Write your name here

Surname	Other names

Edexcel GCE

Centre Number	Candidate Number

Physics

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

Tuesday 8 January 2013 – 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 4 1 6 3 3 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 Which of the following is the SI derived unit for frequency?

☒ **A** m

☒ **B** Hz

☒ **C** s

☒ **D** Pa

(Total for Question 1 = 1 mark)

2 A graph is plotted with velocity on the *y*-axis and time on the *x*-axis. Which of the following would represent the distance travelled?

☒ **A** area under the graph

☒ **B** gradient of the graph

☒ **C** intercept with the *y*-axis

☒ **D** intercept with the *x*-axis

(Total for Question 2 = 1 mark)

3 In an experiment to measure the breaking stress of a wire, the diameter of the wire is measured with a micrometer.

Which of the following procedures would **not** be good practice?

☒ **A** checking for zero errors

☒ **B** repeating the reading three times

☒ **C** rotating the micrometer between readings

☒ **D** using a second piece of the wire to check the diameter

(Total for Question 3 = 1 mark)

4 The diameter of a ball bearing is measured four times.
The measurements are 0.27 mm, 0.29 mm, 0.25 mm, 0.26 mm.

How should the average value be stated?

☒ **A** 0.2675 mm

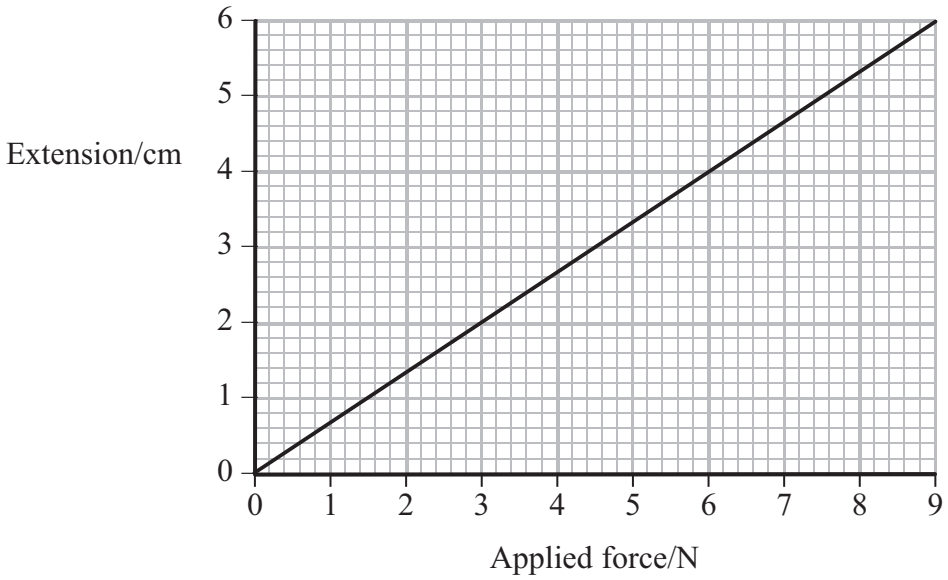
☒ **B** 0.268 mm

☒ **C** 0.27 mm

☒ **D** 0.3 mm

(Total for Question 4 = 1 mark)

5 The graph shows how extension varies with applied force for a spring.



Which of the following is the energy stored in the spring, in joules, when it is extended by 6 cm?

☒ **A** 54 J

☒ **B** 27 J

☒ **C** 0.54 J

☒ **D** 0.27 J

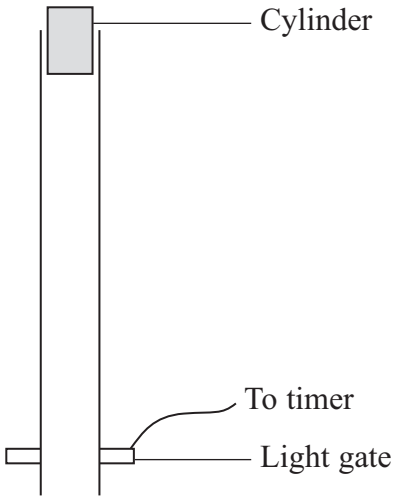
(Total for Question 5 = 1 mark)

TOTAL FOR SECTION A = 5 MARKS

SECTION B

Answer ALL questions in the spaces provided.

6 In an experiment to determine the acceleration of free fall, a metal cylinder is dropped from rest down a glass tube. A light gate is positioned close to the outside of the glass tube.



The light gate measures the time taken for the cylinder to pass through it. This time t is used to calculate the velocity of the cylinder at a distance s from the top of the tube.

(a) The student varies the position of the light gate and records t for different values of s.

Suggest what the student should do to obtain accurate values for t.

(2)

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(b) The student needs to determine the velocity v of the cylinder as it passes through the light gate.

(i) State what additional measurement she needs to make. You may add to the diagram if you wish.

(1)

.....

.....

(ii) State how she would use her measurements to calculate v.

(1)

.....

.....

(c) To determine g, the student uses the equation $v^2 = u^2 + 2as$.

Explain why a graph of v^2 on the y-axis and s on the x-axis should be a straight line through the origin.

(3)

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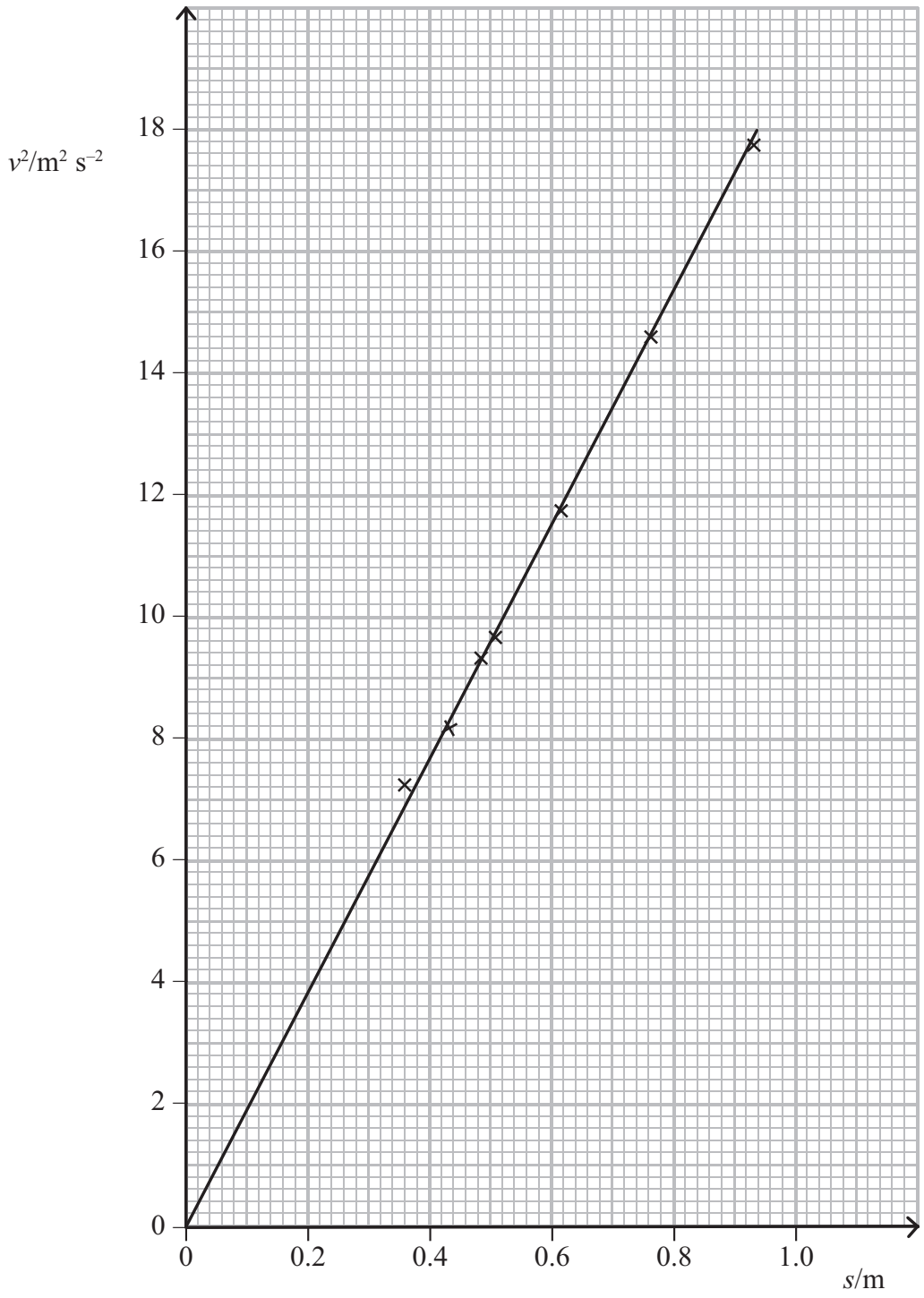
(d) Use the student's graph below to find a value for g.

(2)



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g = ... m s^{-2}

(e) The student's value of g is less than the accepted value of 9.81 m s^{-2}.

Suggest why.

(1)

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(Total for Question 6 = 10 marks)

7 A manufacturer states that a solar cell gives an output of 5 V and 100 mA. An experiment is to be carried out to check the e.m.f. and determine the internal resistance of the cell.

Write a plan for this experiment using standard laboratory apparatus and a graphical method for analysing the data.

You should:

(a) draw a diagram of the circuit to be used and list any additional apparatus that might be required,

(2)

(b) state the quantities to be measured,

(1)

(c) for each of these quantities, state and explain your choice of measuring instrument,

(4)

(d) explain how the data collected will be used to determine the e.m.f. and the internal resistance,

(3)

(e) identify and state how to control all other relevant variables to make it a fair test,

(2)

(f) identify the main sources of uncertainty and/or systematic error,

(1)

(g) comment on safety.

(1)

(Total for Question 7 = 14 marks)

8 A group of students is asked to determine the unknown concentration of a sugar solution by measuring the rotation of the plane of polarisation. The students have taken the following measurements using known concentrations of sugar solution.

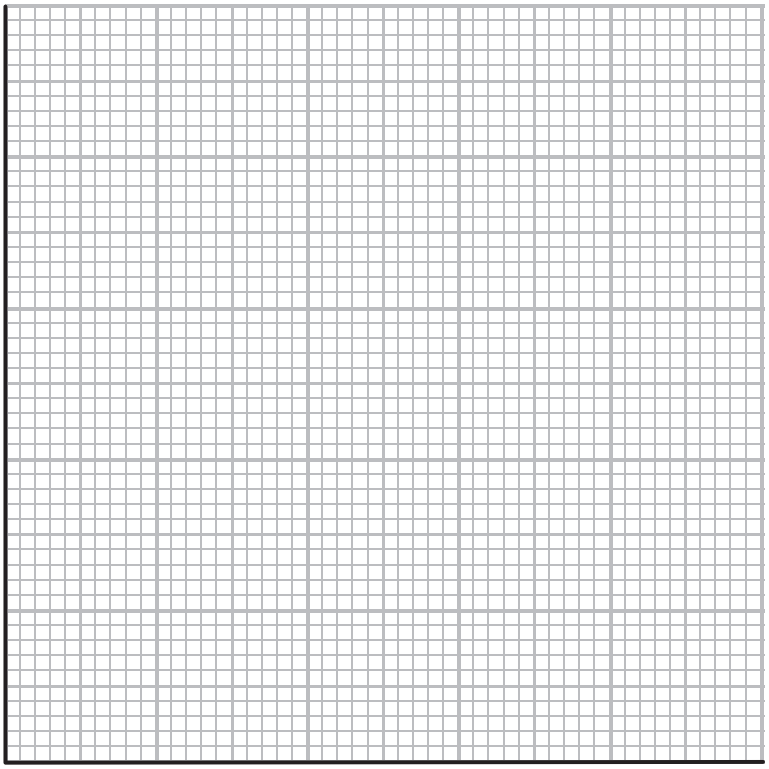
Concentration of sugar solution / %	Angle of rotation of the plane of polarisation / °
0	0
20	16
33	26
43	34

(a) Criticise these measurements.

(3)

(b) Plot a graph of the angle of rotation of the plane of polarisation against the concentration of sugar solution.

(6)



(c) The students measure the angle of rotation for the unknown concentration of sugar solution as 20°.

Use your graph to determine a value for this concentration.

(2)

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(Total for Question 8 = 11 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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