

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.

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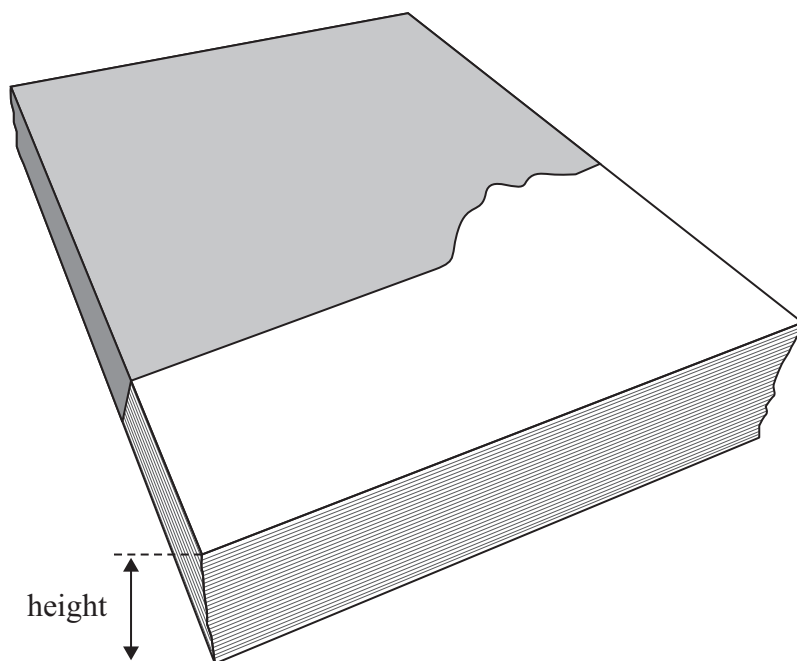
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Pearson

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 g cm^{-3} (2)

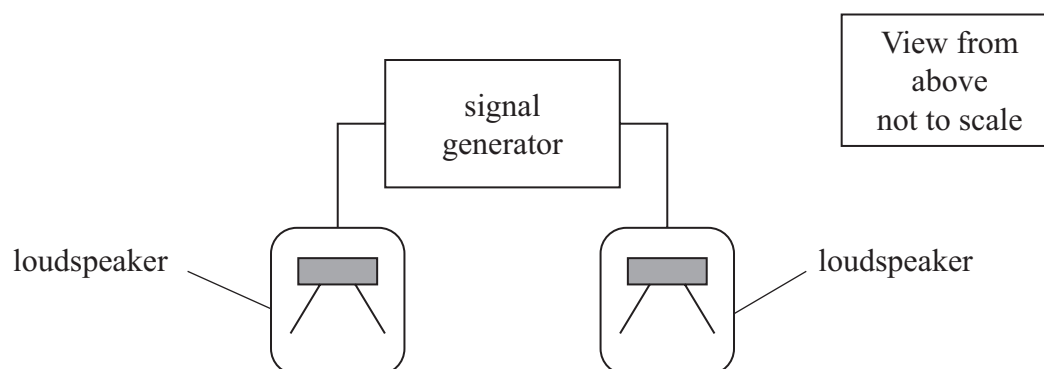


(iii) Identify a potential source of systematic error in the measurement of the mass.

(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.

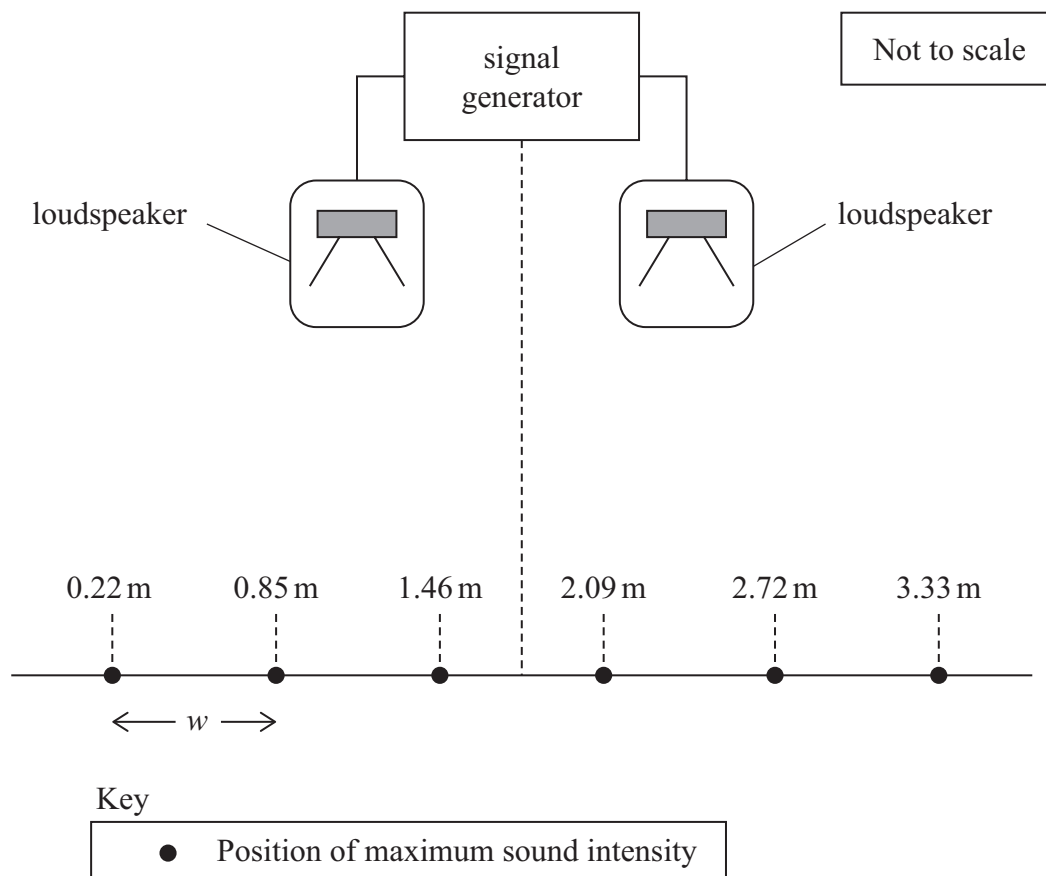
(i) State a reason for connecting both loudspeakers to the same signal generator.

(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 .

$$D = 4.0 \text{ m}$$

$$s = 110 \text{ cm}$$

(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)

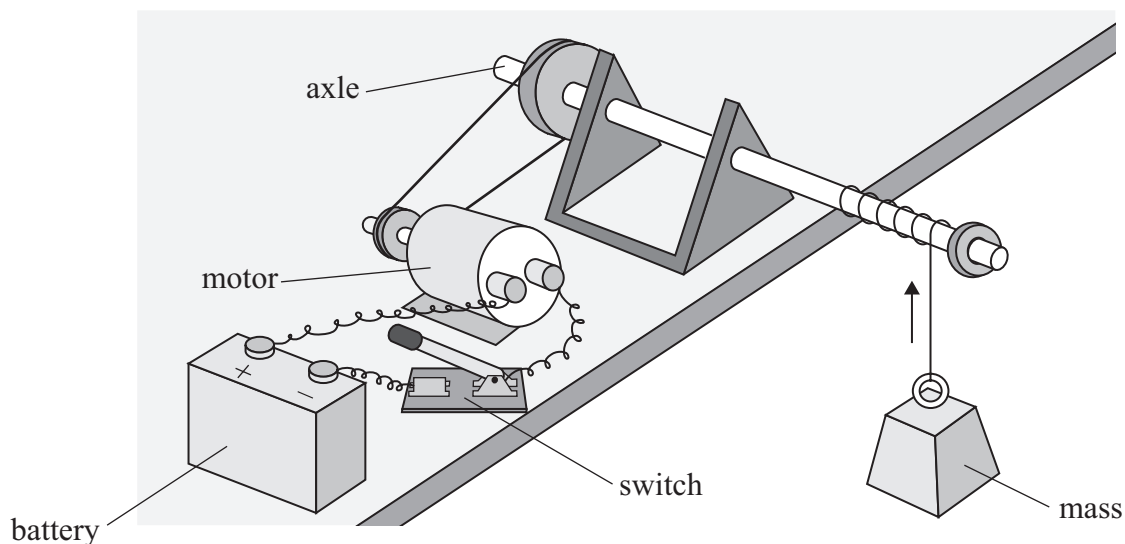
- (ii) On a humid day, the speed of sound in air increases.

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)

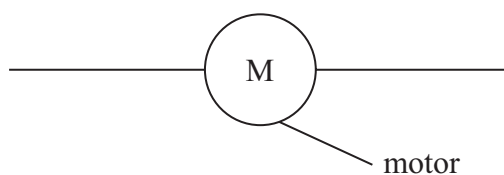
- 3 A student investigated the efficiency of an electric motor, using the apparatus shown.



- (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.

$\lambda / 10^{-7} \text{ m}$	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	$s = \frac{(u + v)t}{2}$ $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
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Forces	$\Sigma F = ma$ $g = \frac{F}{m}$ $W = mg$
--------	--

Momentum	$p = mv$
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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	$P = \frac{E}{t}$ $P = \frac{W}{t}$
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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

$$F = 6\pi\eta r v$$

Hooke's law

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

Elastic strain energy

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

Young modulus

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

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

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

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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Please check the examination details below before entering your candidate information

Candidate surname		Other names	
Centre Number		Candidate Number	

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Afternoon (Time: 1 hour 20 minutes) **Paper reference** **WPH13/01A**

Physics

International Advanced Subsidiary/Advanced Level

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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Answer ALL questions.

1

(a)

(i)

(4)

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(ii)

(2)

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Percentage Uncertainty =

2



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(b)

(i)

(3)

Mean width =

Mean length =

(ii)

(2)

Density = gcm^{-3}



(iii)

(1)

(Total for Question 1 = 12 marks)

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2

(a)

(i)

(1)

(ii)

(2)

(b)

(i)

(3)

(ii)

(2)

Separation =

wavelength =



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(c)

(i)

(2)

(ii)

(2)

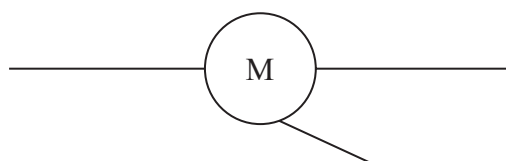
(Total for Question 2 = 12 marks)



3

(a)

(2)



(b)

(i)

(4)

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(ii)

(2)

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(c)

(3)

(Total for Question 3 = 11 marks)



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4

(a)

(3)

(b)

$\lambda / 10^{-7} \text{ m}$	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)

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(ii)

(5)

A large rectangular grid of graph paper, consisting of 20 columns and 20 rows of small squares. The grid is intended for drawing or calculation.

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(iii)

(3)

Planck constant =

(iv)

(2)

(Total for Question 4 = 15 marks)

TOTAL FOR PAPER = 50 MARKS

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