Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Advanced Subsidiary
Unit 3: Exploring Physics

Sample Assessment Material
Time: 1 hour 20 minutes

Paper Reference
WPH03/01

You must have:
Ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **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.*

Information

- The total mark for this paper is 40.
- 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.
- Candidates may use a scientific calculator.

Advice

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

Turn over ▶

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PEARSON

SECTION A

Answer ALL questions.

For questions 1–5, in Section A, select one answer from A to D and put a cross in the box ☒. If you change your mind put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Which of the following is the correct unit for resistivity?

☒ **A** Ω

☒ **B** Ω m

☒ **C** Ω m^{-1}

☒ **D** Ω m^{-2}

(Total for Question 1 = 1 mark)

2 In an experiment to find the resistivity of a wire, the following three measurements of the diameter were recorded.

0.71 mm, 0.72 mm, 0.69 mm

How should the average measurement be stated?

☒ **A** $(7.06 \pm 0.13) \times 10^{-3}$ m

☒ **B** $(7.1 \pm 0.2) \times 10^{-3}$ m

☒ **C** $(7.06 \pm 0.13) \times 10^{-4}$ m

☒ **D** $(7.1 \pm 0.2) \times 10^{-4}$ m

(Total for Question 2 = 1 mark)

3 A falling ball is used in an experiment to determine the acceleration of free fall.

Which of the following measurements would **not** be needed?

☒ **A** distance fallen

☒ **B** initial velocity

☒ **C** mass of the ball

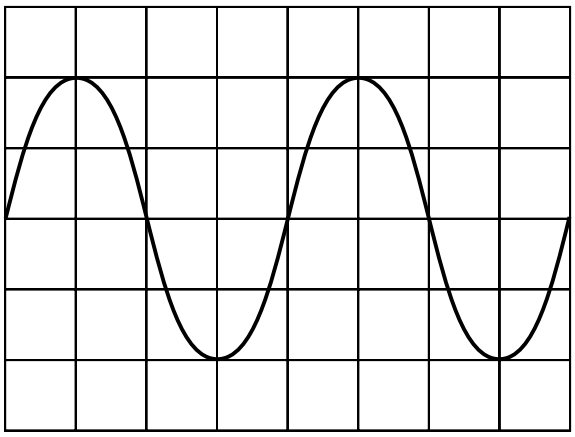
☒ **D** time taken

(Total for Question 3 = 1 mark)

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4 A computer screen is used to display a sound wave. On the horizontal axis 1 division represents 1 ms.

What is the frequency of the wave?



☒ **A** 100 Hz

☒ **B** 250 Hz

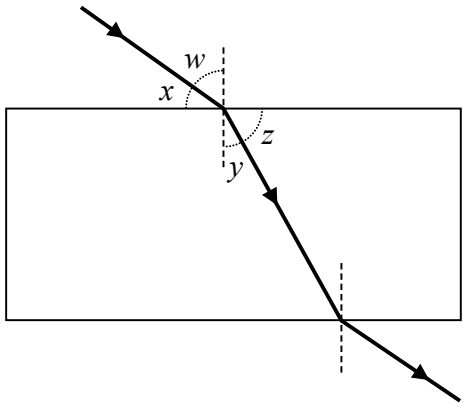
☒ **C** 500 Hz

☒ **D** 1000 Hz

(Total for Question 4 = 1 mark)

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5 The refractive index of glass can be found by tracing a ray of light through a block of glass.



A student uses the equation $_1\mu_2 = \frac{\sin i}{\sin r}$ to calculate the refractive index.

Which of the following pairs of angles could the student measure and substitute directly into the equation?

☒ **A** x and y

☒ **B** x and z

☒ **C** w and y

☒ **D** w and z

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

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SECTION B

Answer ALL questions in the spaces provided.

6 Two students are given 10 coins of the same type, a metre rule measuring in millimetres and a micrometer screw gauge. The diameter of each coin is approximately 20 mm.

They are asked to determine the best value for the diameter of one coin. Student A says that it is better to measure the diameter of just one coin using the micrometer. Student B suggests that they put the coins in a straight line and use the metre rule.

Discuss the advantages and disadvantages of each method. You should refer to uncertainties in your answer.

(4)

(Total for Question 6 = 4 marks)

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7 A student is asked to determine the spring constant of a spiral spring.

Write a plan for an experiment to do this using standard laboratory apparatus and a graphical method.

You should:

(a) draw a labelled diagram of the experimental set-up to be used,

(2)

(b) list any additional apparatus you might need,

(1)

(c) state what quantity is the independent variable and what quantity is the dependent variable,

(2)

(d) describe how you would take your measurements and explain your choice of measuring instruments,

(4)

(e) explain how the data collected will be used to find the spring constant,

(2)

(f) identify the main sources of uncertainty and/or systematic error,

(1)

(g) comment on safety.

(1)

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(Total for Question 7 = 13 marks)

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8 A school experiment to find an approximate value for the Planck constant h uses light emitting diodes (LEDs) of different colours.

The results from one such experiment are shown in the table. The wavelengths λ are taken from the data provided by the manufacturer of the diodes. The potential difference V is measured across the LED when it just lights.

λ /nm	V/V	λ^{-1}/
630	1.06	1.59
610	1.11	1.64
595	1.12	1.68
570	1.24	
465	1.64	
400	1.92	

(a) Complete the final column of the table with the missing unit and values.

(3)

(b) The equation used for the experiment is derived from

$$eV = hf$$

where f is the frequency of the light emitted by the LED.

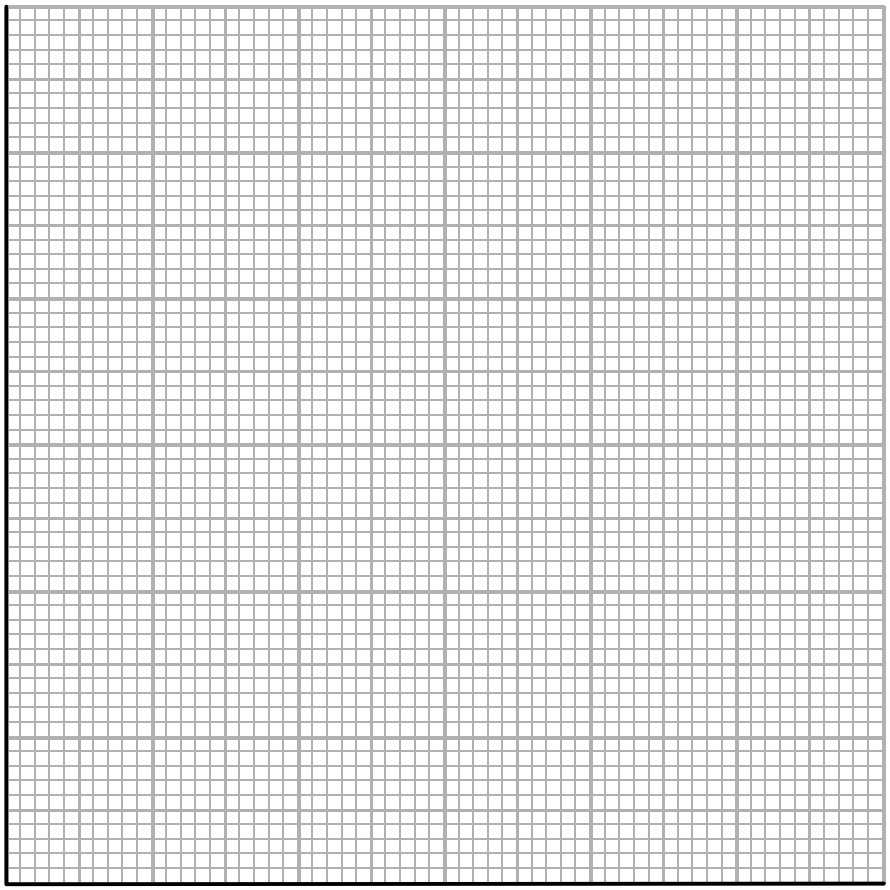
Explain why a graph of V on the y-axis against $1/\lambda$ on the x-axis should be a straight line and show that the gradient of the line will be hc/e.

(3)

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(c) Plot the graph on the grid provided and draw a line of best fit.

(5)



TURN OVER FOR QUESTION 8(d).

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(d) Use your graph to find a value for the gradient and use it to calculate a value for h.

(6)

h = ...

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(e) The accepted value for h is 6.63×10^{-34} J s.

Assuming your calculations are correct, suggest why there is a difference between your value for h and the accepted value.

(1)

(Total for Question 8 = 18 marks)

TOTAL FOR SECTION B = 35 MARKS

TOTAL FOR PAPER = 40 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	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
Forces	$\Sigma F = ma$ $g = F/m$ $W = mg$
Work and energy	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{grav} = mg\Delta h$

Materials

Stokes' law	$F = 6\pi\eta rv$
Hooke's law	$F = k\Delta x$
Density	$\rho = m/V$
Pressure	$p = F/A$
Young modulus	$E = \sigma/\varepsilon$ where Stress $\sigma = F/A$ Strain $\varepsilon = \Delta x/x$
Elastic strain energy	$E_{el} = \frac{1}{2}F\Delta x$

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Unit 2

Waves

Wave speed	$v = f\lambda$
Refractive index	${}_1\mu_2 = \sin i / \sin r = v_1/v_2$

Electricity

Potential difference	$V = W/Q$
Resistance	$R = V/I$
Electrical power, energy and efficiency	$P = VI$ $P = I^2R$ $P = V^2/R$ $W = VIt$ $\%\ \text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}} \times 100$ $\%\ \text{efficiency} = \dfrac{\text{useful power output}}{\text{total power input}} \times 100$
Resistivity	$R = \rho l/A$
Current	$I = \Delta Q/\Delta t$ $I = nqvA$
Resistors in series	$R = R_1 + R_2 + R_3$
Resistors in parallel	$\dfrac{1}{R} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

Quantum physics

Photon model	$E = hf$
Einstein's photoelectric equation	$hf = \phi + \frac{1}{2}mv^2_{\max}$

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