Mass, Weight & Density

Question Paper

Course	CIE IGCSE Physics
Section	1. Motion, Forces & Energy
Topic	Mass, Weight & Density
Difficulty	Medium

Time Allowed 30

Score /22

Percentage /100

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Question 1a

A student is determining the density of wood by two methods.

He is using the wooden rod shown in Fig. 1.1.

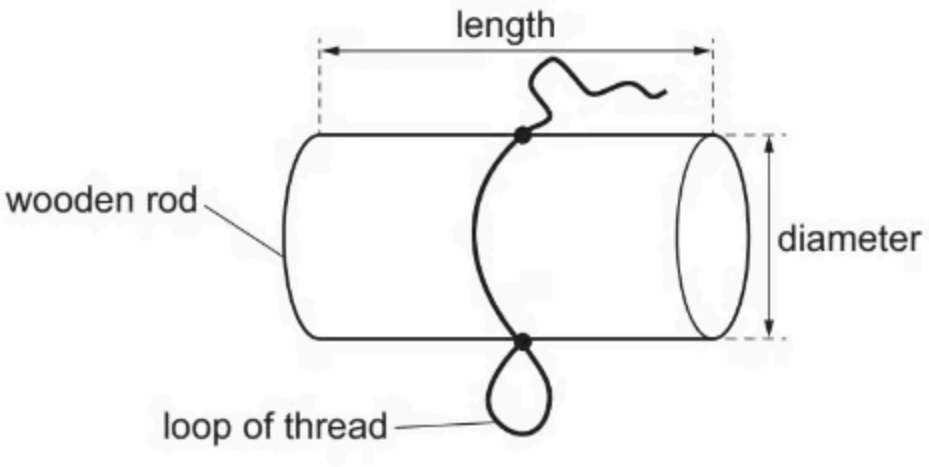

Fig. 1.1

Method 1

The dimensions of the wooden rod are shown full size in Fig. 1.2.

Fig. 1.2

(i) Measure the length *l* and the diameter *d* of the wooden rod in Fig. 1.2.

l = ... cm

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d = ... cm

[2]

(ii) Suggest an accurate method for measuring the diameter of the wooden rod in this experiment.

List any additional apparatus that might be required and briefly describe how you would determine the diameter.

You may draw a diagram if it helps to explain your answer.

[2]

[4 marks]

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Question 1b

The student uses a balance to measure the mass m of the wooden rod as shown in Fig. 1.3.

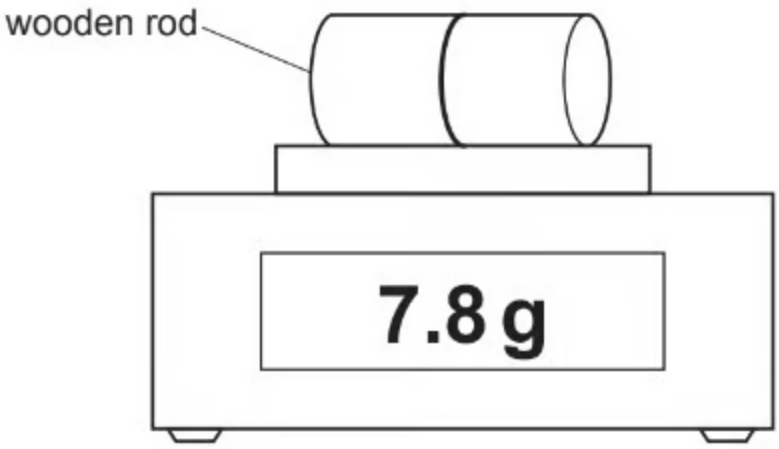

Fig. 1.3

Record the mass *m* of the rod.

m = ...g

Calculate a value ρ_1 for the density of the wooden rod. Use the values *l* = 4.5 cm and *d* = 2.0 cm, the value of the mass, and the equation $\rho_1 = \frac{4m}{\pi d^2 l}$. Include a suitable unit.

ρ_1 = ...

[2 marks]

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Question 1c

Method 2

The student pours water into a measuring cylinder as shown in Fig. 1.4.
He then floats the wooden rod in the water as shown in Fig. 1.5.

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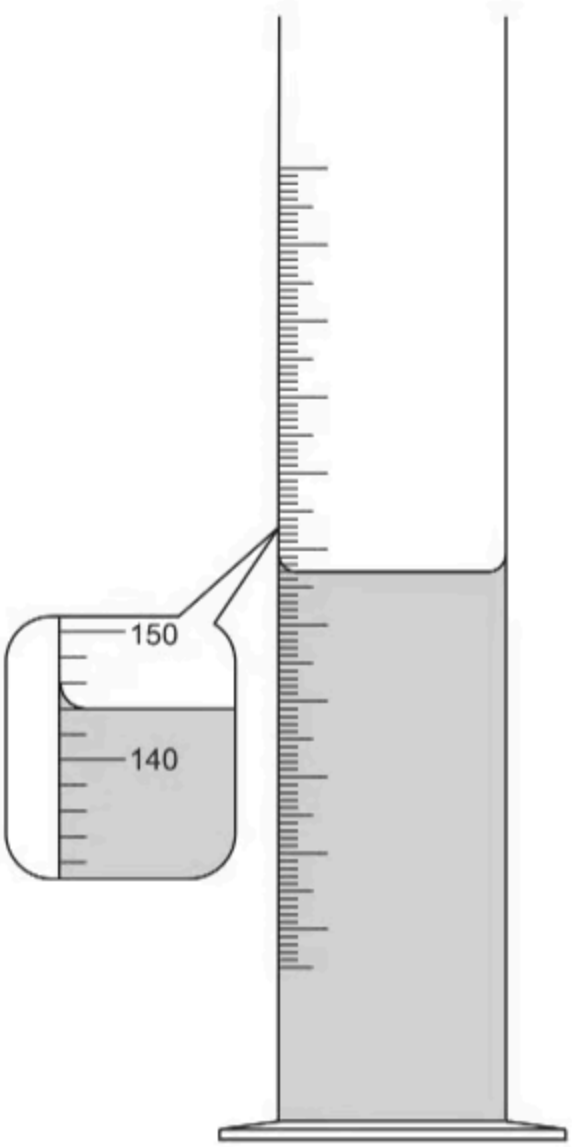

Fig. 1.4

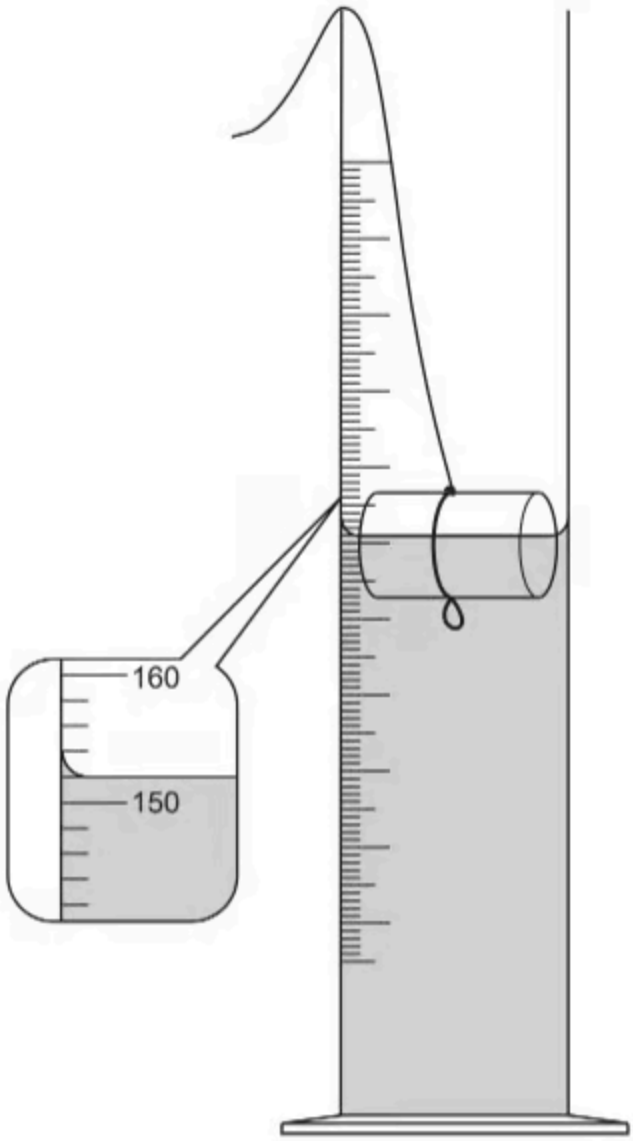

Fig. 1.5

Record the reading V_1 of the water level in the measuring cylinder as shown in Fig. 1.4.

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V_1 = ...cm^3

Record the new reading V_2 of the water level in the measuring cylinder with the rod floating in the water as shown in Fig. 1.5.

V_2 = ...cm^3

[1]

[1 mark]

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Question 1d

The student removes the rod and lowers a piece of modelling clay into the water as shown in Fig. 1.6.

He then hooks the rod to the modelling clay and lowers them into the water as shown in Fig. 1.7.

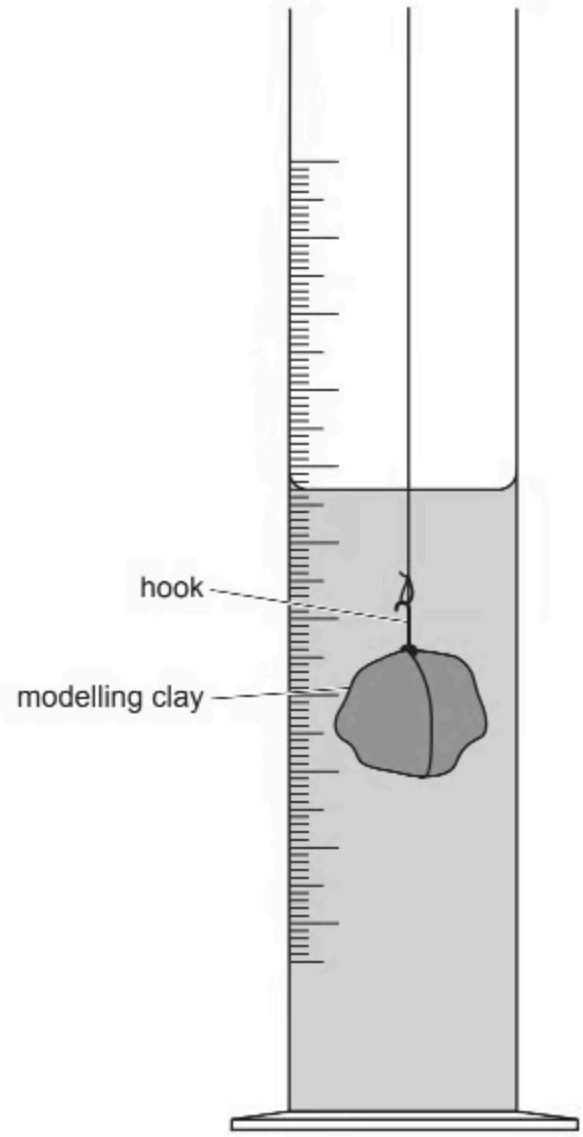

Fig. 1.6

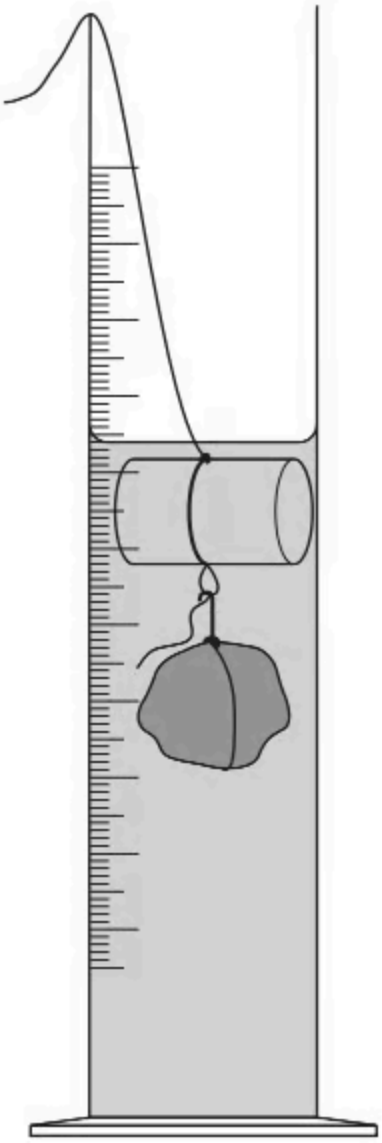

Fig. 1.7

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He records the new reading V_3 of the water level in the measuring cylinder with the modelling clay.

He records the reading V_4 of the water level in the measuring cylinder with the modelling clay and rod.

$V_3 = 164\ cm^3$

$V_4 = 178\ cm^3$

Calculate another value ρ_2 for the density of the wooden rod. Use the values from **(c)** and **(d)** and the equation $\rho_2 = \frac{V_2 - V_1}{V_4 - V_3} \times k$ where $k = 1.0\ g/cm^3$.

ρ_2 = ...

[2 marks]

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Question 1e

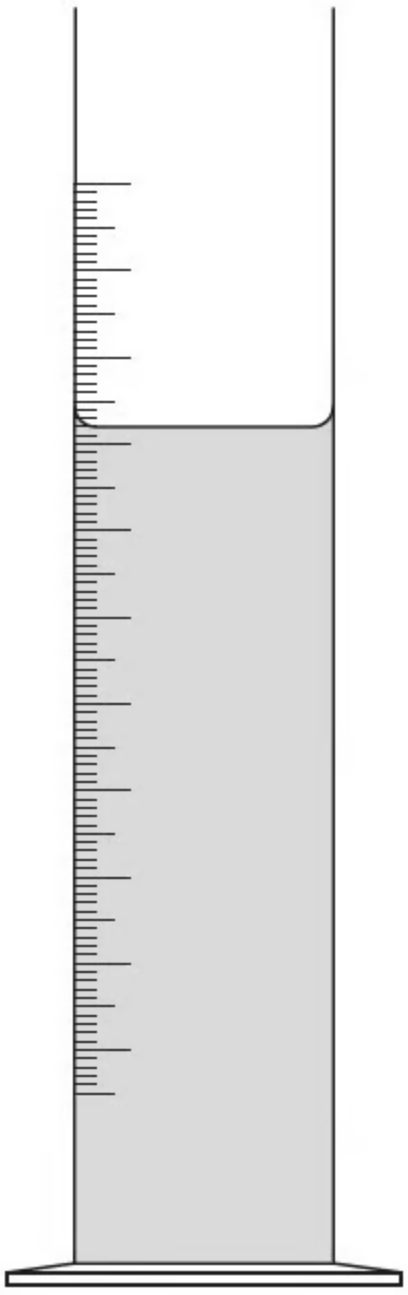

Fig. 1.8

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On Fig. 1.8, draw an arrow showing the correct line of sight for reading the volume of water in the measuring cylinder.

[1 mark]

Question 1f

Suggest a possible source of inaccuracy in Method 2, even if it was carried out carefully.

[1 mark]

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Question 2a

A student is determining the density of modelling clay.

He is using the block shown in Fig. 1.1 and Fig. 1.2.

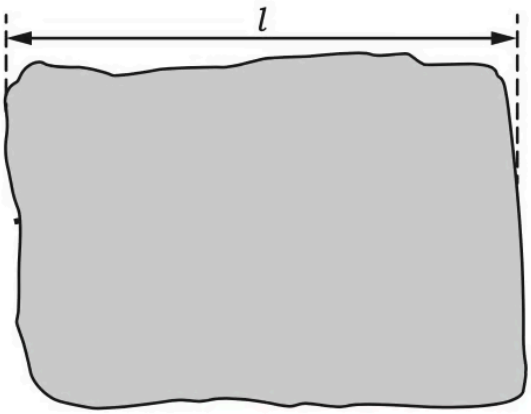

Fig. 1.1

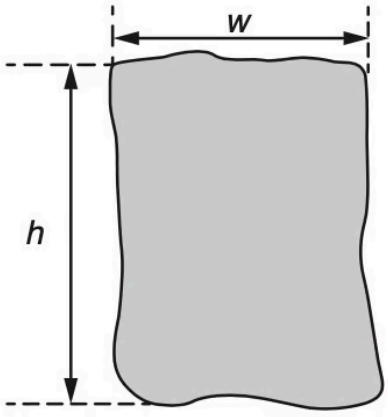

Fig. 1.2 (side view)

(i) Measure the dimensions of the block of modelling clay, as shown in Fig. 1.1 and Fig. 1.2.

length l = ... cm
width w = ... cm
height h = ... cm
[1]

(ii) Calculate the volume V_1 of the block, using your measurements from **(a)(i)** and the following equation:

$$V_1 = l \times w \times h$$

V_1 = ... cm^3 [1]

[2 marks]

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Question 2b

Suggest a possible source of inaccuracy in measuring the dimensions of the block and describe an improvement to the procedure that will produce more reliable measurements of the block.

[2 marks]

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Question 2c

The student suspends the piece of modelling clay from a forcemeter, as shown in Fig. 1.3.

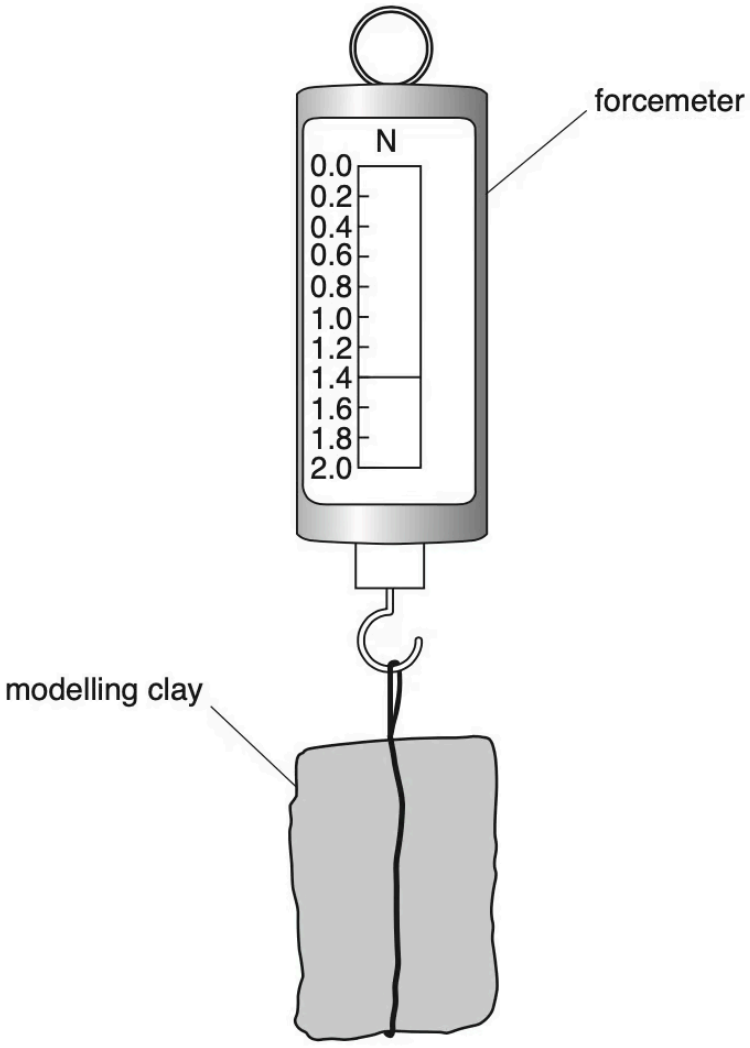

Fig. 1.3

Record the weight *W* of the block of modelling clay shown in Fig. 1.3.

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W = ... N
[1 mark]

Question 2d

Calculate a value ρ_1 for the density of the modelling clay, using your results from **(a)(ii)** and **(c)** and the following equation:

$$\rho_1 = \frac{W \times k}{V_1}$$

Where k = 100 g/N.

ρ_1 = ...
[2 marks]

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Question 2e

The student pours some water into a measuring cylinder, as shown in Fig. 1.4.

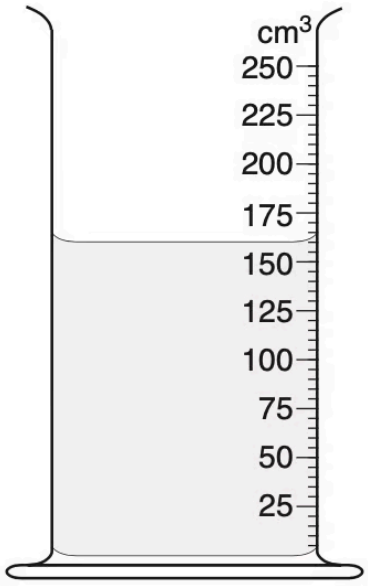

Fig. 1.4

(i) Record the volume V_2 of the water in the measuring cylinder shown in Fig. 1.4.

V_2 = ... cm^3 [1]

(ii) Describe how a measuring cylinder is read to obtain an accurate value for the volume of water. You may draw a diagram to help you.

[1]

[2 marks]

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Question 2f

The student lowers the modelling clay into the water, as shown in Fig. 1.5.

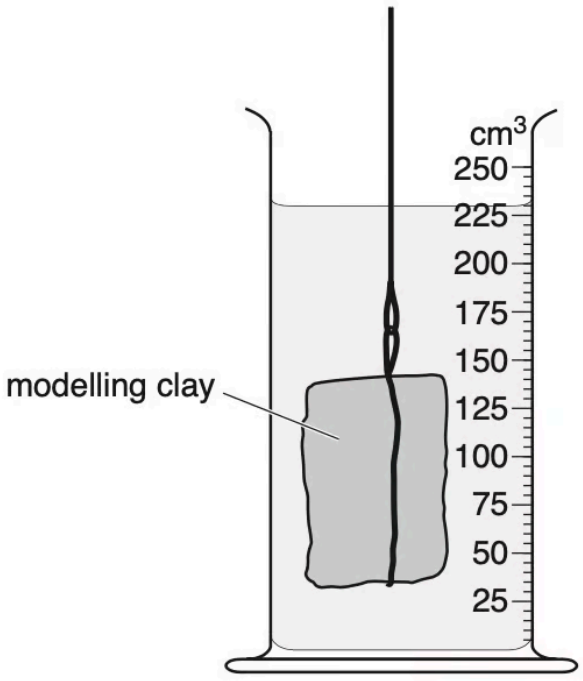

Fig. 1.5

(i) Record the new reading V_3 of the measuring cylinder Fig. 1.5, with the block of modelling clay in the water.

V_3 = ... cm^3

Calculate another value ρ_2 for the density of modelling clay, using your value for V_3, your readings from **(c)** and **(e)(i)** and the equation:

$$\rho_2 = \frac{W \times k}{(V_3 - V_2)}$$

where k = 100 g/N.

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ρ_2 = ...

[1]

(ii) Suggest which of ρ_1 or ρ_2 is likely to be the more accurate value for the density of the modelling clay.

Justify your answer by referring to the procedure.

[1]

[2 marks]

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