Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Advanced Subsidiary
Unit 3: Exploring Physics

Thursday 26 October 2017 – Morning
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.
- 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 an SI base quantity?

☒ **A** force

☒ **B** newton

☒ **C** current

☒ **D** ampere

(Total for Question 1 = 1 mark)

2 A student measures a length as 2.74 m.

Which of the following is the uncertainty in this measurement?

☒ **A** ±0.001 m

☒ **B** ±0.005 m

☒ **C** ±0.01 m

☒ **D** ±0.05 m

(Total for Question 2 = 1 mark)

Questions 3, 4 and 5 refer to the experiment described below.

In an experiment to determine the viscosity of a liquid, a student releases a sphere from rest into the liquid in a tall measuring cylinder. The sphere reaches terminal velocity. She records the distance through which the sphere falls at terminal velocity and the time taken.

3 The times she records are

0.41 s 0.43 s 0.29 s 0.38 s

Which of the following should she use as the mean time in her calculation?

☒ **A** 0.378 s

☒ **B** 0.38 s

☒ **C** 0.407 s

☒ **D** 0.41 s

(Total for Question 3 = 1 mark)

4 Which of the following would be most suitable for measuring the distance, in millimetres, through which the sphere travelled?

☒ **A** metre rule

☒ **B** micrometer screw gauge

☒ **C** scale on the measuring cylinder

☒ **D** vernier calipers

(Total for Question 4 = 1 mark)

5 Which of the following should she use to measure the diameter of the sphere?

☒ **A** metre rule

☒ **B** micrometer screw gauge

☒ **C** scale on the measuring cylinder

☒ **D** vernier calipers

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

SECTION B

Answer ALL questions in the spaces provided.

6 A student plans to determine the resistance of an unknown resistor using a graphical method.

(a) Draw a suitable circuit diagram for the experiment, including a voltmeter, an ammeter and any other necessary apparatus.

(3)

(b) The student uses a digital ammeter.

State one advantage of using a digital ammeter rather than an analogue ammeter.

(1)

.....

.....

(c) The student takes appropriate readings, with repeats, to determine mean values. Explain an experimental technique she should use to ensure an accurate result.

(2)

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.....

(Total for Question 6 = 6 marks)

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7 A student is asked to investigate the relationship between stress and strain for copper. He is given a 2 m length of copper wire and some 100 g masses. He intends to draw a stress-strain graph for the copper wire.

Write a plan for the investigation.

You should:

(a) draw a diagram of the apparatus to be used,

(1)

(b) list any measuring instruments and apparatus needed that are not shown in the 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 two quantities stated in (c) explain your choice of measuring instrument,

(4)

(f) for one quantity stated in (c) comment on whether repeat readings are appropriate in this case,

(1)

(g) explain how the measurements will be used to determine stress and strain and include a sketch of the expected graph,

(3)

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

(2)

(i) comment on safety.

(1)

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(Total for Question 7 = 16 marks)

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8 A student carried out an experiment to determine the refractive index of glass. She measured the angles of incidence and refraction for light entering a rectangular glass block. She recorded the results below.

Angle of incidence i / °	**Angle of refraction r / °**	**sin i**	**sin r**
10	7		
20	14		
30	20		
40	26		

(a) Criticise these results.

(2)

.....

.....

.....

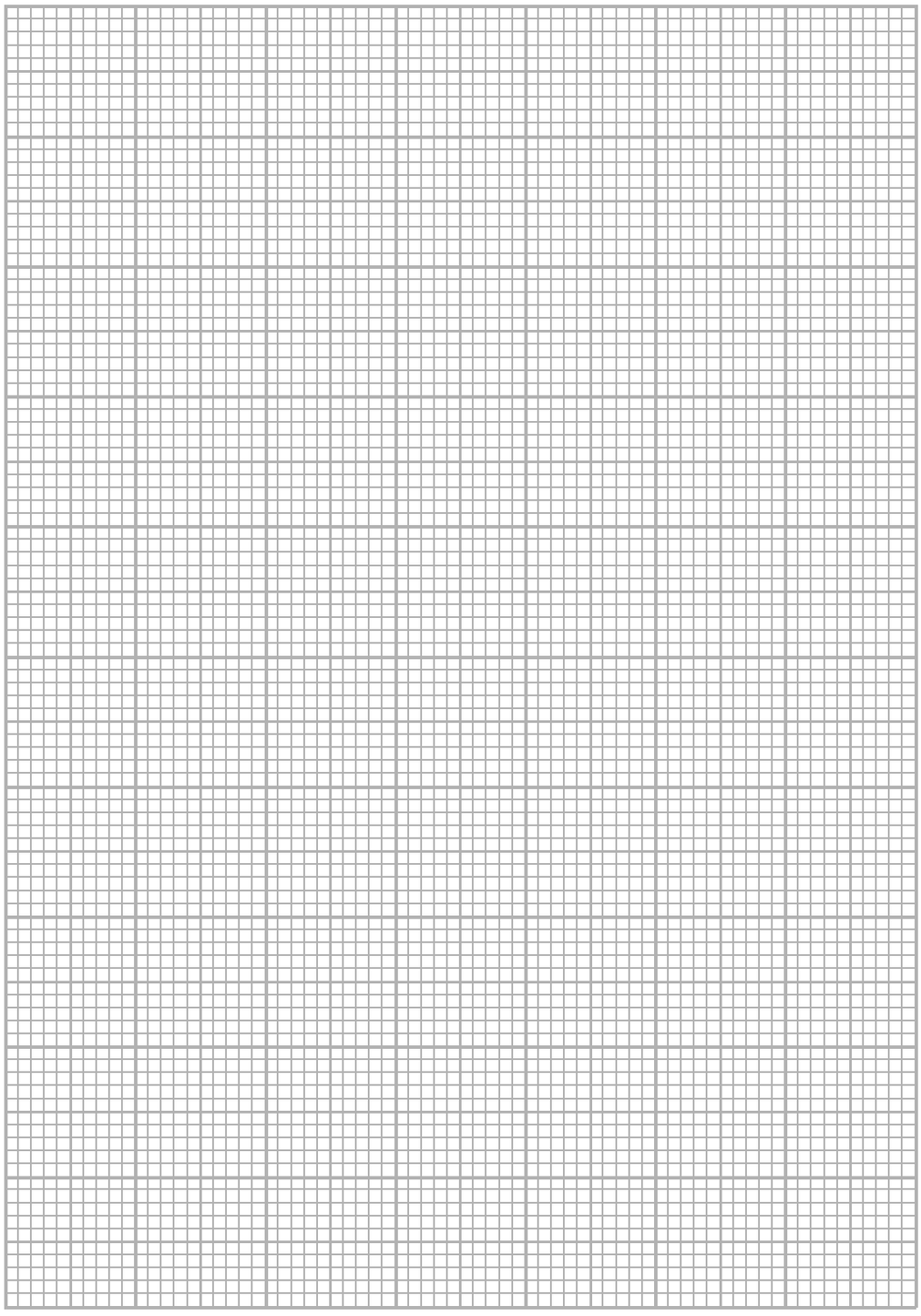
.....

(b) Complete the table.

(3)

(c) Plot a graph of sin i on the y-axis against sin r on the x-axis on the grid provided and draw a line of best fit.

(4)



(d) Use your graph to determine the refractive index of the glass.

(2)

Refractive index = ...

(e) Explain an experimental technique, other than repeating readings, that the student should use to ensure an accurate result.

(2)

(Total for Question 8 = 13 marks)

TOTAL FOR SECTION B = 35 MARKS
TOTAL FOR PAPER = 40 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

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

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	$P = VI$ $P = I^2R$ $P = V^2/R$ $W = VIt$

$$\% \text{ efficiency} = \frac{\text{useful energy output}}{\text{total energy input}} \times 100$$

$$\% \text{ efficiency} = \frac{\text{useful power output}}{\text{total power input}} \times 100$$

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

Quantum physics

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

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