Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 25 October 2018

Morning (Time: 1 hour 20 minutes) | Paper Reference **WPH03/01**

Physics

Advanced Subsidiary
Unit 3: Exploring Physics

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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 5 5 2 3 0 A 0 1 1 6

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 **not** an SI base unit?

☒ **A** ampere

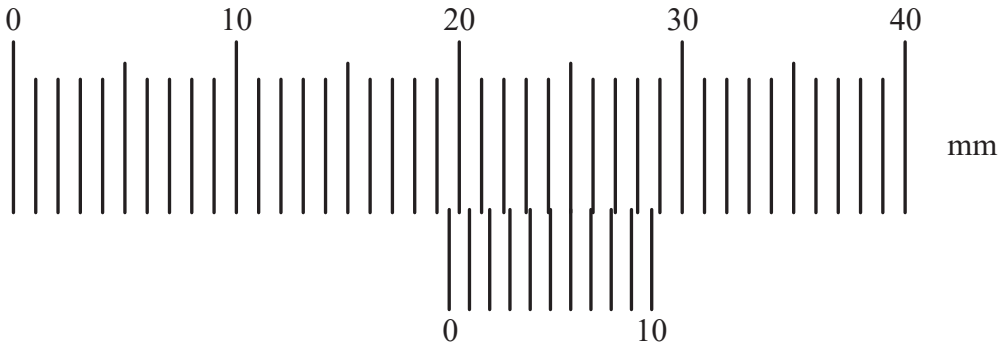
☒ **B** kelvin

☒ **C** second

☒ **D** watt

(Total for Question 1 = 1 mark)

2 The diagram shows a Vernier scale.



Which of the following is the reading on the scale?

☒ **A** 10.9 mm

☒ **B** 19.5 mm

☒ **C** 19.6 mm

☒ **D** 20.1 mm

(Total for Question 2 = 1 mark)

Questions 3, 4, and 5 refer to an experiment to determine the viscosity of a liquid.

A student dropped a sphere into a measuring cylinder containing the liquid. She measured the time taken for the sphere to fall through a given distance in the liquid and repeated this several times.

3 She recorded the times as

2.4 s 2.5 s 1.9 s 2.5 s

Which of the following is the best statement of the time the sphere took to fall?

☒ **A** 2.33 s

☒ **B** 2.4 s

☒ **C** 2.47 s

☒ **D** 2.5 s

(Total for Question 3 = 1 mark)

4 Which of the following quantities is required in the calculation of viscosity?

☒ **A** density of the liquid

☒ **B** mass of the liquid

☒ **C** temperature of the liquid

☒ **D** temperature of the room

(Total for Question 4 = 1 mark)

5 Which of the following should the student **not** do?

☒ **A** Keep the temperature of the liquid constant.

☒ **B** Drop the sphere close to the side of the cylinder.

☒ **C** Allow the sphere to reach terminal velocity before timing starts.

☒ **D** Check for a zero error on the micrometer used to measure the diameter of the sphere.

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

SECTION B

Answer ALL questions in the spaces provided.

6 A student determined the acceleration of free fall by dropping a cricket ball from an upstairs window. The student timed the fall using a stopwatch.

(a) Explain why dropping the ball from an upstairs window, rather than from one closer to the ground, improved the accuracy of the experiment.

(2)

(b) A second student stood outside and recorded the motion of the ball using the video camera on a smartphone.

Explain why this method would produce a more accurate result for the time than using a stopwatch.

(2)

(Total for Question 6 = 4 marks)

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7 A student is asked to determine the Young modulus of a metal in the form of a wire, using a graphical method. Standard laboratory apparatus is available.

Write a plan for the experiment.

You should:

(a) draw and label a diagram for the experiment,

(2)

(b) list any additional apparatus required that is not shown in your diagram,

(1)

(c) state the quantities to be measured,

(1)

(d) state which is the independent variable and which is the dependent variable,

(2)

(e) for one of the quantities listed in (c) explain your choice of measuring instrument,

(2)

(f) comment on whether repeat readings are appropriate,

(1)

(g) explain how the data collected will be used, including a sketch of the expected graph,

(4)

(h) explain the main source of uncertainty and/or systematic error,

(2)

(i) comment on safety.

(1)

(Total for Question 7 = 16 marks)

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8 In an experiment to determine the resistivity ρ of a metal in the form of a wire the following results were recorded.

Length l/m	Current I/A	Potential difference V/V	Resistance R/Ω
1.00	6.8	2.00	0.294
1.50	4.5	2.00	0.444
2.00	3.4	2.00	0.59
2.50	2.7	2.00	0.74
3.00	2.3	2.00	

(a) Criticise these results.

(2)

(b) Complete the last row of the table.

(1)

(c) Explain why a graph of R on the y-axis against l on the x-axis should be a straight line through the origin.

(2)

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

(4)

(ii) The wire has a diameter of 0.27 mm.

Use your graph to determine the resistivity of the metal.

(4)

Resistivity = ...

(e) Suggest two techniques which would ensure that accurate results are obtained.

(2)

(Total for Question 8 = 15 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	$E_{el} = \frac{1}{2}F\Delta x$

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