Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Advanced Subsidiary
Unit 3: Exploring Physics

Friday 13 January 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 ▶

P48362A

©2017 Pearson Education Ltd.

1/1/1/

P 4 8 3 6 2 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 an SI base unit?

☒ **A** force

☒ **B** newton

☒ **C** second

☒ **D** time

(Total for Question 1 = 1 mark)

2 A student records the following times in an experiment.

0.71 s 0.69 s 0.70 s 0.59 s

Which of the following should be stated as the mean value of the time with a suitable uncertainty?

☒ **A** 0.70 ± 0.11 s

☒ **B** 0.70 ± 0.01 s

☒ **C** 0.67 ± 0.08 s

☒ **D** 0.67 ± 0.16 s

(Total for Question 2 = 1 mark)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Questions 3, 4 and 5 refer to an experiment to determine the Young Modulus for the material of a wire.

3 To determine the Young Modulus of the material, which of the following is **not** needed?

- ☒ **A** density
- ☒ **B** extension
- ☒ **C** force applied
- ☒ **D** original length

(Total for Question 3 = 1 mark)

4 Which of the following instruments should be used to measure the diameter of the wire?

- ☒ **A** half-metre rule
- ☒ **B** metre rule
- ☒ **C** micrometer screw gauge
- ☒ **D** vernier callipers

(Total for Question 4 = 1 mark)

5 Which of the following is a correct unit for the Young Modulus?

- ☒ **A** N
- ☒ **B** $N\ m^{-1}$
- ☒ **C** Pa
- ☒ **D** $Pa\ m^{-1}$

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

DO NOT WRITE IN THIS AREA

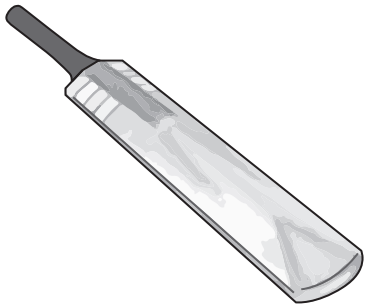
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

SECTION B

Answer ALL questions in the spaces provided.

6 A student has been asked to determine the centre of gravity of a cricket bat like the one shown.



(a) Describe a simple method to determine the centre of gravity of the cricket bat.

(4)

(b) Explain the physics of your method and any assumptions you have made.

(2)

(Total for Question 6 = 6 marks)

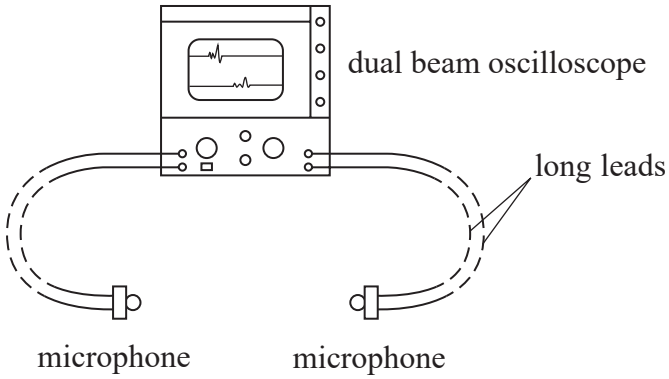
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

7 A student is asked to determine the speed of sound in air.

The apparatus to do this includes two microphones connected to an oscilloscope as shown.



The student will make a noise near one of the microphones. The oscilloscope can display the signals from both microphones as traces on the same screen. The student will observe the difference between the two stationary traces.

Write a plan for this experiment.

You should:

(a) outline the experimental procedure,

(4)

(b) list any additional apparatus required not shown in the diagram,

(2)

(c) state the quantities to be measured, identifying the independent and dependent variables,

(2)

(d) comment on whether repeat readings are appropriate,

(2)

(e) state how the data collected will be used to determine the speed of sound,

(1)

(f) identify the main sources of uncertainty and/or systematic error and explain how you would minimise these,

(3)

(g) comment on safety.

(1)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 7 = 15 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

8 A student investigates the resistance of a circuit component at different potential differences. Her results are shown in the table.

Potential difference across component *V*/V	Current through component *I* /mA
0	0
0.5	0
1.0	12
1.5	30
2	52
2.5	78

(a) Criticise her results.

(3)

.....

.....

.....

.....

.....

.....

(b) Plot a graph of *V* on the *x*-axis against *I* on the *y*-axis on the grid opposite and draw a line of best fit.

(5)

(c) (i) Use your graph to determine the resistance at 40 mA.

(4)

.....

.....

.....

Resistance = ...

(ii) With reference to the resistance of the component, explain the shape of the graph between 0 and 0.5 V.

(2)

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(Total for Question 8 = 14 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	$E_{el} = \frac{1}{2}F\Delta x$

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

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

BLANK PAGE

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

BLANK PAGE

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE