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Surname					Other names									
<b>Pearson Edexcel</b>					Centre Number					Candidate Number				
<b>International</b>					[ ] [ ] [ ] [ ] [ ] [ ]					[ ] [ ] [ ] [ ] [ ] [ ]				
<b>Advanced Level</b>														
<b>Physics</b>														
<b>Advanced Subsidiary</b>														
<b>Unit 3: Exploring Physics</b>														
Friday 8 May 2015 – Morning										Paper Reference				
<b>Time: 1 hour 20 minutes</b>										<b>WPH03/01</b>				
<b>You must have:</b>										Total Marks				
Ruler										[ ]				

### 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** 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**  $\Omega \text{ m}^{-1}$
- B**  $\Omega \text{ m}$
- C**  $\Omega$
- D**  $\text{m } \Omega^{-1}$

**(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  $\lambda = 595 \text{ nm}$ . Which of the following is the correct value of  $\lambda^{-1}$ ?

- A  $1.68 \text{ nm}$
- B  $1.68 \times 10^{-6} \text{ nm}^{-1}$
- C  $1.68 \times 10^6 \text{ nm}^{-1}$
- D  $1.68 \times 10^6 \text{ m}^{-1}$

(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)

**(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)



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**(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.

$d/\text{m}$	$I/\text{W m}^{-2}$	$\frac{1}{d^2} /$
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.

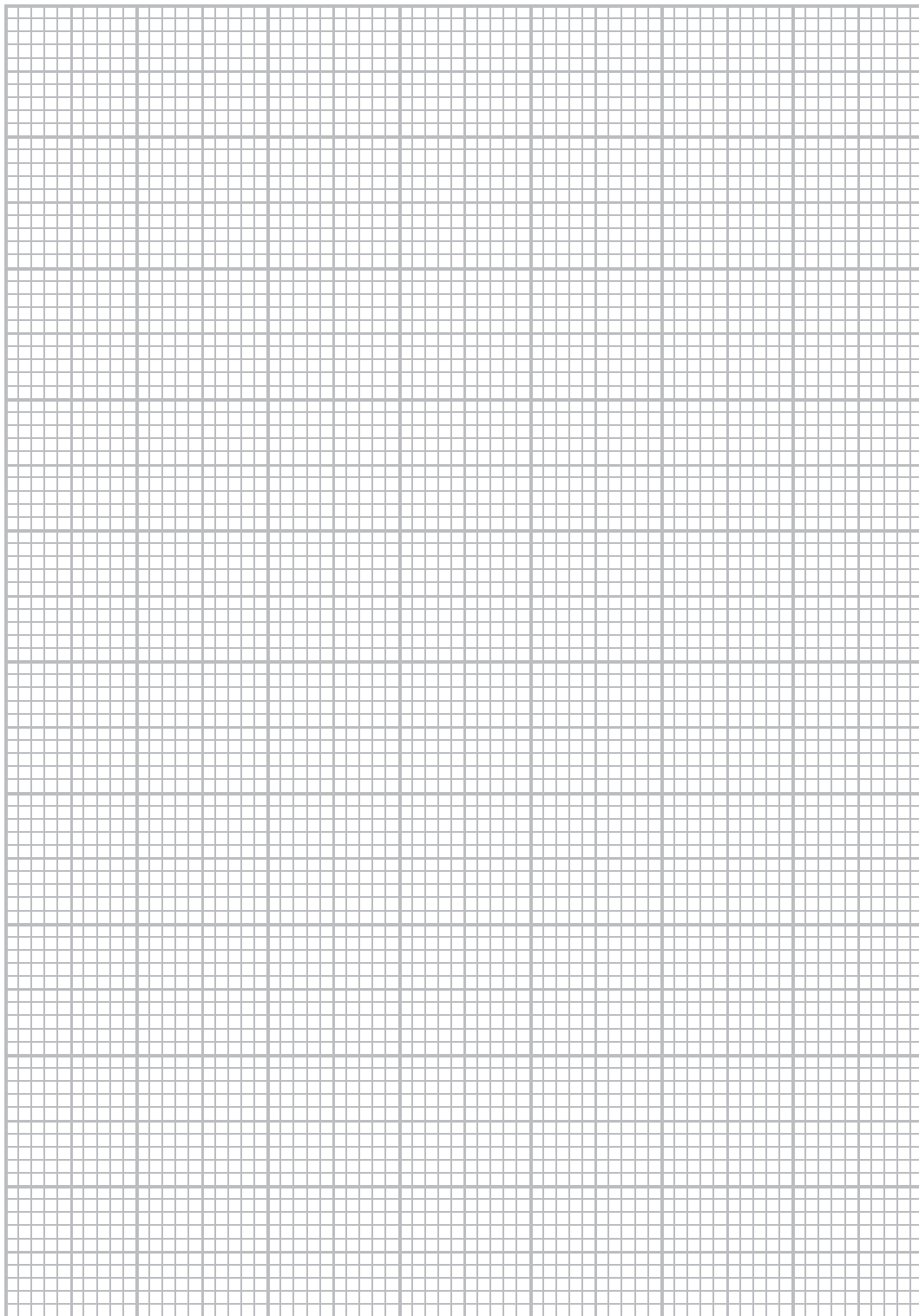
Explain why a graph of  $I$  on the  $y$ -axis against  $\frac{1}{d^2}$  on the  $x$ -axis should be a straight line through the origin.

(2)



- (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)

$I = \dots\dots\dots$  W m<sup>-2</sup>

**(Total for Question 8 = 14 marks)**

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**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	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{\text{grav}} = mg\Delta h$

##### Materials

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



**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  
 $P = VI$   
 $P = I^2R$   
 $P = V^2/R$   
 $W = VI t$

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

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

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



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