Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

Candidate Declaration. 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	

For Examiner's Use	
Examiner's Initials	
Section	Mark
Section A Part 1	
Section B Part 2	
Section B	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2011

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

For this paper you must have	Instructions
• your completed Section A Part 2 question paper / answer booklet. • a ruler • a pencil • a calculator.	• Use black ink or black ball-point pen. • Fill in the boxes at the top of this page. • Answer **all** questions. • You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages. • Show all your working. • Do all rough work in this book. Cross through any work you do not want to be marked.
Time allowed • 1 hour 15 minutes	**Information** • The marks for questions are shown in brackets. • The maximum mark for this paper is 24.

Details of additional assistance (if any). 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.

Yes ☐ No ☐

Practical Skills Verification 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.	**Yes** ☐

Signature of teacher ..... Date .....

Section B

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

The 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 (a) Use your graph to determine

1 (a) (i) V_0, the voltmeter reading, where $x = 0$ mm,

V_0 = ...

1 (a) (ii) V_{280}, the voltmeter reading where $x = 280$ mm,

V_{280} = ...

1 (a) (iii) x_0, the value of x in mm, when $V = 0$.

x_0 = ... mm

(2 marks)

1 (b) (i) Determine the gradient, G, of your graph, where $x = 200$ mm.

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.....

.....

G = ...

1 (b) (ii) Evaluate $\dfrac{G(280 - x_0)}{V_{280} - V_0}$

.....

.....

.....

$\dfrac{G(280 - x_0)}{V_{280} - V_0}$ = ...

(4 marks)

6

2 Suppose that you repeated the experiment using a supply with a lower emf.

2 (a) State the effect, if any, this change will have on

2 (a) (i) your value of G,

.....

2 (a) (ii) your value of $\frac{V_{260}}{V_{20}}$.

.....

(2 marks)

2 (b) Explain the reasoning behind your answers to part (a).

.....

.....

.....

(1 mark)

3

3 (a) State without explanation how you could determine from your graph the value of x at which the width of the conductive paper changes.

.....

.....

(1 mark)

3 (b) Student A claims that to reduce the uncertainty in the value of x at which the width of the conductive paper changes, it would be a good idea to take more readings around that point.
Student B says it is better to make sure that there are enough readings so that both straight line regions can be accurately plotted.
Explain which student has the better argument.

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(2 marks)

3

4 In Section A Part 1 you measured the diameter of a wire using a micrometer screw gauge.

4 (i) Suggest a possible source of random error in this measurement.

.....

.....

4 (ii) Describe and explain a procedure that can be followed that may reduce the effect of the source of random error you identified in part (i).

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4 (iii) Suggest a procedure that can be followed that may reduce the effect of systematic error in the determination of the diameter.

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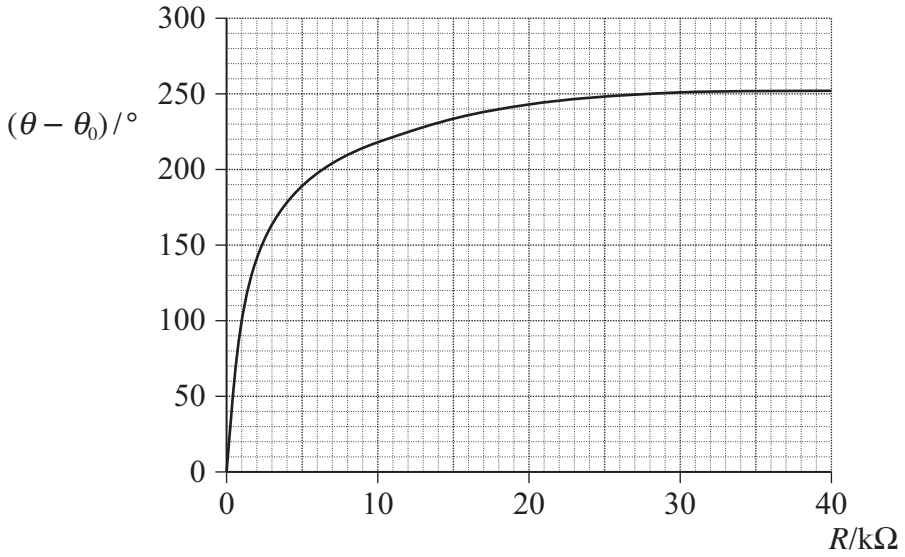
(4 marks)

4

5 In Section A Part 1 you were asked to record the position, θ, of the control knob against a scale when the voltmeter read zero and then to plot a graph from which the resistance, R_U, of an unknown resistor was determined.
A student who has carried out this experiment produces the graph shown in **Figure 5**.

Figure 5



The student estimates that the uncertainty in each reading of θ is ± 1.5°.

5 (i) State the uncertainty in the calculated values of $(\theta - \theta_0)$.

.....

5 (ii) Hence explain why the student would find it difficult to use **Figure 5** to make an accurate determination of R_U if the resistance was approximately 25 kΩ.
You may add detail to **Figure 5** to illustrate your answer.

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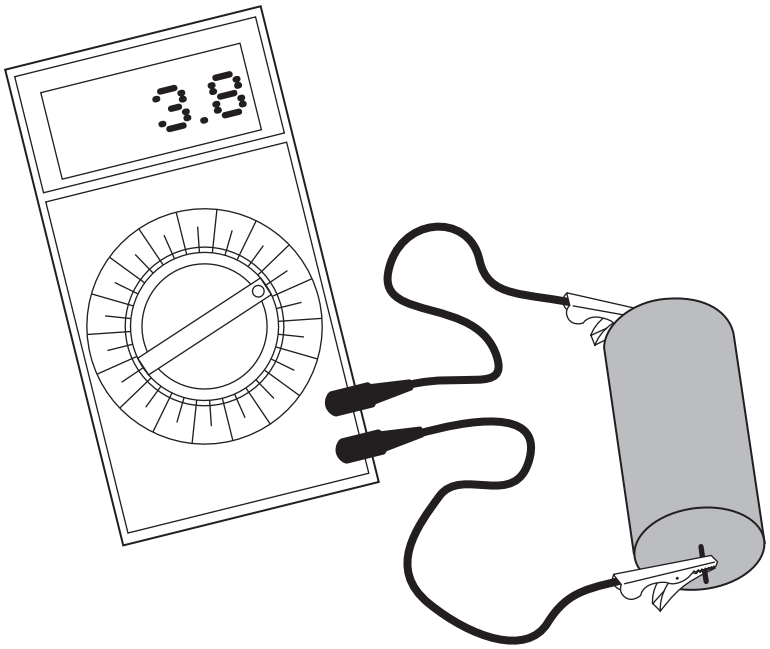
(3 marks)

3

6 Conducting putty is a material made by mixing silicone rubber with carbon powder. The putty can be easily formed into different shapes so the effect of these changes on the electrical resistance can be investigated.

A student forms a sample of the putty into a cylinder and connects the ends of the cylinder to a resistance meter which gives a direct reading of the resistance in Ω, as shown in **Figure 6**.

Figure 6



The student then forms the sample of putty into cylinders of different lengths, each time measuring the length L, and the resistance R.
The student's results for these different cylinders are shown in **Table 4**.

Table 4

L / cm	R / Ω
6.6	2.9
10.6	7.6
13.8	13.0
17.8	21.6
21.4	30.4

for use in answering part (a)

Theory suggests that $R = kL^2$, where k is a constant.

6 (a) Show whether the data in **Table 4** confirm the theory.
You may use the right-hand column of **Table 4** to assist you with this question.

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(3 marks)

6 (b) Estimate the length of the cylinder, the resistance of which is shown being measured in **Figure 6**.

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.....

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(2 marks)

5

END OF SECTION B

There are no questions printed on this page

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