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

Friday 11 May 2012 – Morning
Time: 1 hour 20 minutes

Paper Reference
6PH07/01

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 3 9 8 5 7 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 A student is measuring the diameter of a piece of wire with a micrometer. Her readings are

0.27 mm, 0.29 mm, 0.26 mm, 0.42 mm, 0.26 mm.

Which of the following is the best mean value for the diameter of the wire, stated with a suitable uncertainty?

☒ **A** 0.30 ± 0.08 mm

☒ **B** 0.27 ± 0.08 mm

☒ **C** 0.27 ± 0.02 mm

☒ **D** 0.267 ± 0.015 mm

(Total for Question 1 = 1 mark)

2 Which of the following is a unit for viscosity?

☒ **A** $N\ m\ s^{-2}$

☒ **B** $N\ m^{-2}\ s^{-1}$

☒ **C** $N\ m^{-1}\ s^{-1}$

☒ **D** $N\ m^{-2}\ s$

(Total for Question 2 = 1 mark)

3 A student is asked to do an experiment to find the acceleration due to gravity using a simple pendulum. He is told to vary the length l and determine the time T for one oscillation.

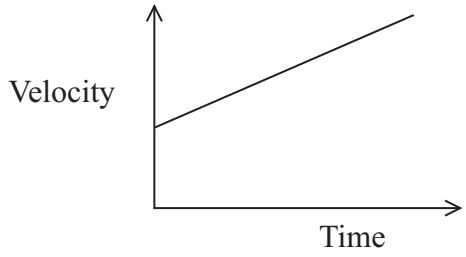
He is given the equation $T = 2\pi\sqrt{\frac{l}{g}}$ and told to draw a suitable graph.

Which of the following would give a straight line graph?

		***y*-axis**	***x*-axis**
☒	**A**	T	l
☒	**B**	T^2	$1/l$
☒	**C**	$\sqrt{T}$	l
☒	**D**	T^2	l

(Total for Question 3 = 1 mark)

Questions 4 and 5 refer to the graph below.



4 Which of the following would give the distance travelled?

- ☒ **A** area under the graph
- ☒ **B** gradient of the graph
- ☒ **C** intercept on the *x*-axis
- ☒ **D** intercept on the *y*-axis

(Total for Question 4 = 1 mark)

5 Which of the following would give the acceleration?

- ☒ **A** area under the graph
- ☒ **B** gradient of the graph
- ☒ **C** intercept on the *x*-axis
- ☒ **D** intercept on the *y*-axis

(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

SECTION B

Answer ALL questions in the spaces provided.

6 When doing experiments students are often advised to repeat readings and use a graphical method.

(a) Explain how repeating readings helps to improve reliability.

(2)

(b) Discuss the advantages of using a graph.

(3)

(Total for Question 6 = 5 marks)

7 A student is asked to determine the emf and internal resistance of a 1.5 V cell. Write a plan for an experiment which could be used to do this using standard laboratory apparatus and a graphical method.

You should:

(a) draw a diagram of the circuit to be used, **(2)**

(b) state the quantities to be measured, **(1)**

(c) for **two** of these quantities state and explain your choice of measuring instrument, **(4)**

(d) explain how the data collected will be used to find the emf and the internal resistance, **(3)**

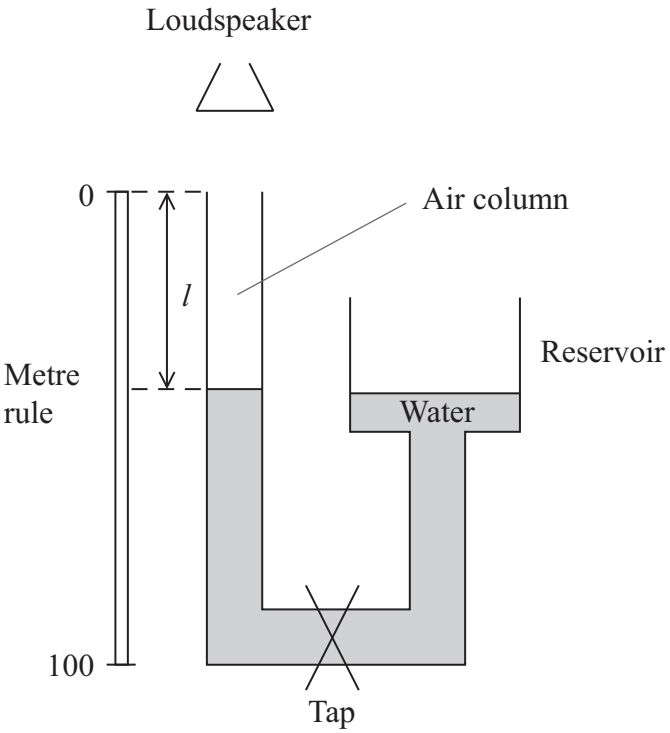
(e) identify the main sources of uncertainty and/or systematic error, **(2)**

(f) comment on safety. **(1)**

(Total for Question 7 = 13 marks)

8 A student determines the speed of sound using standing waves in an air column.

A diagram of the apparatus is shown.



He moves the reservoir up and down to change the length l of the air column.

When a standing wave is formed a louder sound is heard. He records the readings on the metre rule when this happens.

Reading on metre rule /mm	36	192	356	516

(a) Criticise these results.

(2)

(b) The distance between successive readings on the metre rule should be half the wavelength.

Calculate a mean value for the wavelength of the sound with a suitable uncertainty.

(4)

Wavelength = ... ± ..... mm

(c) Use your value of the mean wavelength to calculate a value for the velocity of sound in air.

The frequency of the sound is 1024 Hz.

(2)

Velocity = ...

(Total for Question 8 = 8 marks)

9 A student is investigating the energy stored in a stretched spring. She hangs weights on the end of the spring and measures the length of the spring. Her results are shown below.

Force / N	Length of spring / mm	
0.00	400	
0.20	416	
0.40	432	
0.60	448	
0.80	455	
1.20	487	
1.60	520	

(a) On the grid opposite plot a graph of force on the *y*-axis against extension on the *x*-axis.

Use the blank column in the table for your processed data.

(5)

(b) Use your graph to determine the energy stored in the stretched spring when it is extended by 100 mm. Show all your working.

(4)

.....

.....

.....

.....

.....

.....

Energy stored in spring = ... J

(Total for Question 9 = 9 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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