Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Physics

Advanced Subsidiary
Unit 3B: Exploring Physics
International Alternative to Internal Assessment

Wednesday 18 May 2011 – Afternoon
Time: 1 hour 20 minutes

Paper Reference
6PH07/01

You must have:
Ruler
Protractor

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 ☒.

A table tennis ball is dropped from a known height. It hits the ground and the height to which it rebounds is measured. The experiment is repeated.

Use the stem above for questions 1 and 2.

1 From this experiment which of the following equations could be used to calculate the velocity v just before the ball hits the ground?

☒ **A** $v = u + at$

☒ **B** $v^2 = u^2 + 2as$

☒ **C** $s = \frac{1}{2}(u + v)t$

☒ **D** $s = ut + \frac{1}{2}at^2$

(Total for Question 1 = 1 mark)

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2 Three measurements of the height of rebound are:

0.85 m, 0.86 m, 0.89 m

Which of the following should be stated as the mean height?

☒ **A** 0.86 m

☒ **B** 0.866 m

☒ **C** 0.867 m

☒ **D** 0.87 m

(Total for Question 2 = 1 mark)

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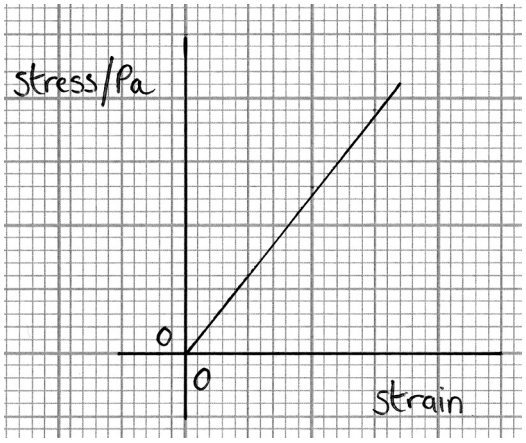
3 A group of students are investigating a new material. They have drawn the graph shown below.



Which of the following quantities could they find directly by calculating the area under the graph?

- ☒ **A** energy stored
- ☒ **B** energy stored per unit volume
- ☒ **C** ultimate stress
- ☒ **D** Young modulus

(Total for Question 3 = 1 mark)

4 The equation $R = \rho l/A$ is to be used to determine the resistivity ρ of the material of a wire.

Which of the following would **not** be needed?

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

(Total for Question 4 = 1 mark)

5 Which of the following is the correct unit for resistivity ρ?

- ☒ **A** Ω
- ☒ **B** Ω m
- ☒ **C** Ω m^{-1}
- ☒ **D** Ω m^{-2}

(Total for Question 5 = 1 mark)

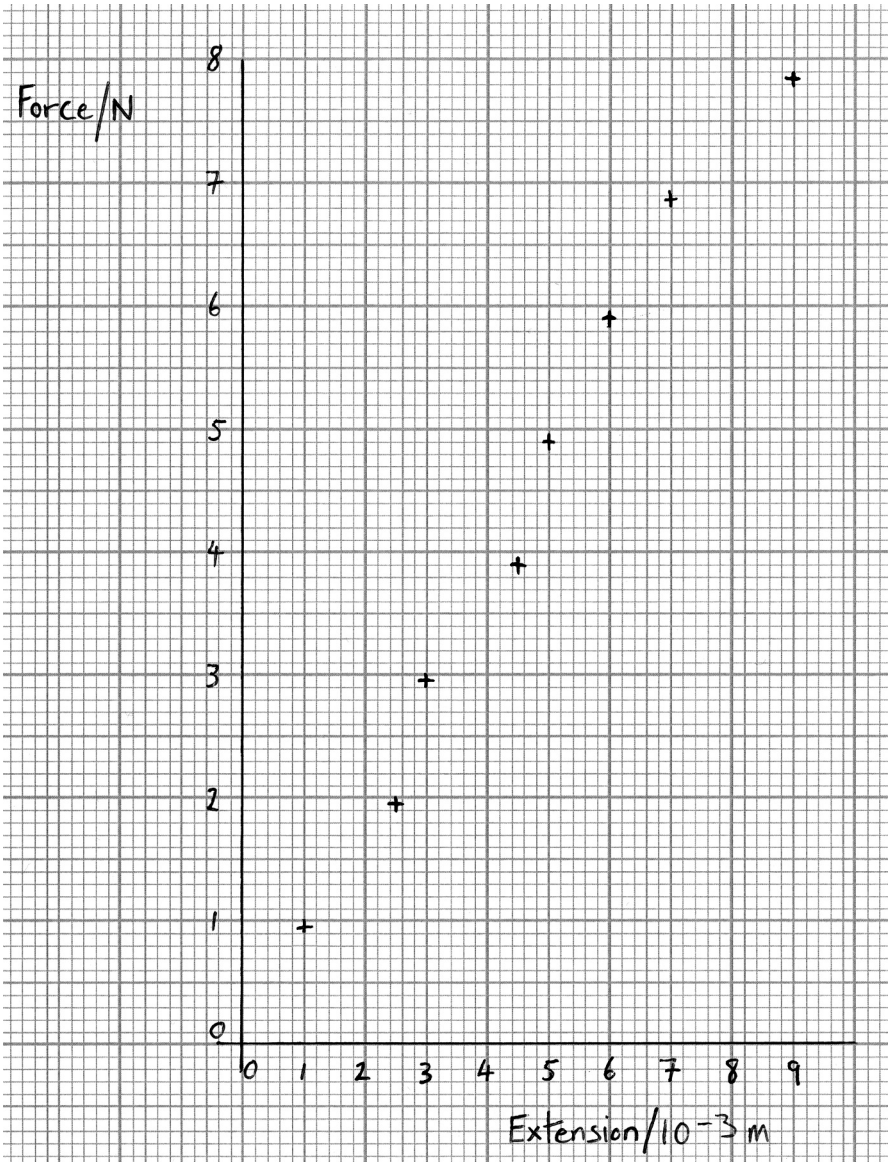
TOTAL FOR SECTION A = 5 MARKS

SECTION B

Answer ALL questions in the spaces provided.

6 A student's results and graph from an experiment to find the stiffness *k* of a material are shown below.

Mass / kg	Force	Extension / m
0.1	0.98	0.001
0.2	1.96	0.0025
0.3	2.94	0.003
0.4	3.92	0.0045
0.5	4.91	0.005
0.6	5.89	0.006
0.7	6.87	0.007
0.8	7.85	0.009



(a) Criticise the results.

(2)

(b) Draw in a line of best fit and comment on the relationship between force and extension shown by the graph.

(2)

(c) Use the graph to determine a value for *k*.

(3)

k = ...

(d) The material is in the form of a wire of length about two metres. State which **two** additional quantities should be measured to determine the Young modulus of the material. Suggest a suitable measuring instrument for each quantity.

(4)

.....

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.....

.....

.....

(Total for Question 6 = 11 marks)

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7 You are to plan an experiment to investigate the variation of the resistance of a negative temperature coefficient thermistor with temperature. You are to use a graphical method. Assume that standard laboratory apparatus is available.

Your answer should include:

(a) a labelled diagram of the apparatus to be used,

(1)

(b) a list of any additional apparatus required that is not shown in the diagram,

(1)

(c) the quantities to be measured,

(1)

(d) an explanation of your choice of measuring instrument for **two** of these quantities,

(4)

(e) which is the independent and which is the dependent variable,

(1)

(f) how the data collected will be used,

(1)

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

(1)

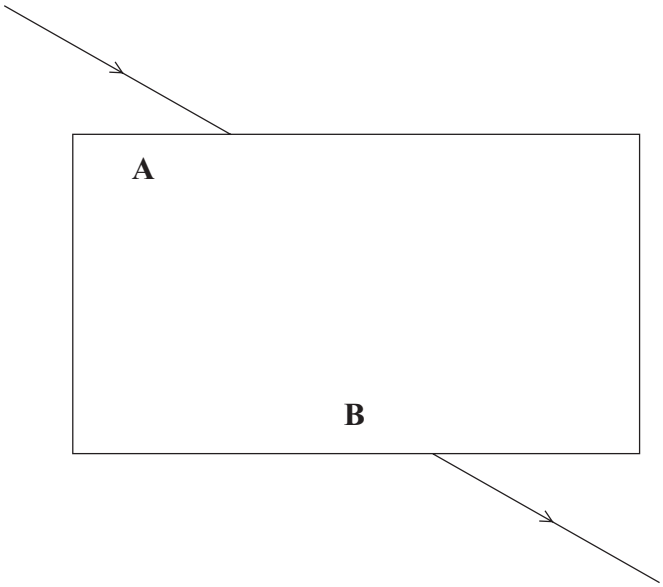
(h) a comment on safety.

(1)

(Total for Question 7 = 11 marks)

8 A student does an experiment to measure the refractive index μ for light travelling from air into a transparent material.

The student shines a ray of light through a rectangular block of the material. The paths of the incident and emergent rays are shown in the full size diagram below.



(a) On the diagram draw the path of the ray within the block.

(1)

(b) (i) By measuring appropriate angles at A and B determine an average value of μ.

You should show any construction lines and your measurements on the diagram.

Give your final answer to an appropriate number of significant figures.

(7)

μ = ...

(ii) By estimating the uncertainty in your measurement of the angles show that the uncertainty in the value of μ is about ± 0.05.

(2)

(c) Use your value for μ and the table below to identify the material of the block.

(1)

Material	Refractive index
Crown glass	1.612
Flint glass	1.578
Perspex	1.495
Polystyrene	1.591

The material is .....

(d) The student's teacher suggests that a graphical method could be used to increase the accuracy of the value of μ.

Describe how this could be done.

(2)

(Total for Question 8 = 13 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	$P = VI$ $P = I^2R$ $P = V^2/R$ $W = VIt$ $\%\ \text{efficiency} = \dfrac{\text{useful energy output}}{\text{energy input}} \times 100$ $\%\ \text{efficiency} = \dfrac{\text{useful power output}}{\text{power input}} \times 100$
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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