

Write your name here

Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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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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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)

- 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)

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

- ☐ A $\Omega \text{ m}^{-1}$
☐ B $\Omega \text{ m}$
☐ C Ω
☐ D $\text{m } \Omega^{-1}$

(Total for Question 3 = 1 mark)



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 λ^{-1} ?

- ☐ A 1.68 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)



Handwriting practice area with 20 sets of three horizontal lines (top, middle, bottom) for letter formation.



(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 | $I/\text{W m}^{-2}$ | $\frac{1}{d^2} /$ |
|--------------|---------------------|-------------------|
| 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)

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.....

.....

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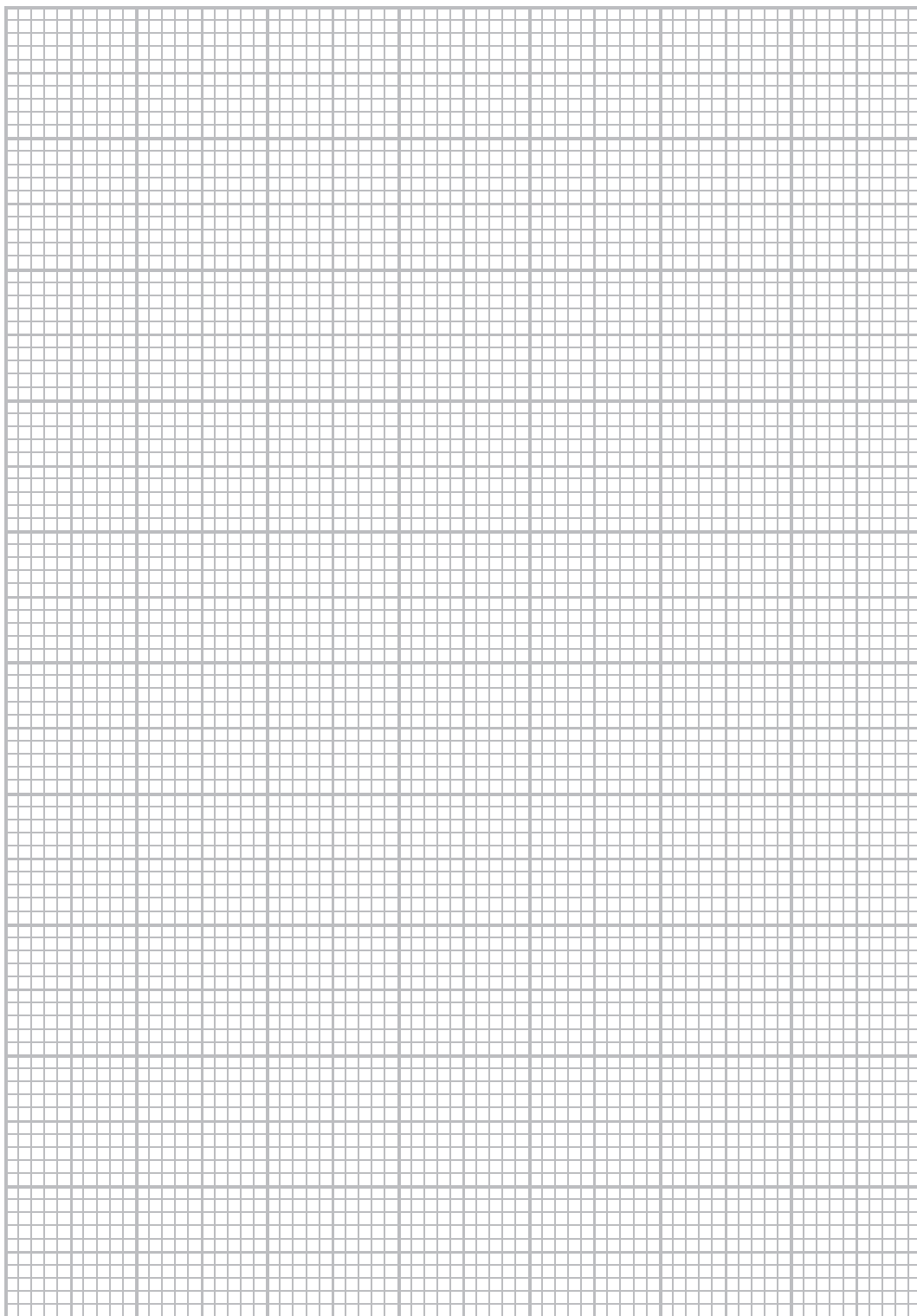
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- (e) Plot a graph of I on the y -axis against $\frac{1}{d^2}$ on the x -axis on the grid provided and draw a line of best fit.

(5)



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

(2)

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

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 | $E = \sigma/\epsilon$ 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

$$P = VI$$

$$P = I^2R$$

$$P = V^2/R$$

$$W = VIt$$

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

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

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

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



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