

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

Wednesday 11 May 2016 – Afternoon

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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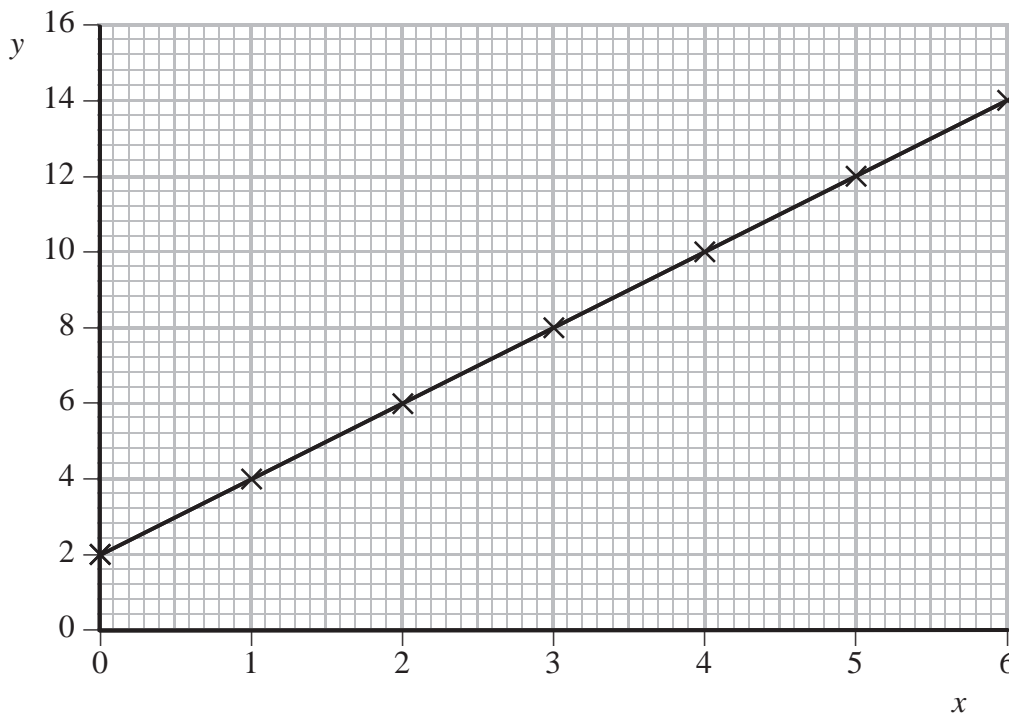

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SECTION A

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 The graph shows the results from an experiment.



Which statement about the two quantities is correct?

- A They are directly proportional.
- B They are inversely proportional.
- C There is a negative relationship.
- D There is a linear relationship.

(Total for Question 1 = 1 mark)

2 Which of the following is a derived SI quantity?

- A mass
- B pascal
- C second
- D velocity

(Total for Question 2 = 1 mark)

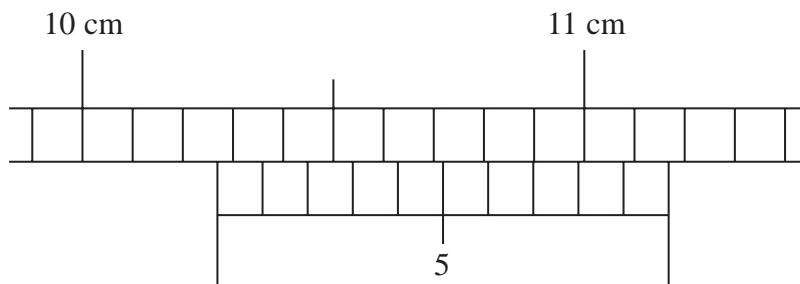
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3 A vernier scale is used to make a measurement.



Which is the correct reading of the scale in centimetres?

- A 10.27
- B 10.50
- C 10.70
- D 12.70

(Total for Question 3 = 1 mark)

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Questions 4 and 5 are about an experiment to measure the acceleration of free fall g .

During this experiment a football falls through a known distance s . The time of fall t is measured.

4 In the following equations the symbols have their usual meanings.
Which equation should be used to calculate g ?

A $s = \frac{1}{2}(u + v)t$

B $s = ut + \frac{1}{2}at^2$

C $v = u + at$

D $v^2 = u^2 + 2as$

(Total for Question 4 = 1 mark)

5 Three measurements of s are:

2.55 m 2.56 m 2.59 m

Which of the following should be stated as the average result?

A 2.56 m

B 2.566 m

C 2.567 m

D 2.57 m

(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's uncertainty in recording her reaction time was ± 0.03 s.
She recorded a reaction time of 0.38 s.

(a) What was the range of her measurements?

(1)

.....
.....

(b) Calculate the percentage uncertainty in her measurement.

(2)

.....
.....
.....

Percentage uncertainty = %

(c) The student plans to use a stopwatch to measure the time taken for a trolley to move down a slope. She estimates this time to be about 3 s.
Comment on her plan.

(2)

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.....

(Total for Question 6 = 5 marks)

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7 A student is asked to determine the refractive index of glass.

Write a plan for this experiment that uses a rectangular glass block, standard laboratory apparatus and a graphical method.

You should:

- (a) draw a labelled diagram of the apparatus to be used and list any additional apparatus needed, (2)
- (b) show on your diagram the quantities to be measured, (2)
- (c) explain your choice of measuring instrument for **one** of these quantities, (2)
- (d) comment on whether repeat readings are appropriate in this case, (1)
- (e) explain how to determine the refractive index, (3)
- (f) identify the main source of uncertainty and/or systematic error, (1)
- (g) comment on safety. (1)

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(Total for Question 7 = 12 marks)



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8 In an experiment to determine the resistivity of the material of a wire, a student measured the diameter of the wire to be 0.56×10^{-3} m.

(a) Describe how the student should measure the diameter of the wire.

(2)

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.....

(b) During this experiment, the student kept the current constant at 0.11 A and recorded the following results.

Length / m	Potential difference / V	Resistance / Ω
1.00	0.52	
0.80	0.41	
0.60	0.27	
0.40	0.19	
0.20	0.1	

(i) Criticise his results.

(2)

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(ii) Suggest how the student could keep the current constant.

(1)

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(iii) Complete the last column of the table.

(2)

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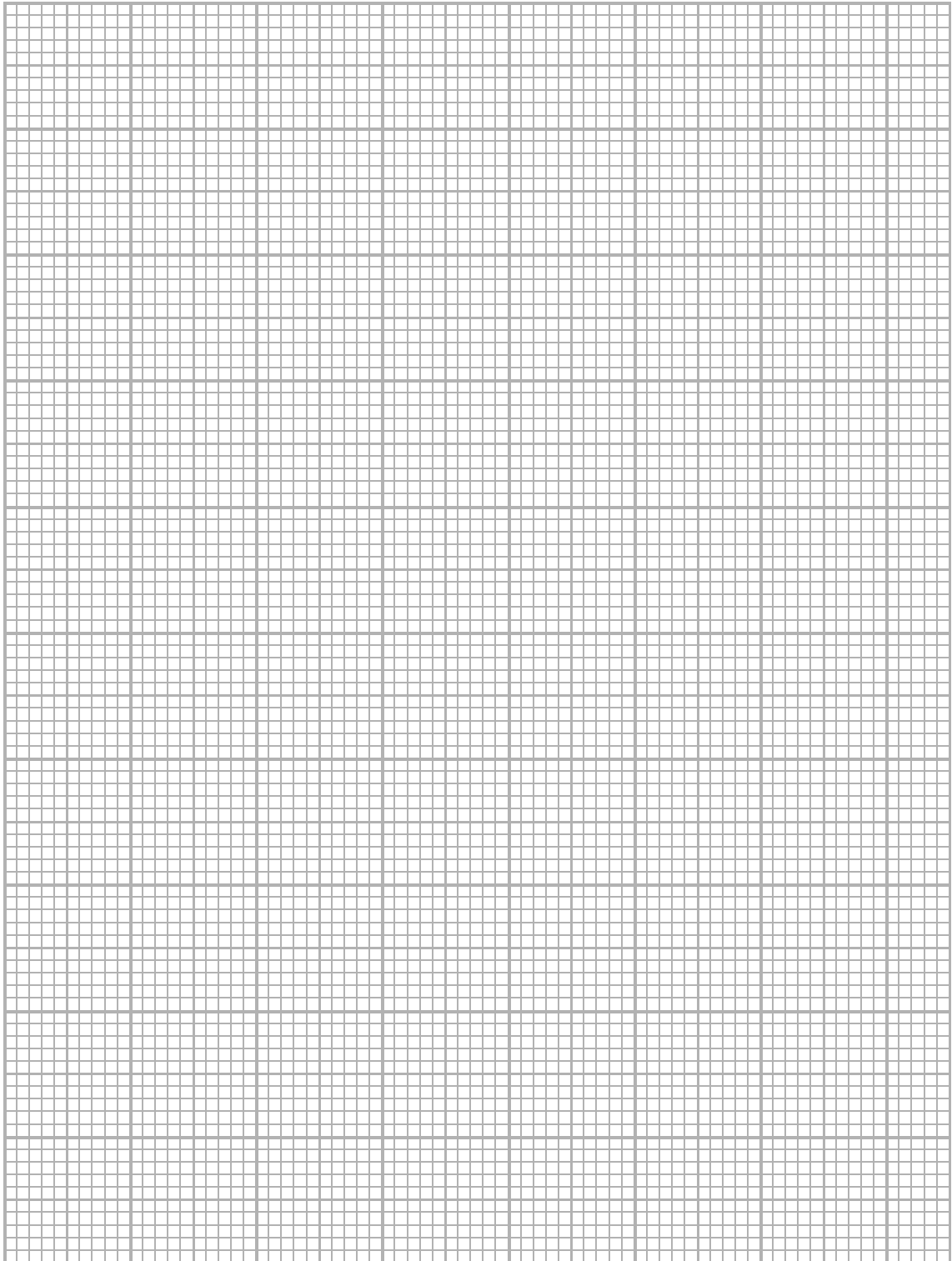
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- (c) (i) Plot a graph of resistance on the y -axis and length on the x -axis and draw a line of best fit.

(4)



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(ii) Determine the gradient of the graph.

(2)

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Gradient =

(iii) Use your value for the gradient to calculate a value for the resistivity.

(4)

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Resistivity =

(iv) There may be a difference between the value in (c)(iii) and the accepted value for the resistivity of the material of the wire.

Suggest why there may be a difference. You may assume that your calculations are correct.

(1)

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(Total for Question 8 = 18 marks)

TOTAL FOR SECTION B = 35 MARKS

TOTAL FOR PAPER = 40 MARKS

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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	$v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$
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Forces	$\Sigma F = ma$ $g = F/m$ $W = mg$
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Work and energy	$\Delta W = F\Delta s$ $E_k = \frac{1}{2}mv^2$ $\Delta E_{\text{grav}} = mg\Delta h$
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Materials

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