Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number	Candidate Number

Physics

Advanced Subsidiary
Unit 3: Exploring Physics

Friday 8 May 2015 – 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.
- 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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P 4 4 9 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 In an experiment to determine the Young modulus of a material in the form of a wire, which of the following instruments should be used to measure the diameter of the wire?

☐ **A** electronic balance

☐ **B** metre rule

☐ **C** micrometer screw gauge

☐ **D** vernier calipers

(Total for Question 1 = 1 mark)

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2 Four readings are taken of the diameter of a wire:

0.27 mm   0.29 mm   0.72 mm   0.26 mm

Which of the following should be recorded as the mean value?

☐ **A** 0.39 mm

☐ **B** 0.385 mm

☐ **C** 0.273 mm

☐ **D** 0.27 mm

(Total for Question 2 = 1 mark)

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3 Which of the following is the SI unit for resistivity?

☐ **A** $\Omega\ m^{-1}$

☐ **B** $\Omega\ m$

☐ **C** Ω

☐ **D** $m\ \Omega^{-1}$

(Total for Question 3 = 1 mark)

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4 In an experiment to determine the resistivity of the material of a wire, which of the following measurements of the wire would **not** be required?

- ☒ **A** diameter
- ☒ **B** length
- ☒ **C** mass
- ☒ **D** resistance

(Total for Question 4 = 1 mark)

5 In an experiment to determine the Planck constant a student uses light of wavelength $\lambda = 595$ nm. Which of the following is the correct value of λ^{-1}?

- ☒ **A** 1.68 nm
- ☒ **B** 1.68×10^{-6} nm^{-1}
- ☒ **C** 1.68×10^{6} nm^{-1}
- ☒ **D** 1.68×10^{6} m^{-1}

(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 A student has been asked to carry out an experiment to determine the internal resistance of a 1.5 V cell. The circuit will contain the following components: the cell, a switch, a variable resistor, an ammeter and a voltmeter.

(a) Draw a circuit diagram of the circuit.

(1)

(b) State why this experiment is considered to be low risk.

(1)

....

....

(c) The teacher says that the resistance of the variable resistor should **not** be reduced to zero.

Suggest why.

(1)

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(Total for Question 6 = 3 marks)

7 A student is asked to plan an experiment to determine the energy stored in a stretched spring when it is extended by 300 mm. The student is told to use a graphical method.

For a 1 N load the extension of the spring is 40 mm.

Write a plan which could be used for this experiment.

You should:

(a) draw a labelled diagram of the experimental set-up and list any additional apparatus required,

(3)

(b) state which quantity is the independent variable and which quantity is the dependent variable,

(2)

(c) state and explain your choice of measuring instruments for the independent and dependent variables,

(4)

(d) describe how you would ensure that your measurement of the extension is as accurate as possible,

(2)

(e) comment on whether repeat readings are appropriate in this case,

(1)

(f) explain how the data collected will be used to determine the energy stored,

(4)

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

(1)

(h) comment on safety.

(1)

(Total for Question 7 = 18 marks)

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8 In an investigation of the inverse square law for light, a student measured the radiation flux I of the light at different distances d from a light bulb.

Her results table is shown below.

d/m	I/W m^{-2}	$\frac{1}{d^2}$ /
0.125	996	64.0
0.25	276	16.0
0.375	109.3	7.1
0.5	48	4.0
0.75	18	
1	3.3	

(a) Add a unit for $\frac{1}{d^2}$ to the table.

(1)

(b) Criticise the results table.

(2)

....

....

....

....

(c) Complete the table.

(2)

(d) The relationship between I and d is given by

$$I = \frac{k}{d^2}$$

where k is a constant.

Explain why a graph of I on the y-axis against $\frac{1}{d^2}$ on the x-axis should be a straight line through the origin.

(2)

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(e) Plot a graph of I on the y-axis against $\frac{1}{d^2}$ on the x-axis on the grid provided and draw a line of best fit.

(5)

(f) Use your graph to determine I when d = 20 cm.

(2)

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....

....

....

I = ... W m^{-2}

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

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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