

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**

Thursday 9 May 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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**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 correct unit for resistivity?

- A  $\Omega$
- B  $\Omega \text{ m}$
- C  $\Omega \text{ m}^{-1}$
- D  $\Omega \text{ m}^{-2}$

(Total for Question 1 = 1 mark)

2 In an experiment to find the resistivity of a wire, the following three measurements of the diameter were recorded.

0.71 mm, 0.72 mm, 0.69 mm

How should the average measurement be stated?

- A  $(7.06 \pm 0.13) \times 10^{-3} \text{ m}$
- B  $(7.1 \pm 0.2) \times 10^{-3} \text{ m}$
- C  $(7.06 \pm 0.13) \times 10^{-4} \text{ m}$
- D  $(7.1 \pm 0.2) \times 10^{-4} \text{ m}$

(Total for Question 2 = 1 mark)

3 A falling ball is used in an experiment to determine the acceleration of free fall.

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

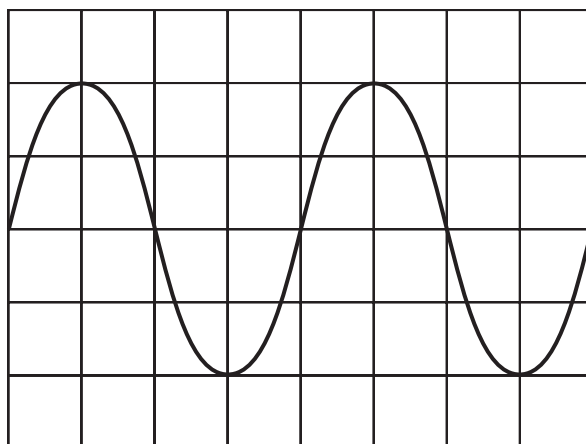
- A distance fallen
- B initial velocity
- C mass of the ball
- D time taken

(Total for Question 3 = 1 mark)



4 A computer screen is used to display a sound wave. On the horizontal axis 1 division represents 1 ms.

What is the frequency of the wave?

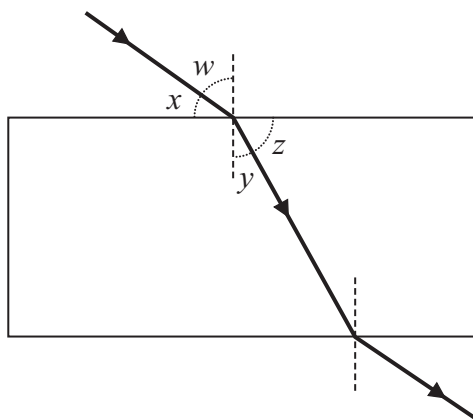


- A 100 Hz
- B 250 Hz
- C 500 Hz
- D 1000 Hz

(Total for Question 4 = 1 mark)



- 5 The refractive index of glass can be found by tracing a ray of light through a block of glass.



A student uses the equation  ${}_1\mu_2 = \frac{\sin i}{\sin r}$  to calculate the refractive index.

Which of the following pairs of angles could the student measure and substitute directly into the equation?

- A  $x$  and  $y$
- B  $x$  and  $z$
- C  $w$  and  $y$
- D  $w$  and  $z$

(Total for Question 5 = 1 mark)

**TOTAL FOR SECTION A = 5 MARKS**



**SECTION B**

**Answer ALL questions in the spaces provided.**

**6** Two students are given 10 coins of the same type, a metre rule measuring in millimetres and a micrometer screw gauge. The diameter of each coin is approximately 20 mm.

They are asked to determine the best value for the diameter of one coin. Student A says that it is better to measure the diameter of just one coin using the micrometer. Student B suggests that they put the coins in a straight line and use the metre rule.

Discuss the advantages and disadvantages of each method. You should refer to uncertainties in your answer.

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**(Total for Question 6 = 4 marks)**

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7 A student is asked to determine the spring constant of a spiral spring.

Write a plan for an experiment to do this using standard laboratory apparatus and a graphical method.

You should:

- (a) draw a labelled diagram of the experimental set-up to be used, (2)
- (b) list any additional apparatus you might need, (1)
- (c) state what quantity is the independent variable and what quantity is the dependent variable, (2)
- (d) describe how you would take your measurements and explain your choice of measuring instruments, (4)
- (e) explain how the data collected will be used to find the spring constant, (2)
- (f) identify the main sources of uncertainty and/or systematic error, (1)
- (g) comment on safety. (1)

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(Total for Question 7 = 13 marks)



- 8 A school experiment to find an approximate value for the Planck constant  $h$  uses light emitting diodes (LEDs) of different colours.

The results from one such experiment are shown in the table. The wavelengths  $\lambda$  are taken from the data provided by the manufacturer of the diodes. The potential difference  $V$  is measured across the LED when it just lights.

$\lambda$ /nm	$V$ /V	$\lambda^{-1}$
630	1.06	1.59
610	1.11	1.64
595	1.12	1.68
570	1.24	
465	1.64	
400	1.92	

- (a) Complete the final column of the table with the missing unit and values.

(3)

- (b) The equation used for the experiment is derived from

$$eV = hf$$

where  $f$  is the frequency of the light emitted by the LED.

Explain why a graph of  $V$  on the  $y$ -axis against  $1/\lambda$  on the  $x$ -axis should be a straight line and show that the gradient of the line will be  $hc/e$ .

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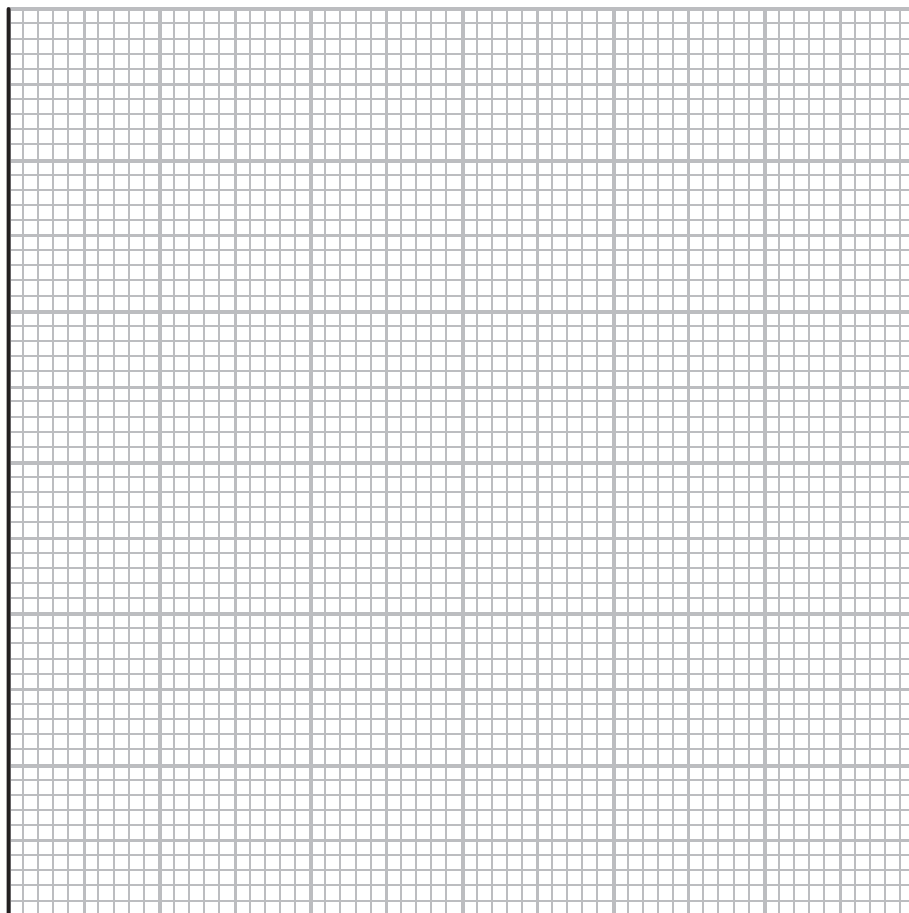
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(c) Plot the graph on the grid provided and draw a line of best fit.

(5)



**TURN OVER FOR QUESTION 8(d).**



(d) Use your graph to find a value for the gradient and use it to calculate a value for  $h$ .

(6)

$h =$  .....



(e) The accepted value for  $h$  is  $6.63 \times 10^{-34}$  J s.

Assuming your calculations are correct, suggest why there is a difference between your value for  $h$  and the accepted value.

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**(Total for Question 8 = 18 marks)**

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**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

$$P = VI$$
$$P = I^2R$$
$$P = V^2/R$$
$$W = VI t$$

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

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

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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