

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Friday 17 October 2025

Afternoon (Time: 1 hour 20 minutes)

Paper reference **WPH13/01**

Physics

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Physics I

You must have:
Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- **Show all your working out** in calculations and **include units** where appropriate.

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- The list of data, formulae and relationships is printed at the end of this booklet.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

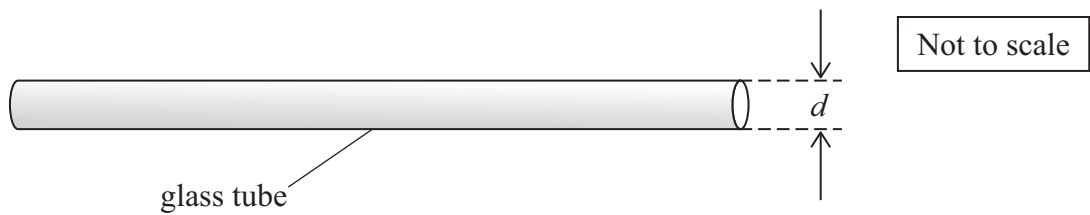
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Answer ALL questions.

- 1 A student used a micrometer screw gauge to measure the diameter d of the glass tube shown.



- (a) The walls of the glass tube are very thin.

Identify a health and safety issue associated with this measurement and how it may be dealt with.

(2)

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- (b) The student made measurements to determine a mean value for d .

He measured d at different orientations along the glass tube.

Explain another technique he should use to reduce error when measuring d with a micrometer screw gauge.

(2)

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(c) The student recorded the following measurements.

d/mm	3.19	3.22	3.19	3.21	3.20
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(i) Calculate the mean value of d .

(2)

Mean value of d =

(ii) Determine the percentage uncertainty in the mean value of d .

(2)

Percentage uncertainty =

(Total for Question 1 = 8 marks)

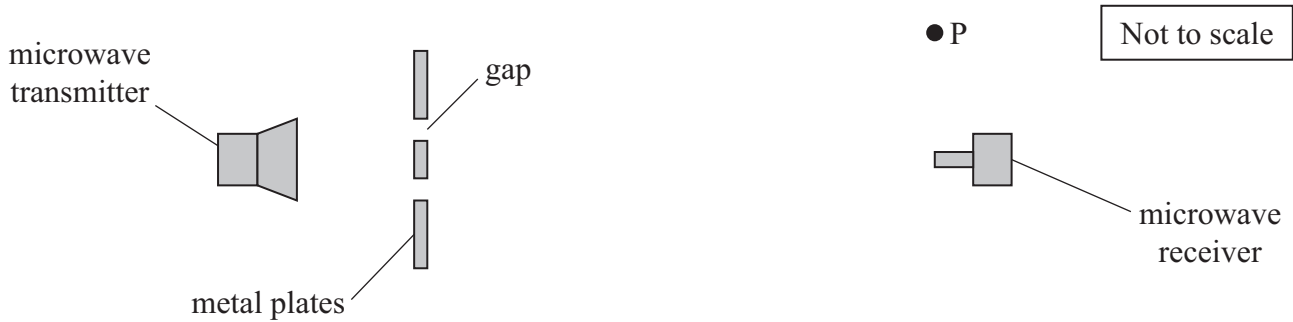
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- 2 A student investigated the diffraction of microwaves using the apparatus shown.



The student placed the microwave receiver opposite the centre of the middle metal plate.

- (a) The student moved the microwave receiver towards point P. The microwave receiver detected a series of maximum and minimum values of intensity.
- (i) Explain why there are positions of minimum intensity.

(2)

- (ii) The student located the first position where the intensity was a minimum.

The student used vernier calipers to measure the distance x from the initial position to the position of this minimum.

Identify two possible sources of uncertainty in the measurement of x .

(2)

- (b) The student suggested that the wavelength λ of the microwaves is given by

$$\lambda = \frac{2xd}{D}$$

where

d is the distance between the centres of the gaps in the metal plates

D is the perpendicular distance between the metal plates and the initial position of the receiver.

- (i) Calculate the frequency f of the microwaves.

$$x = 17.84 \text{ cm}$$

$$d = 4.09 \text{ cm}$$

$$D = 0.502 \text{ m}$$

(3)

$$f = \dots\dots\dots$$

- (ii) The student increased the value of D .

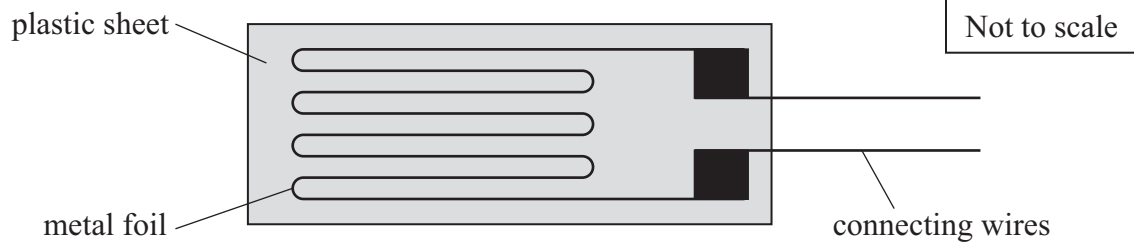
Explain how increasing D reduces the percentage uncertainty in x .

(2)

(Total for Question 2 = 9 marks)

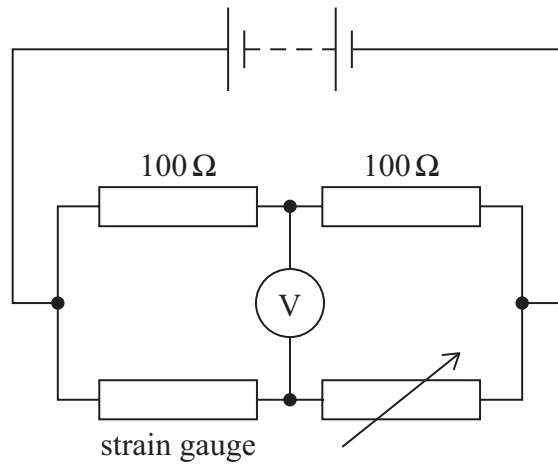


- 3 A strain gauge is a sensor made from metal foil fixed to a plastic sheet, as shown.

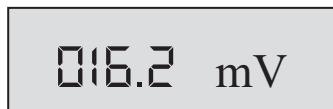


Bending the plastic sheet changes the dimensions of the metal foil.
This changes the resistance of the metal foil.

A student connected the strain gauge into the circuit shown below.



- (a) The student switched on the power supply and the voltmeter displayed the following reading.



Determine the percentage uncertainty in this reading.

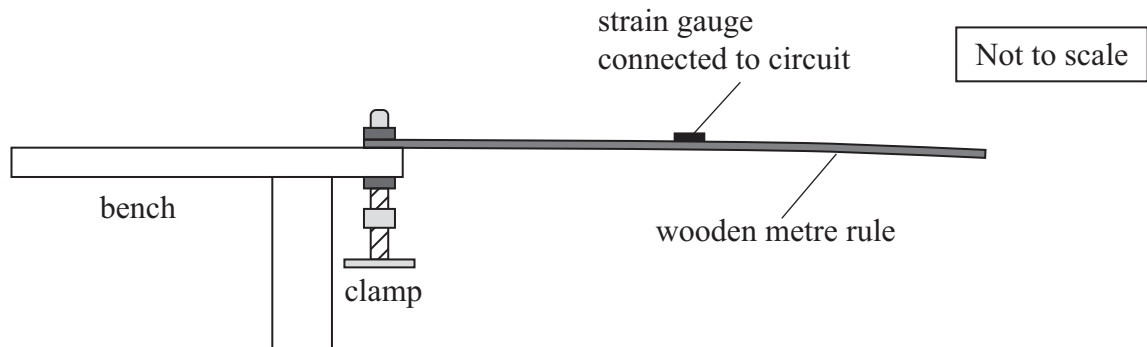
(2)

Percentage uncertainty =



- (b) The student adjusted the variable resistor in the circuit so that the reading on the voltmeter was 0.0 mV .

He attached the strain gauge to a wooden metre rule. He clamped the metre rule to hang over the edge of a bench, as shown.



- (i) The reading on the voltmeter increased. The student adjusted the variable resistor again so that the reading on the voltmeter was 0.0 mV .

Explain the reason for this adjustment.

(2)

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- (ii) The student attached a 500 g mass to the metre rule at a distance L from the centre of the strain gauge.

The strain ε can be calculated using the formula

$$\varepsilon = \frac{6WL}{Ebt^2}$$

where

W is the weight of the 500 g mass

E is the Young modulus of the wood

b is the width of the metre rule

t is the thickness of the metre rule.

Show that ε is about 1.5×10^{-3}

$$E = 11.9 \text{ GPa}$$

$$L = 0.513 \text{ m}$$

$$b = 25.3 \text{ mm}$$

$$t = 5.8 \text{ mm}$$

(3)

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- (iii) The student added more masses to the metre rule.

For each mass he recorded the reading V on the voltmeter and determined the corresponding value of ε .

The student recorded the following data to plot a graph of ε against V .

Mass/g	ε	V/mV
500	1.5×10^{-3}	520
750	2.24×10^{-3}	372
1000	3×10^{-3}	494

Criticise the recording of the data.

(3)

- (c) Engineers use strain gauges to monitor the forces exerted on aeroplane wings.

Suggest two reasons why engineers need to monitor these forces.

(2)

(Total for Question 3 = 12 marks)



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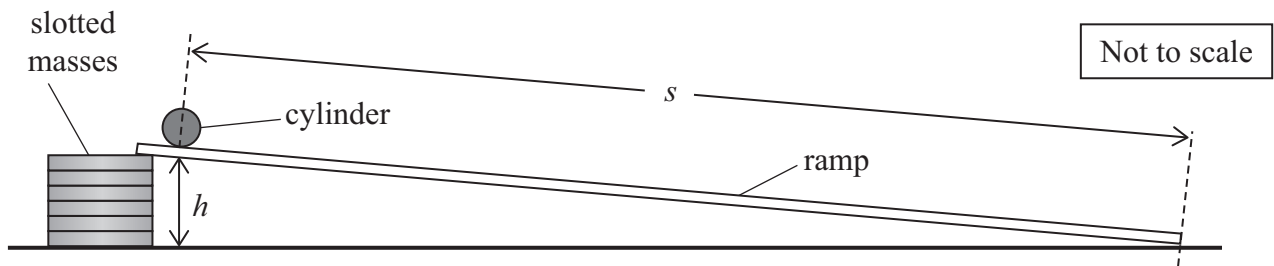
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- 4 A student determined a value for the acceleration of freefall g using the apparatus shown.



- (a) The student released the cylinder at a distance s from the bottom edge of the ramp. She measured the time t for the cylinder to travel the distance s .
- (i) Describe an accurate method to determine t using a stopwatch.

(3)

- (ii) The student suggested that adding a light gate near the top of the ramp and a light gate near the bottom of the ramp would improve the measurement of t .

Describe advantages and disadvantages of using light gates to measure t .

(3)



(b) In this investigation, the relationship between t and h is given by

$$\frac{1}{t^2} = \left(\frac{g}{3s^2} \right) h - R$$

where R is a constant.

- (i) Explain how a graph of $\frac{1}{t^2}$ against h can be used to determine the value of g . (2)

- (ii) The student varied the number of slotted masses to adjust h .

She determined corresponding values of t and recorded the following results.

h/m	t/s	
0.066	2.15	
0.057	2.25	
0.044	2.66	
0.033	3.36	
0.022	4.71	

Complete the table with corresponding values of $\frac{1}{t^2}$ (2)

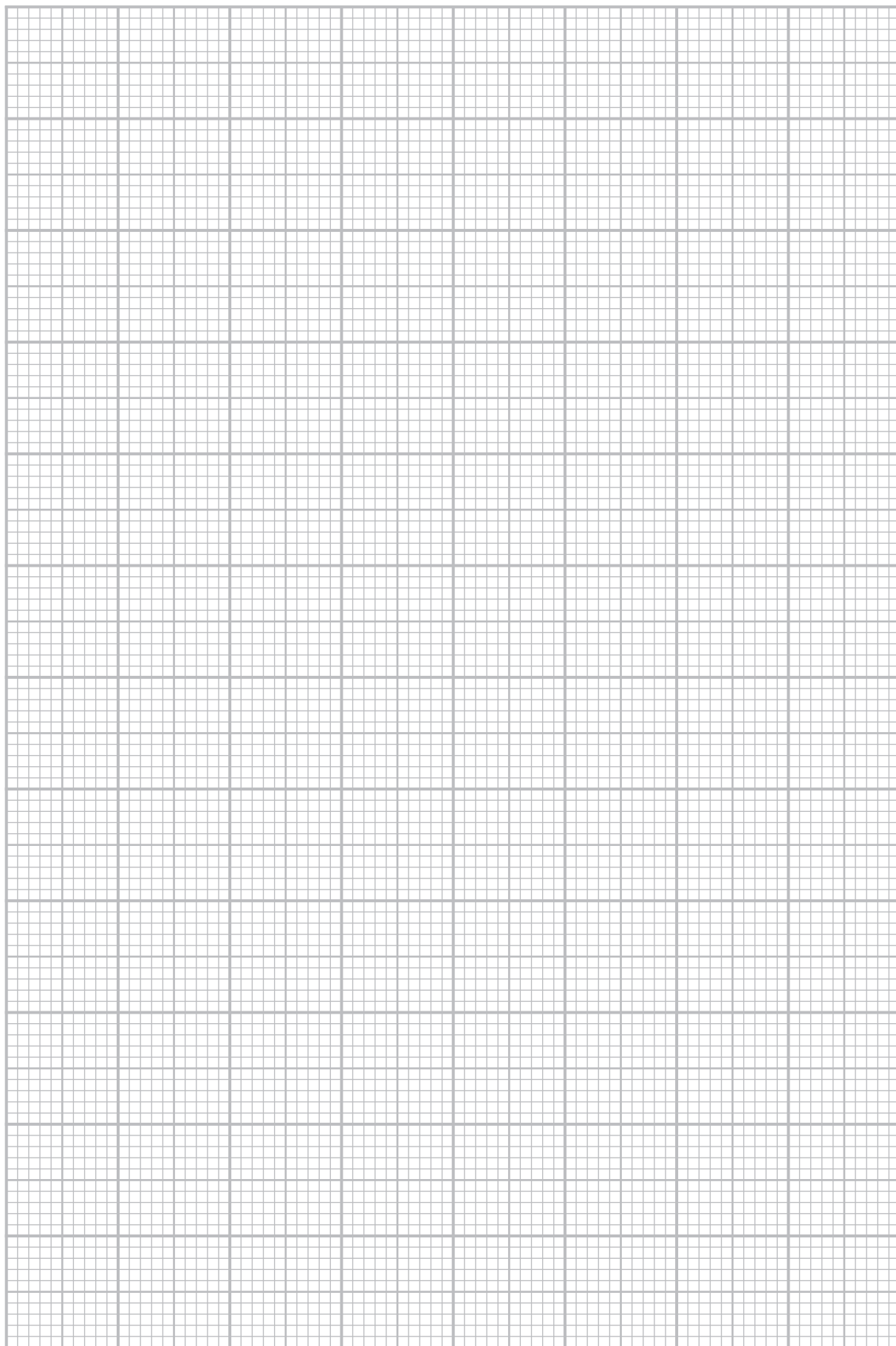
- (iii) Plot a graph of $\frac{1}{t^2}$ on the y -axis against h on the x -axis on the grid opposite. (5)



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- (iv) Determine a value for g from the graph.

$$s = 0.900 \text{ m}$$

(4)

$$g = \dots\dots\dots$$

- (v) The student determined the value of g as 9.56 ms^{-2} with a percentage uncertainty of 4%.

Deduce whether the student's value of g is consistent with the accepted value.

(2)

(Total for Question 4 = 21 marks)

TOTAL FOR PAPER = 50 MARKS

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List of data, formulae and relationships

Acceleration of free fall	$g = 9.81 \text{ m s}^{-2}$	(close to Earth's surface)
Electron charge	$e = -1.60 \times 10^{-19} \text{ C}$	
Electron mass	$m_e = 9.11 \times 10^{-31} \text{ kg}$	
Electronvolt	$1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$	
Gravitational field strength	$g = 9.81 \text{ N kg}^{-1}$	(close to Earth's surface)
Planck constant	$h = 6.63 \times 10^{-34} \text{ J s}$	
Speed of light in a vacuum	$c = 3.00 \times 10^8 \text{ m s}^{-1}$	

Unit 1*Mechanics*

Kinematic equations of motion

$$s = \frac{(u + v)t}{2}$$

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Forces

$$\Sigma F = ma$$

$$g = \frac{F}{m}$$

$$W = mg$$

Momentum

$$p = mv$$

Moment of force

$$\text{moment} = Fx$$

Work and energy

$$\Delta W = F\Delta s$$

$$E_k = \frac{1}{2}mv^2$$

$$\Delta E_{\text{grav}} = mg\Delta h$$

Power

$$P = \frac{E}{t}$$

$$P = \frac{W}{t}$$



Efficiency

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

$$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

Materials

Density

$$\rho = \frac{m}{V}$$

Stokes' law

$$F = 6\pi\eta rv$$

Hooke's law

$$\Delta F = k\Delta x$$

Elastic strain energy

$$\Delta E_{\text{el}} = \frac{1}{2}F\Delta x$$

Young modulus

$$E = \frac{\sigma}{\varepsilon} \text{ where}$$

$$\text{Stress } \sigma = \frac{F}{A}$$

$$\text{Strain } \varepsilon = \frac{\Delta x}{x}$$

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Unit 2*Waves*

Wave speed

$$v = f\lambda$$

Speed of a transverse wave
on a string

$$v = \sqrt{\frac{T}{\mu}}$$

Intensity of radiation

$$I = \frac{P}{A}$$

Refractive index

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$n = \frac{c}{v}$$

Critical angle

$$\sin C = \frac{1}{n}$$

Diffraction grating

$$n\lambda = d \sin \theta$$

Electricity

Potential difference

$$V = \frac{W}{Q}$$

Resistance

$$R = \frac{V}{I}$$

Electrical power, energy

$$P = VI$$

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

$$W = VIt$$

Resistivity

$$R = \frac{\rho l}{A}$$

Current

$$I = \frac{\Delta Q}{\Delta t}$$

$$I = nqvA$$

Resistors in series

$$R = R_1 + R_2 + R_3$$

Resistors in parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Particle nature of light

Photon model

$$E = hf$$

Einstein's photoelectric
equation

$$hf = \phi + \frac{1}{2}mv_{\max}^2$$

de Broglie wavelength

$$\lambda = \frac{h}{p}$$



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