(1 mark)

(Total for Question 1 is 5 marks)

2. Complete the following questions based density.

a) For part (i) to part (iv) calculate the density of the material.

- i. A block of metal has a mass of 500 g and a volume of 50 cm³.

Density = ... unit:
(2 marks)

- ii. A wooden shipping crate has a mass of 120 kg and a volume of 0.4 m³.

Density = ... unit:
(2 marks)

- iii. A student measures out 250 cm³ of a liquid. The mass of the liquid is 200 g.

Density = ... unit:
(2 marks)

- iv. A solid metal cube has sides of 2 cm and a mass of 64 g.

Density = ... unit:
(2 marks)

b) For part (v) to part (viii) calculate the volume of the material.

- i. A piece of gold has a mass of 386 g. If the density of gold is 19.3 g/cm³, calculate its volume.

Volume = ...
(2 marks)

- ii. A large concrete block has a mass of 4800 kg. The density of concrete is 2400 kg/m³.
Calculate the volume of the block.

Volume = ...
(2 marks)

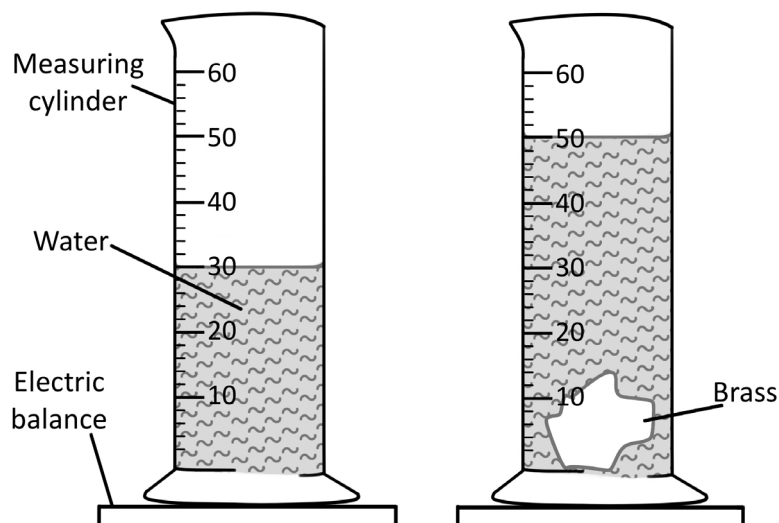
- iii. The density of ethanol is 0.8 g/cm³. What volume does 400 g of ethanol occupy?

Volume = ...
(2 marks)

(Total for Question 2 is 14 marks)

3. A teacher is clearing out an old cupboard and finds a random oddly shaped bit of brass. The teacher wants to find the density of the bit of brass.

The teacher places the bit of brass into a measuring cylinder that containing 35 ml of water. The image below shows what the teacher saw when they did this.



After recording the volume the teacher then found the mass of the bit of brass using an electric balance. The teacher only had one slightly faulty balance that always recorded the mass as being 7.2 g higher than the real value.

When the teacher used this balance they found the mass of the bit of brass to be 65.6 g.

Using this information and the figure above. Determine each of the following.

- i. Give the mass of the bit of brass.

Mass of the bit of brass = ... g
(2 marks)

- ii. Give the volume of the bit of brass.

Volume of the bit of brass = ... cm^3
(2 marks)

- iii. What is the density of the bit of brass?

Density of the bit of brass = ... unit:
(3 marks)

(Total for Question 3 is 7 marks)

4. This question is about density.

a) The density of an object is an important quantity to know. What is the density of an object?

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(1 mark)

A student is working with some copper foil as part of an electronics project.

The density of copper is 8.90 g/cm^3 . The thickness of a rectangular sheet of copper foil varies, but is less than 1 mm thick. The student wants to find the **average** thickness.

The table below shows the measurements the student took.

Mass of copper foil	133.5 g
Length of copper foil	40.0 cm
Width of copper foil	25.0 cm

b) Using the students measurements, calculate the following.

i. The volume of the foil.

Volume of the foil = ... cm^3
(2 marks)

ii. The average thickness of the foil.

Thickness = ... cm
(2 marks)

c) Another student, provided with a means of cutting the sheet, decides to find its average thickness using a single measuring instrument. Assume the surfaces of the sheet are perfectly smooth.

i. Name a measuring instrument he could use.

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(1 mark)

- ii. Describe the procedure he should follow to obtain an accurate value of the average thickness of the sheet. Details of how to read the instrument are not required.

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(3 marks)

- d) The student notes that the stacking method described in (c)(ii) often yields a slightly larger value for the average thickness than the true thickness of the foil.

Suggest **one** practical reason for this, and state how the student could adjust their method to minimise this effect.

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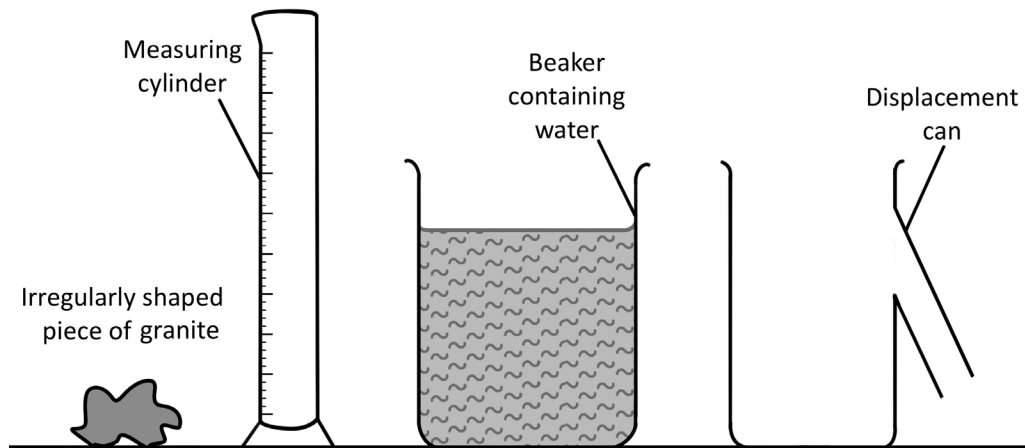
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(2 marks)

(Total for Question 4 is 11 marks)

5. A student determines the density of an irregularly shaped lump of granite.

They are provided with the lump of granite and the following **unlabelled** equipment:



- a) Describe how the student can use this equipment to find the volume of the lump of granite. Your description should include the identity of each piece of equipment.

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(5 marks)

- b) The mass of a different lump of granite is 135 g. The volume of this piece is 50 cm³. Calculate the density of the granite.

Density = ... unit:
(3 marks)

(Total for Question 5 is 8 marks)

6. A student mixes two different liquids, Liquid A and Liquid B, in a beaker to create a new mixture.

- She uses 200 cm^3 of **Liquid A**, which has a density of 0.80 g/cm^3 .
- She uses 300 cm^3 of **Liquid B**, which has a density of 1.10 g/cm^3 .

Assume the total volume of the mixture is exactly equal to the volume of liquid A plus the volume of liquid B.

a) Calculate the density of the final mixture.

Density = ... unit:
(4 marks)

b) A metal worker creates a new alloy by melting together two different metals, **Metal X** and **Metal Y**.

- He uses 300 g of Metal X, which has a density of 15.0 g/cm^3 .
- She uses 270 g of Metal Y, which has a density of 9.0 g/cm^3 .

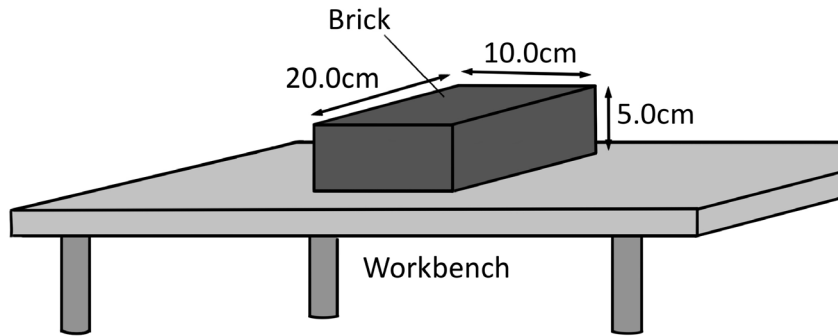
Assume the total volume of the solid alloy is exactly equal to the volume of Metal X plus the volume of Metal Y.

Calculate the density of the final alloy.

Density = ... unit:
(4 marks)

(Total for Question 6 is 8 marks)

7. A solid rectangular brick has dimensions of 20.0 cm (length), 10.0 cm (width), and 5.0 cm (height). It is placed on a flat, horizontal workbench.



- a) Calculate the area of the brick in contact with the workbench when it is resting on its largest face.

Area = ... cm^2
(2 marks)

- b) The mass of the brick is 2.5 kg.

Calculate the weight of the brick. (Assume gravitational field strength, $g = 9.8 \text{ N/kg}$).

Weight = ... N
(2 marks)

- c) A completely different concrete block has a weight of 450 N.

The area of this block in contact with the ground is 0.15 m^2 .

Calculate the pressure this concrete block exerts on the ground. Give your answer in Pascals (Pa).

Pressure = ... Pa
(2 marks)

- d) Calculate the maximum pressure that this brick could possibly exert on the workbench.

Give your answer in N/cm^2 .

Pressure = ... N/cm^2
(3 marks)

(Total for Question 7 is 9 marks)