Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Education
January 2008
Advanced Subsidiary Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS (SPECIFICATION B) **PHB3**
Unit 3 Practical

Wednesday 16 January 2008 1.30 pm to 3.30 pm

For this paper you must have:
- a calculator
- A4 graph paper
- a ruler
- a protractor.

Time allowed: 2 hours

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided. A separate sheet of graph paper is required for Question 3. Attach your graph to this book before handing it to the invigilator at the end of the examination.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 78.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- Questions 1(c)(i) and (ii) and 2(b)(ii) and (iii) should be answered in continuous prose. In these questions you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

Advice
- You are allowed 30 minutes for each of Questions 1 and 2, and one hour for Question 3.
- Before commencing the first part of any question, read the question through completely.

For Examiner's Use			
Question	Mark	Question	Mark
1			
2			
3			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

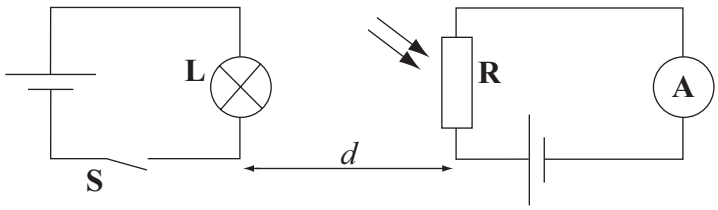
Answer **all** questions in the spaces provided.

You are allowed 30 minutes for this question.

1 You are going to consider how a light dependent resistor (LDR) is affected by light from a lamp.

(a) The circuits for the LDR **R** and lamp **L** shown in **Figure 1** have been connected for you.

Figure 1



(i) With the switch **S** open, record a value for the ammeter reading under normal background lighting conditions.
The distance between **R** and **L** is *d*.

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(ii) Close **S** and determine the ammeter readings, *I*, corresponding to values of *d* of 10 mm and 40 mm. Complete the table below.
Do **not** repeat your readings.

***d*/mm**	***I***
10	
40	

(iii) Explain how you ensured that the distances for *d* were the values shown in the table.

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(5 marks)

(b) Use a non-graphical method to test whether or not your data support the relationship $I \propto \frac{1}{d^2}$.

State and explain the outcome of your test.

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(3 marks)

(c) With a colour filter placed between the lamp and the LDR, you might expect the readings on the ammeter to decrease when compared with the experiment that you have performed. One variable which would be expected to affect the readings would be the thickness of the filter.

Two of the 10 marks in parts (c)(i) and (c)(ii) are available for the quality of your written communication.

(i) Suggest another factor, **other than** the thickness of the filter **or** the separation between the lamp and the LDR, which would be expected to affect the ammeter reading. Explain clearly how varying this factor would affect the ammeter reading.

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Question 1 continues on the next page

(ii) Describe how you would investigate the relationship between the thickness of a coloured filter and the ammeter reading.
Your description should include:

- improvements that you would make compared with the apparatus used in part (a)
- how you would measure the thickness of the filter with suitable precision
- a statement of any variables that you would control
- how you would display your results
- the likely outcome of your experiment.

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(10 marks)

18

You are allowed 30 minutes for this question.

2 You are going to consider the toppling of rectangular plywood tiles.

(a) (i) Using the ruler provided, measure the dimensions of a tile in cm and hence calculate its volume.

(ii) Estimate the absolute uncertainty in the length of each side of a tile.

(iii) Calculate the percentage uncertainty in the volume of the tile.

(iv) Taking the density of the plywood to be $(0.75 \pm 0.05)\,\mathrm{g\,cm^{-3}}$, calculate the mass of the tile.

(v) Calculate the percentage uncertainty in the mass of the tile.

(9 marks)

Question 2 continues over the page

(b) Two of the 9 marks in this question are available for the quality of your written communication.

Figure 2

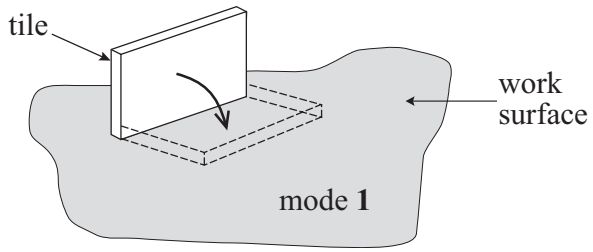
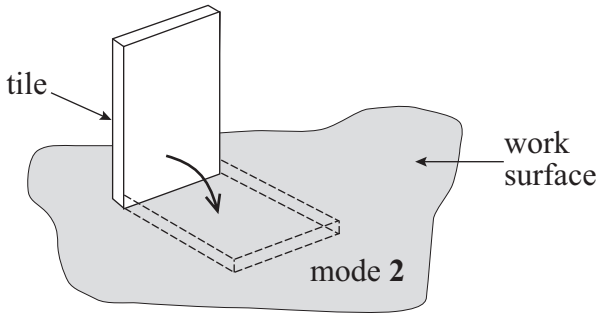


Figure 3



(i) A single tile can be balanced on a long edge or a short edge and toppled onto the work surface by giving the top of the tile a small push.
Calculate the maximum kinetic energy of the tile falling from a long edge as shown in **Figure 2**. This way of falling is called mode **1**.

gravitational field strength, $g = 9.8\,\text{ms}^{-2}$

(ii) Mode **2** falling occurs when a tile topples from one of its shorter edges as shown in **Figure 3**.

Without performing further calculations, state and explain how the maximum kinetic energy of a tile toppling in mode **2** compares with that in mode **1**.

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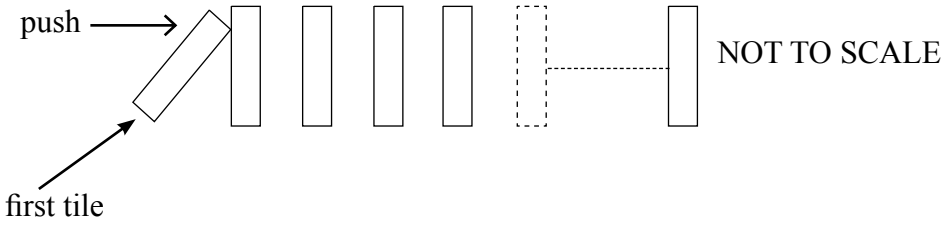
(iii) Consider a series of tiles lined up at 20 mm spacing and being made to topple in each of modes **1** and **2** as shown in **Figure 4**.

Figure 4



Suggest reasons why one of the modes would result in energy travelling along the series of tiles at a higher rate than the other mode.

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(9 marks)

(c) (i) You have been provided with a sheet of paper with lines drawn at 20 mm intervals. Place 14 tiles with the front of their edges on the lines. Measure the time taken for energy to pass through the series of tiles when they topple in each of modes **1** and **2**.

(ii) Comment on the consistency of your results with your suggestion in part (b)(ii).

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(3 marks)

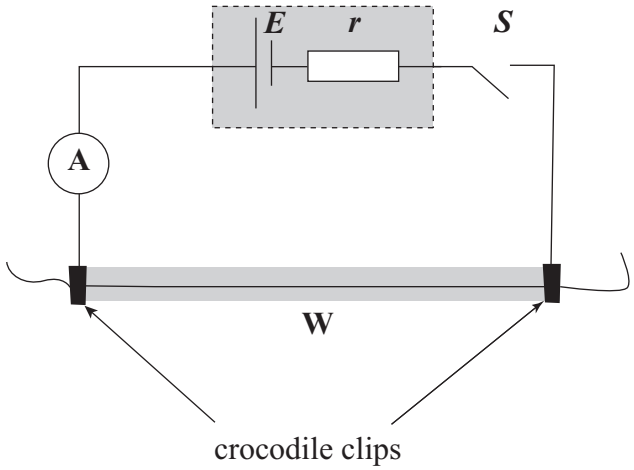
21

You are allowed one hour for this question.

3 You are to take measurements which will allow you to measure the emf E and internal resistance r of a cell modified by the addition of a resistance as shown in **Figure 5**.

(a) Connect the circuit shown in **Figure 5**. **W** is a length of wire mounted on a half-metre ruler. Make sure that the switch **S** is open and that the length of wire between the crocodile clips is 50 cm.

Figure 5



(b) Now close the switch and record, in mA, the reading on the ammeter. *(3 marks)*

(c) You are going to investigate how the current I varies with the length of wire L in the circuit. In the space on **page 9** construct a table in which to record your results. This should include columns for the length L in metres, the current I in milliamps and $\frac{1}{I}$.

You should include a suitable unit for $\frac{1}{I}$.

(5 marks)

(d) Take and record in your table a series of readings of L and I. Complete your table by calculating and recording values of $\frac{1}{I}$. *(12 marks)*

(e) Plot a graph of L (y-axis) against $\frac{1}{I}$ (x-axis).

Start the L axis from the origin but use a false origin for the $\frac{1}{I}$ axis.

Draw the best straight line through your plotted points. *(8 marks)*

Question 3 continues on the next page

(f) Calculate the gradient of your best straight line.

(3 marks)

(g) For the circuit, E and r are related to L and I by the equation

$$L = \left(\frac{E}{k}\right)\frac{1}{I} - \frac{r}{k}$$

where k is a constant of magnitude 10.0.

(i) Suggest a suitable unit for k.

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(ii) By comparing this equation with the general equation of a straight line graph, $y = mx + c$, calculate values for E and r.

(8 marks)

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END OF QUESTIONS

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