Pearson Edexcel International Advanced Level

Friday 17 October 2025

Afternoon (Time: 1 hour 20 minutes)

Paper reference **WPH13/01A**

Physics

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Physics I

Question paper

You must have:
Scientific calculator, ruler and Answer book (sent separately).
Do not return this question paper with the answer book.

Turn over ▶

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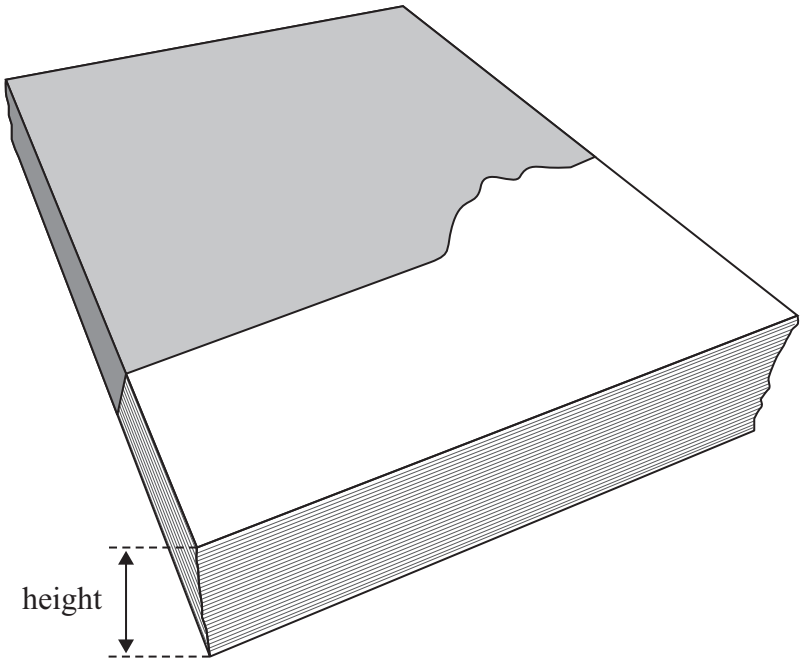
P 8 7 4 4 2 A

Pearson

Answer ALL questions.

1 A group of students are given a packet of 500 sheets of paper and asked to determine the thickness of one sheet of paper.



(a) The students use a digital caliper to measure the height.

(i) Describe a method to accurately determine the thickness of one sheet of paper.

(4)

(ii) The students measure the height as 60.00 mm

Determine the percentage uncertainty in their measurement of the height.

(2)

(b) The students were then asked to determine the density of the paper and took the following additional measurements of the packet of paper.

Width / mm	Length / mm
210.20	297.25
210.35	297.00
210.15	296.75
210.25	297.10

(i) Determine the mean values of width and length.

(3)

(ii) The students measured the mass of the packet of paper with a balance as 2.070 kg

Determine the density of the paper in gcm^{-3}

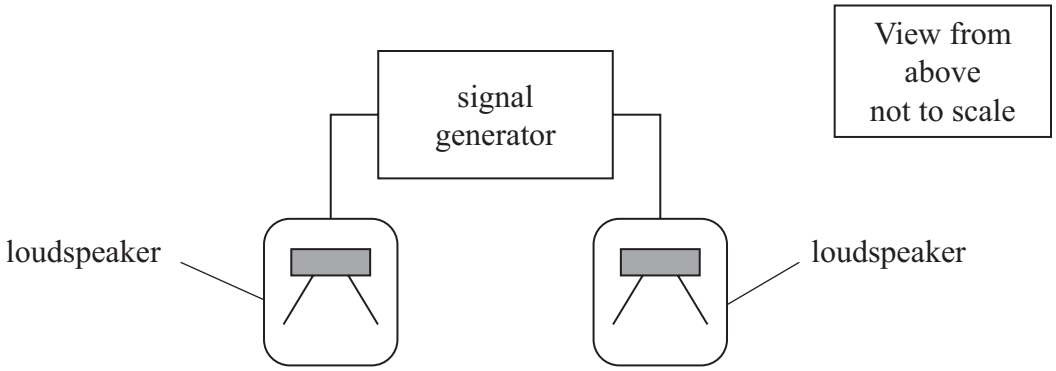
(2)

(iii) Identify a potential source of systematic error in the measurement of the mass.

(1)

(Total for Question 1 = 12 marks)

2 A student investigated the interference of sound waves. The student used a signal generator with two loudspeakers, as shown.



(a) The student adjusted the signal generator output until he heard a loud, continuous sound from the loudspeakers.

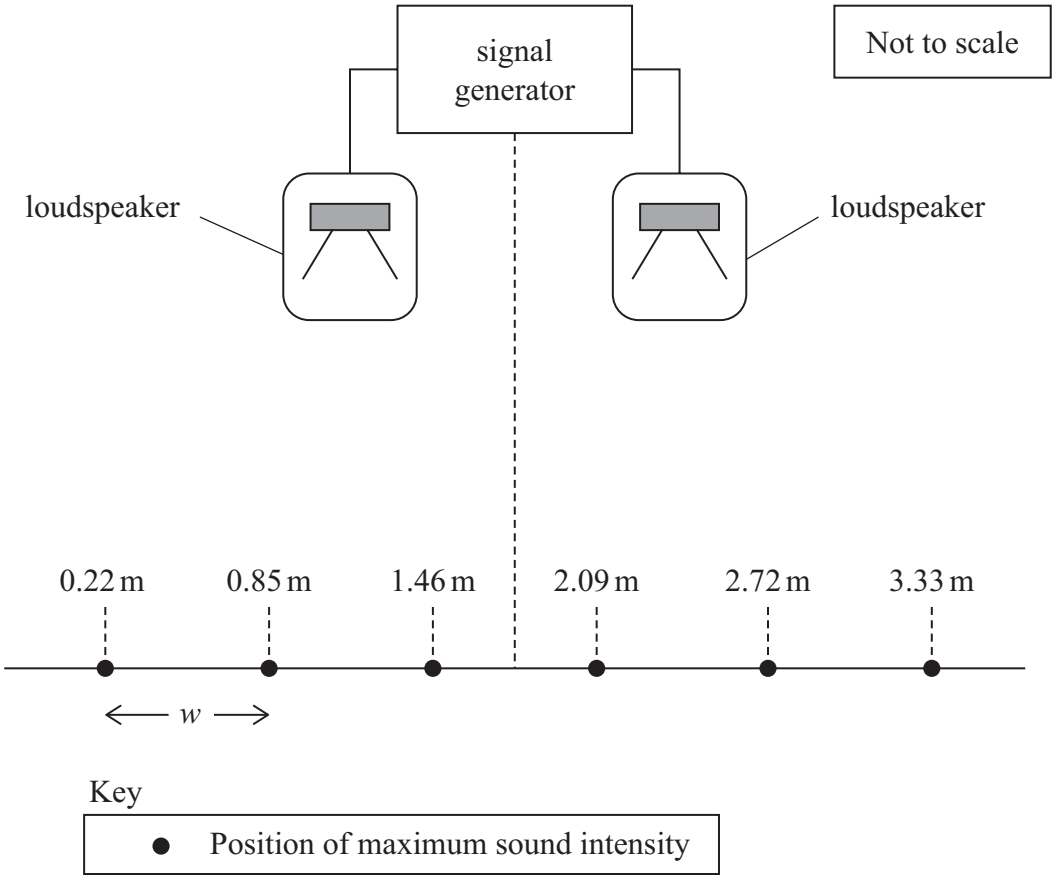
(i) State a reason for connecting both loudspeakers to the same signal generator.

(1)

(ii) Identify a health and safety issue for the student and how it may be dealt with.

(2)

(b) The student walked along a line between points A and B carrying a sound meter. The sound meter indicated the positions of maximum sound intensity, as shown.



The student measured the distance of each maximum from point A using a tape measure.

(i) Determine an accurate value for the separation w of the maxima.

(3)

(ii) The relationship between w and the wavelength λ of the sound waves is given by

$$w = \frac{\lambda D}{s}$$

where D is the perpendicular distance between the loudspeakers and the line AB, and s is the separation of the loudspeakers.

Determine the value of λ.

D = 4.0 m

s = 110 cm

(2)

(c) The student used this investigation to determine the speed of sound in air.

(i) To determine an accurate value for the speed of sound, the student would need to use other apparatus.

Explain what other apparatus the student would need.

(2)

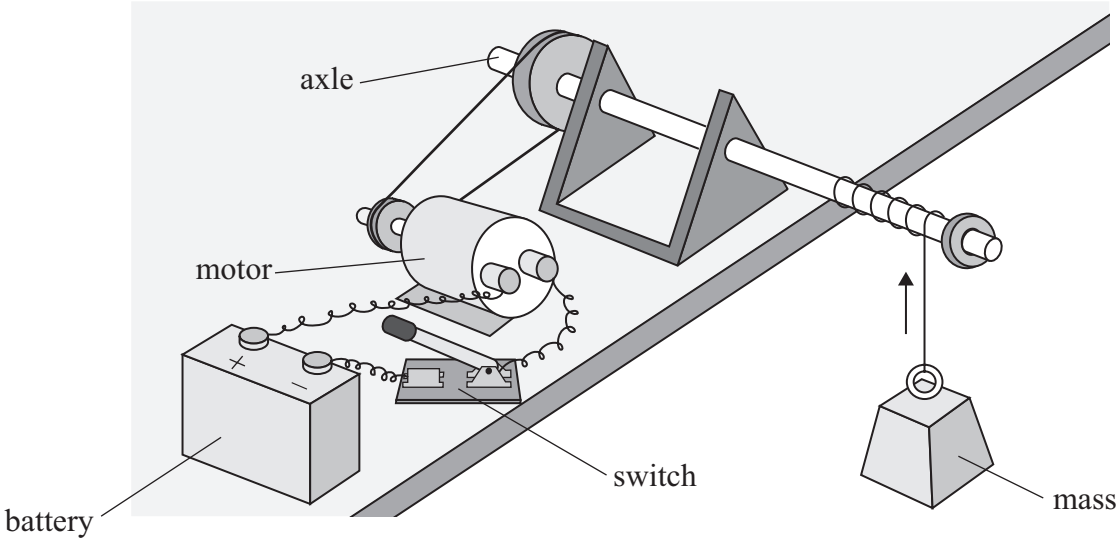
(ii) On a humid day, the speed of sound in air increases.

Explain how an increase in the speed of sound would affect the value of w for this investigation.

(2)

(Total for Question 2 = 12 marks)

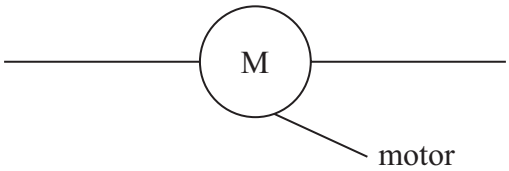
3 A student investigated the efficiency of an electric motor, using the apparatus shown.



(a) The motor was connected in a circuit including a battery and a switch.

The student connected additional components to determine the power of the motor.

Complete the circuit diagram in the answer book for the circuit the student should use.



(2)

(b) The student closed the switch in the circuit, and the motor lifted the mass from the floor.

She used a metre rule to measure the height gained by the mass in 10 s.

(i) Describe how she should measure a single value of the height gained as accurately as possible.

You should include the use of any additional apparatus needed.

(4)

(ii) Explain why repeat measurements are appropriate for this measurement.

(2)

(c) Explain how the measurements made by the student should be used to determine the efficiency of the motor as it lifts the mass.

(3)

(Total for Question 3 = 11 marks)

4 The activation potential difference (p.d.) is the minimum p.d for photons to be emitted from a light emitting diode (LED). A student measured the activation p.d. for different LEDs. The relationship between activation p.d. and wavelength is given by the equation

$$eV_a = \frac{hc}{\lambda} + W$$

where

V_a is the activation p.d.

λ is the wavelength of the photons emitted by the LED

W is a constant representing the work done by an electron passing through an LED.

(a) Explain why a graph of V_a against $1/\lambda$ should give a straight line.

(3)

(b) The student recorded his values of activation p.d. and the manufacturer's corresponding values of wavelength.

λ / 10^{-7} m	V_a / V	
6.60	1.82	
6.12	1.97	
5.92	2.02	
5.85	2.07	
5.30	2.31	
4.70	2.58	

(i) Complete the table in the answer book with the corresponding values of $1/\lambda$.

(2)

(ii) Plot a graph of V_a on the y-axis against $1/\lambda$ on the x-axis.

(5)

(iii) Determine the value of the Planck constant given by the student's data.

(3)

(iv) The student states that the value for the Planck constant obtained from the graph is accurate.

Evaluate the student's statement.

(2)

(Total for Question 4 = 15 marks)

TOTAL FOR PAPER = 50 MARKS

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

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

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

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

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

Young modulus $E = \frac{\sigma}{\varepsilon}$ where

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

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

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	$P = VI$
	$P = I^2R$
	$P = \frac{V^2}{R}$
	$W = VIt$
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	$hf = \phi + \frac{1}{2}mv^2_{max}$
de Broglie wavelength	$\lambda = \frac{h}{p}$

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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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Physics

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UNIT 3: Practical Skills in Physics I
Answer book

You must have:
Scientific calculator, ruler and question paper (sent separately)

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 the question paper.

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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M:1/1/1/1/

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Pearson

Answer ALL questions.

1

(a)

(i)

(4)

(ii)

(2)

Percentage Uncertainty = ...

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b)

(i)

(3)

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Mean width = ...

Mean length = ...

(ii)

(2)

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Density = ... gcm^{-3}

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(iii)

(1)

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(Total for Question 1 = 12 marks)

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2

(a)

(i)

(1)

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(ii)

(2)

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(b)

(i)

(3)

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Separation = ...

(ii)

(2)

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wavelength = ...

(c)

(i)

(2)

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(ii)

(2)

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(Total for Question 2 = 12 marks)

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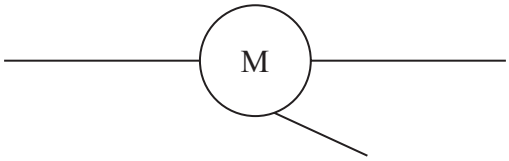
3

(a)

(2)



(b)

(i)

(4)

(ii)

(2)

(c)

(3)

(Total for Question 3 = 11 marks)

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4

(a)

(3)

(b)

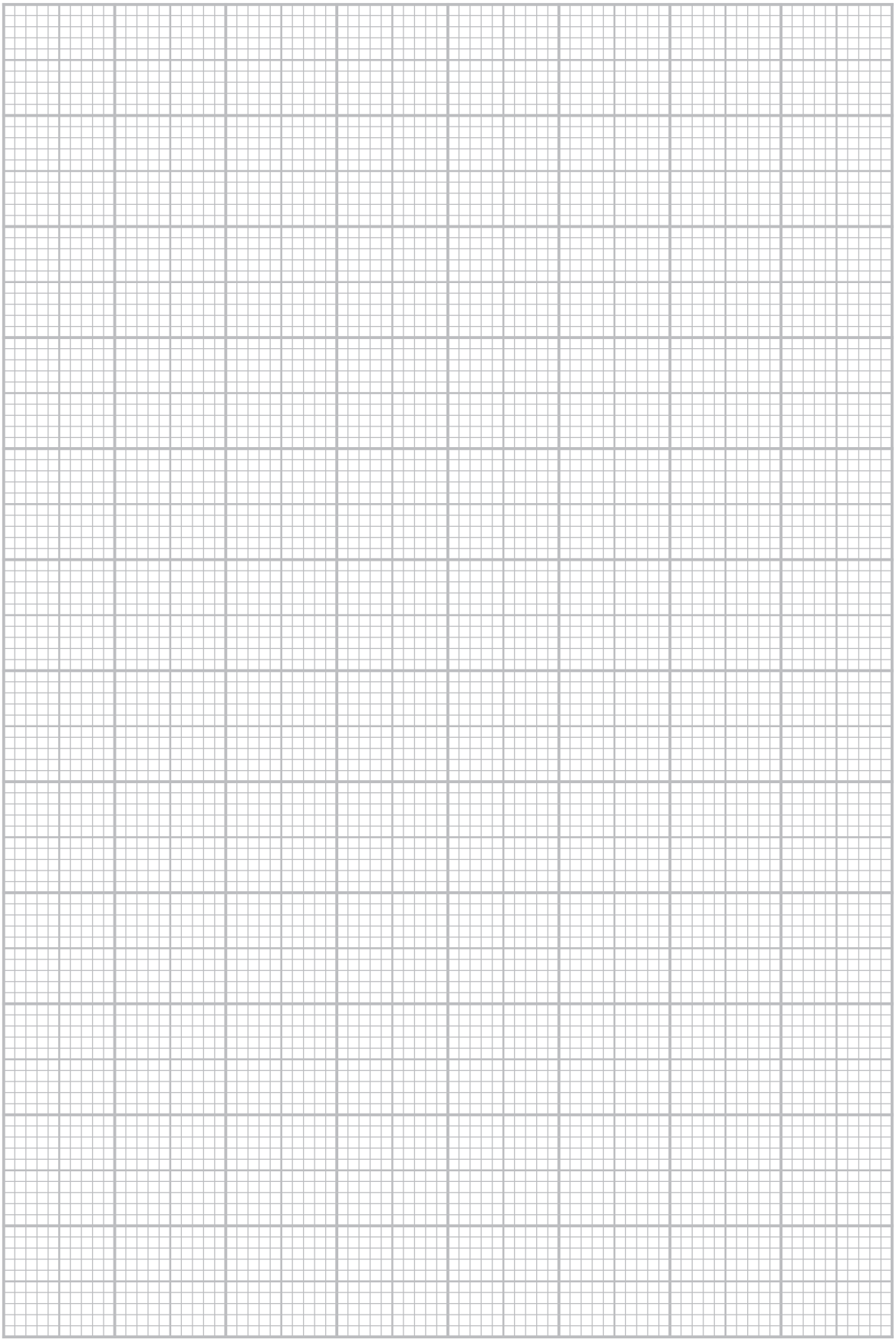
λ / 10^{-7} m	V_a / V	
6.60	1.82	
6.12	1.97	
5.92	2.02	
5.85	2.07	
5.30	2.31	
4.70	2.58	

(i)

(2)

(ii)

(5)



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(iii)

(3)

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Planck constant = ...

(iv)

(2)

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(Total for Question 4 = 15 marks)

TOTAL FOR PAPER = 50 MARKS

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