

Centre Number						Candidate Number					
Surname						Other Names					
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<b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.											
Candidate Signature						Date					

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Section	Mark
Section A Part 1 Q1	
Section A Part 1 Q2	
Section A Part 2 Q1	
Section B Q1	
Section B Q2	
Section B Q3	
TOTAL	



General Certificate of Education  
Advanced Subsidiary Examination  
June 2012

# Physics (Specifications A and B)

## PHA3/B3/X

**Unit 3 Investigative and Practical Skills in AS Physics**  
**Route X Externally Marked Practical Assignment (EMPA)**

### Section B Written Test

<p><b>For this paper you must have</b></p> <ul style="list-style-type: none"> <li>your completed Section A Part 2 question paper / answer booklet.</li> <li>a ruler</li> <li>a pencil</li> <li>a calculator.</li> </ul>	<p><b>Instructions</b></p> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.</li> <li>Show all your working.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul>
<p><b>Time allowed</b></p> <ul style="list-style-type: none"> <li>1 hour 15 minutes</li> </ul>	<p><b>Information</b></p> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>The maximum mark for this paper is 24.</li> </ul>
<p><b>Details of additional assistance (if any).</b> Did the candidate receive any help or information in the production of this work? If you answer yes, give the details below or on a separate page.</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p>	

<p><b>Practical Skills Verification</b> Teacher Declaration: I confirm that the candidate has met the requirement of the practical skills verification (PSV) in accordance with the instructions and criteria in section 3.8 of the specification.</p>	<p>Yes <input type="checkbox"/></p>
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Signature of teacher ..... Date .....

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**Section B**

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

Time allowed is 1 hour 15 minutes.

You will need to refer to the work you did in Section A Part 2 when answering these questions.

- 1 (i) Determine the gradient,  $G$ , of your graph.

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$$G = \dots\dots\dots$$

(2 marks)

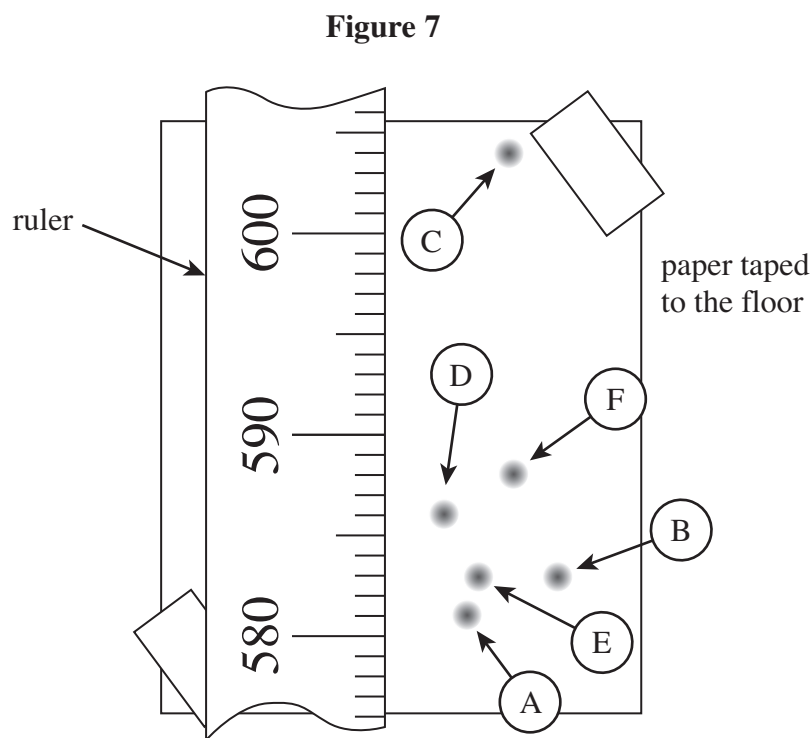
- 1 (ii) Calculate  $\frac{G^2(H-h)}{H}$ .

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$$\frac{G^2(H-h)}{H} = \dots\dots\dots$$

(2 marks)

- 2 **Figure 7** shows the impact marks (labelled A to F) produced on a piece of paper, taped to the floor, as a student attempts to make a measurement of  $x_1$ .



The six marks were produced by successive impacts of the same ball bearing which was released, on each occasion, from the **same point** on the track and at the **same height** above the bench. The ruler shown in **Figure 7** was then placed over the piece of paper and the zero graduation of the ruler was positioned level with a point marked on the floor, directly below the end of the track.

- 2 (i) Explain how, in your experiment, you located the point on the floor, directly below the end of the track.

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.....  
(1 mark)

- 2 (ii) Suggest why impact mark C is isolated from the other five impact marks.

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.....  
(1 mark)

- 2 (iii) Using the information in **Figure 7**, state and explain the measurement of  $x_1$  that should be recorded by the student.

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(3 marks)

- 2 (iv) Calculate the uncertainty in the student's result for  $x_1$ . Show your working.

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(2 marks)

Turn over for the next question



Turn over ►

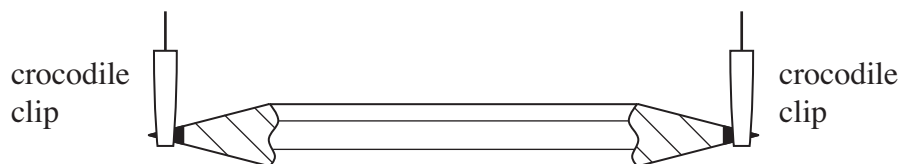
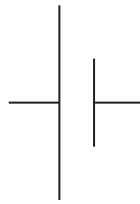
- 3 The electrically conductive surfaces of the paper you used in Section A Part 1 have a coating of paint containing a form of carbon (graphite) similar to that used in pencils.

Using a pencil as part of a circuit containing a single 1.5 V cell, a student designs an experiment to find out more about the electrical properties of graphite.

- 3 (a) Complete **Figure 8** to show the external circuit that the student should use to investigate the current – potential difference (pd) characteristic of the graphite used in the pencil.

**Figure 8**

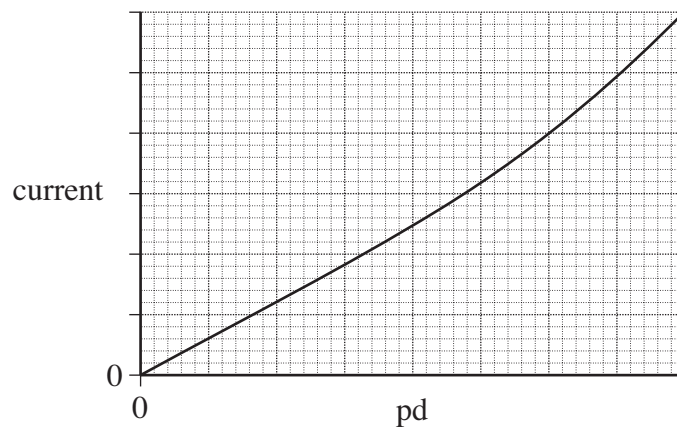
single 1.5 V cell



(2 marks)

The experimental results are displayed in **Figure 9**.

**Figure 9**



- 3 (b) With reference to **Figure 9**, explain how the resistance of the graphite is affected by temperature.

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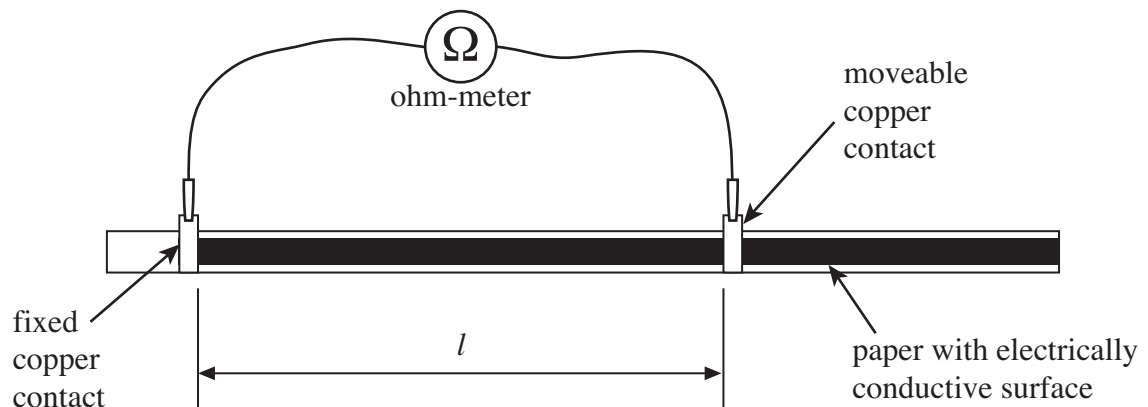
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(3 marks)

Using the equipment used in Section A Part 1, the student then carries out measurements on one strip of the paper with the electrically conductive surface. By using the moveable contact shown in **Figure 10**, the student investigates how  $l$ , the length of the strip, affects the ohm-meter reading.

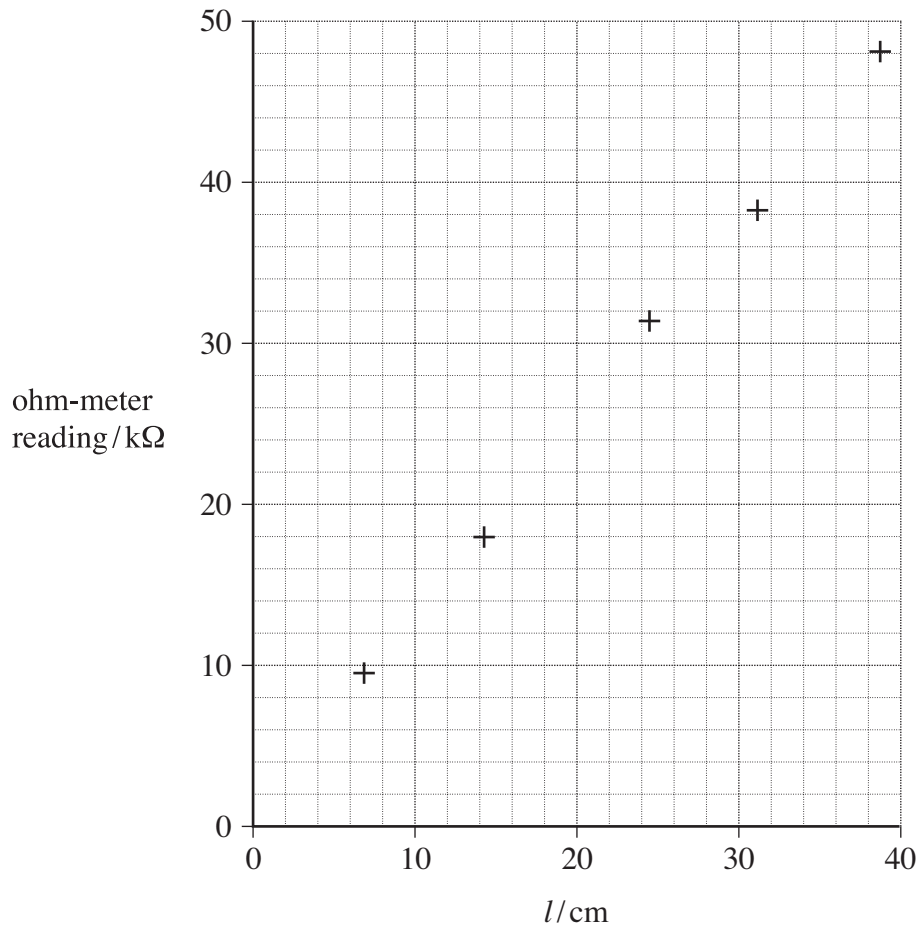
**Figure 10**



Turn over ►

The experimental results are displayed in **Figure 11**.

**Figure 11**



- 3 (c)** Use **Figure 11** to determine the resistance per metre of the strip. Show your working.

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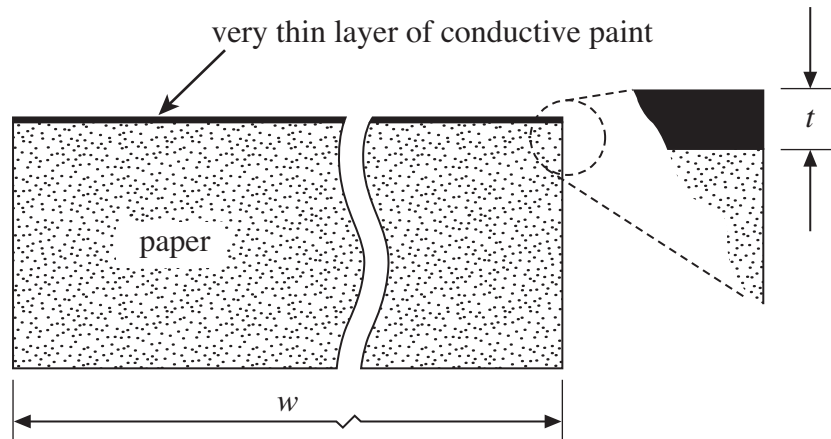
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(3 marks)

**Figure 12** shows a cross-sectional view of the strip; the conductive layer of graphite paint is of uniform thickness =  $t$  and the width of the paper strip =  $w$ .

**Figure 12**



- 3 (d) Show that  $\frac{R}{l} = \frac{\rho}{wt}$ , where  $\frac{R}{l}$  = resistance per unit length of the strip and  $\rho$  = resistivity of graphite.

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(2 marks)

- 3 (e) Describe how  $w$ , the width of the conductive paper strip, can be measured and explain how your procedure reduces uncertainty in the result.

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(3 marks)

**END OF QUESTIONS**

**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**