

Measurements and their errors

8 questions · 24 marks

Answer all questions. The marks available are shown against each part. Every question is taken unaltered from a past paper; the source is noted beneath it. In Section A, choose the best answer and write its letter in the box.

Section A · Multiple choice

6 questions · 6 marks

1. Which is the shortest distance? [1 mark] 1 mark

A 10^{-19} Gm ☐

B 10^{-14} km ☐

C 10^{-4} μ m ☐

D 10^7 fm ☐

Answer

AQA 7408/1 Physics · 2021 · Paper 1, Question 8

2. Which combination of an object's speed and journey time gives a distance travelled of 1 mm? [1 mark] 1 mark

	Speed	Journey time	
A	$10 \mu\text{m s}^{-1}$	100 s	☐
B	10 km s^{-1}	$0.01 \mu\text{s}$	☐
C	1 nm s^{-1}	1 Gs	☐
D	0.1 Mm s^{-1}	100 ns	☐

Answer

AQA 7408/1 Physics · May 2023 · Paper 1, Question 7

3. A student carries out an experiment to determine the resistivity of a metal wire. She determines the resistance from measurements of potential difference between the ends of the wire and the corresponding current. She measures the length of the wire with a ruler and the diameter of the wire using a micrometer. Each measurement is made with an uncertainty of 1% 1 mark

Which measurement gives the largest uncertainty in the calculated value of the resistivity?

[1 mark]

- | | | |
|----------|----------------------|-----------------------|
| A | current | ☐ |
| B | diameter | ☐ |
| C | length | ☐ |
| D | potential difference | ☐ |

Answer

— AQA 7408/1 Physics · June 2018 · Paper 1, Question 8

4. Which is approximately equal to 3 kW h? 1 mark

[1 mark]

- | | | |
|----------|---------------------------|-----------------------|
| A | $3 \times 10^3 \text{ J}$ | ☐ |
| B | $1 \times 10^4 \text{ J}$ | ☐ |
| C | $2 \times 10^5 \text{ J}$ | ☐ |
| D | $1 \times 10^7 \text{ J}$ | ☐ |

Answer

— AQA 7408/1 Physics · 2021 · Paper 1, Question 7

5. A person jumps as high as she can from a standing position. 1 mark

What is a reasonable estimate of her speed just after she leaves the ground?

[1 mark]

- | | | |
|----------|-----------------------|-----------------------|
| A | 2 m s^{-1} | ☐ |
| B | 4 m s^{-1} | ☐ |
| C | 8 m s^{-1} | ☐ |
| D | 10 m s^{-1} | ☐ |

Answer

— AQA 7408/1 Physics · May 2023 · Paper 1, Question 8

6. Water waves of wavelength λ and wave speed v are related by $v = \sqrt{k\lambda}$ where k is a constant. 1 mark

What is a possible SI unit for k ?

[1 mark]

A m s^{-2} ☐

B m s^{-1} ☐

C $\text{m}^{\frac{3}{2}} \text{s}^{-1}$ ☐

D $\text{m}^{\frac{1}{2}} \text{s}^{-1}$ ☐

Answer

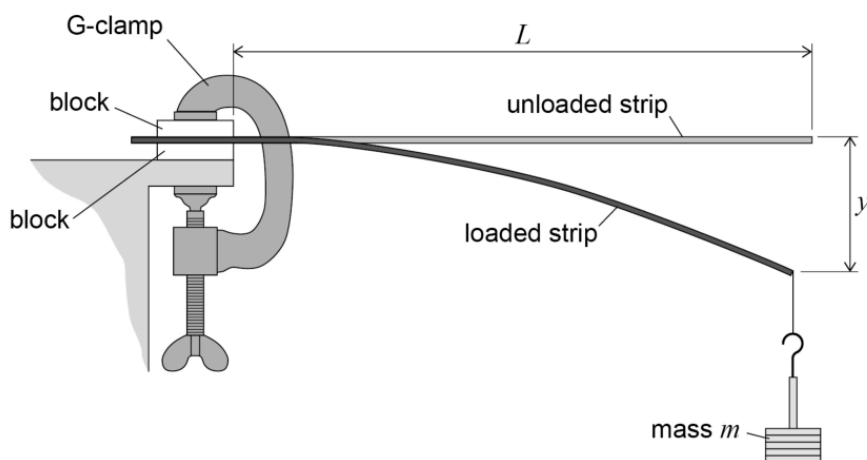
— AQA 7408/1 Physics · May 2020 · Paper 1, Question 7

Section B · Structured questions

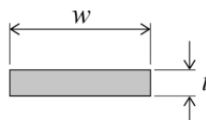
2 questions · 18 marks

7. **Figure 5** shows a strip of steel of rectangular cross-section clamped at one end. The strip extends horizontally over the edge of a bench. 7 marks

Figure 5

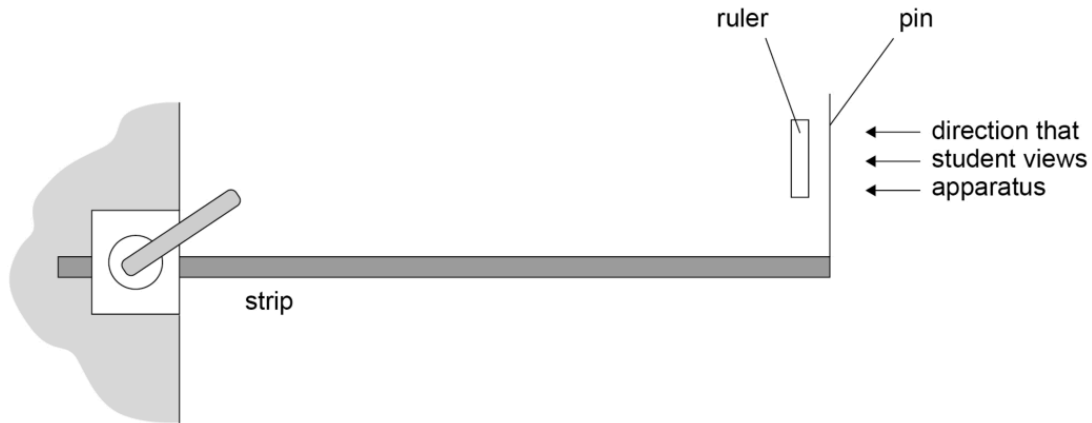
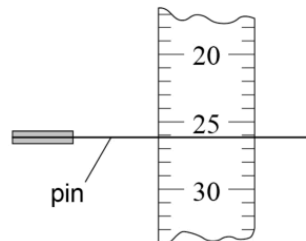


end view of unloaded steel strip



1

A mass m is suspended from the free end of the strip.
 This produces a vertical displacement y .
 A student intends to measure y with the aid of a horizontal pin fixed to the free end of the steel strip.
 She positions a clamped vertical ruler behind the pin, as shown in **Figure 6**.

Figure 6**plan view****view seen by student**

Explain a procedure to avoid parallax error when judging the reading indicated by the position of the pin on the ruler.
 You may add detail to **Figure 6** to illustrate your answer.

[2 marks]

2

It can be shown that

$$y = \frac{4mgL^3}{Ewt^3}$$

where:

L is the distance between the free end of the **unloaded** strip and the blocks

w is the width of the strip and is approximately 1 cm

t is the thickness of the strip and is approximately 1 mm

E is the Young modulus of the steel.

A student is asked to determine E using the arrangement shown in **Figure 5** with the following restrictions:

- only one steel strip of approximate length 30 cm is available
- m must be made using a 50 g mass hanger and up to four additional 50 g slotted masses
- the experimental procedure must involve only **one** independent variable
- a graphical method must be used to get the result for E .

Explain what the student must do to determine E .

[5 marks]

— AQA 7408/3A Physics · 2022 · Paper 3, Question 2

8. Conductive putty can easily be formed into different shapes to investigate the effect of shape on electrical resistance.

11 marks

1

A student uses vernier callipers to measure the diameter d of a uniform cylinder made of the putty.

Suggest **one** problem with using callipers to make this measurement.

[1 mark]

2

Table 1 shows the calliper measurements made by a student.

Table 1

d_1 / mm	d_2 / mm	d_3 / mm	d_4 / mm	d_5 / mm
34.5	34.2	32.9	33.4	34.0

Show that the percentage uncertainty in d is about 2.4%. Assume that all the data are valid.

[2 marks]

3

The length of the cylinder is 71 ± 2 mm.

Determine the uncertainty, in mm^3 , in the volume of the cylinder.

[4 marks]

This image shows a full page of blank handwriting practice paper. It features ten sets of horizontal lines across the page. Each set consists of three lines: a solid top line, a dashed middle line, and a solid bottom line. The lines are evenly spaced and extend across the entire width of the page, providing a guide for letter height and placement. There is no text or other markings on the page.uncertainty = mm³

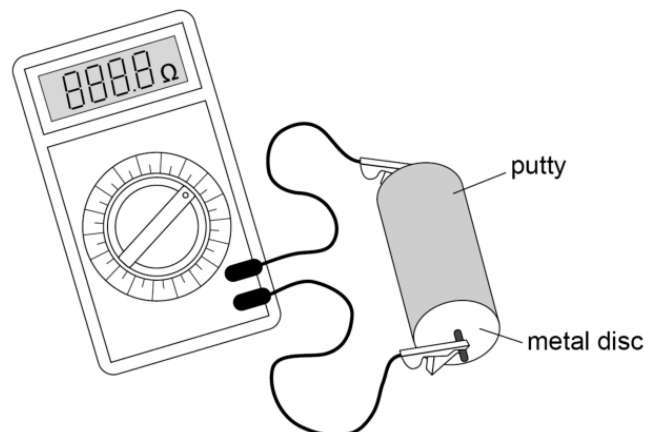
4

A student is given some putty to form into cylinders.

To find the resistance of a cylinder, metal discs are placed in contact with the ends of the cylinder and connected to a resistance meter.

Figure 7 shows the apparatus.

Figure 7



The student forms the putty into cylinders of different lengths, each of volume $5.83 \times 10^{-5} \text{ m}^3$.

The length L and resistance R are measured for each cylinder.

It can be shown that $R = \frac{\rho L^2}{5.83 \times 10^{-5}}$ where ρ is the resistivity of the conductive putty.

The student plots the graph shown in **Figure 8**.

Determine ρ .

State an appropriate SI unit for your answer.

[4 marks]

$\rho =$ unit =

Figure 8

