

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
TOTAL	



General Certificate of Education  
Advanced Subsidiary Examination  
June 2015

## Physics

(Specifications A and B)

# PHA3/B3/XPM1

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

### Section A Task 1

**For this paper you must have:**

- a calculator
- a pencil
- a ruler.

### Instructions

- 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 spaces 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.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Task 1 is 16.

# PHA3/B3/XPM1

### Section A Task 1

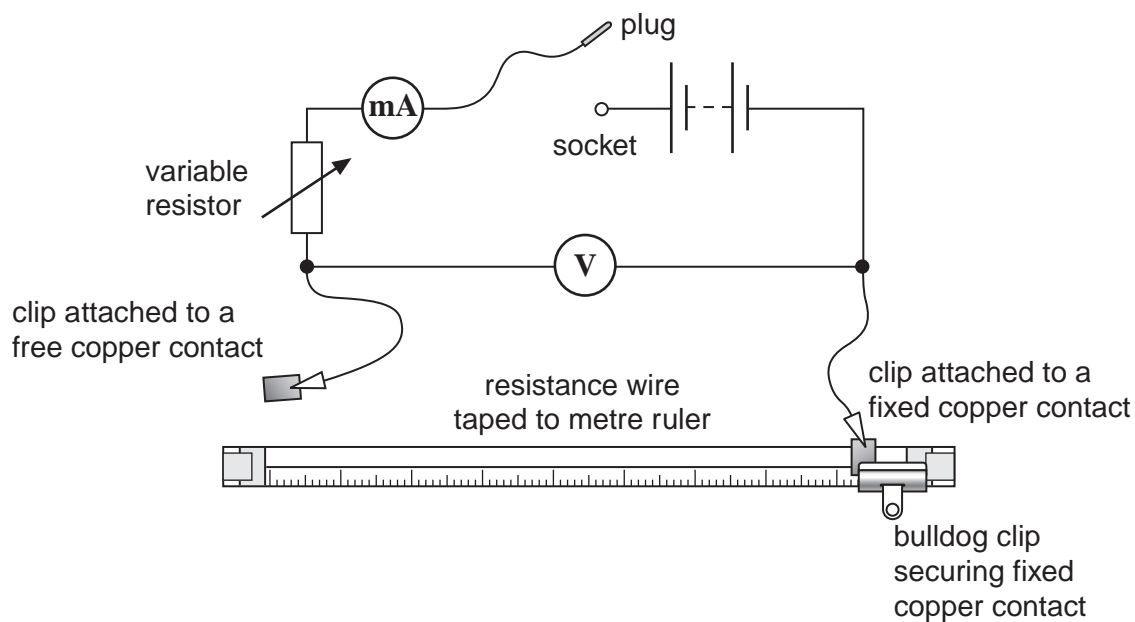
Follow the instructions given below.

Give the information required in the spaces provided.

No description of the experiment is required.

- 1 You are to determine the resistance per metre of a resistance wire using the circuit in **Figure 1**.

**Figure 1**



- 1 (a) Connect the plug to the socket.  
Hold the free copper contact firmly on the resistance wire so there is about 0.8 m of wire between the free and fixed contacts.  
Without moving the free contact, adjust the setting of the variable resistor until the current in the circuit is about 20 mA.
- 1 (a) (i) Determine and record the length  $l_a$  of the wire connected between the contacts.

$$l_a = \dots\dots\dots$$

- 1 (a) (ii) Read and record the current  $I_a$  in the wire and the potential difference (pd)  $V_a$  across the wire.

$$I_a = \dots\dots\dots$$

$$V_a = \dots\dots\dots$$

**1 (b)** Move the free contact so there is about 0.2 m of resistance wire between the free and fixed contacts.  
Without moving the free contact adjust the setting of the variable resistor until the current in the circuit is once again about 20 mA.

**1 (b) (i)** Determine and record the length  $l_b$  of the wire now connected between the clips.

$$l_b = \dots\dots\dots$$

**1 (b) (ii)** Read and record the current  $I_b$  in the wire and the pd  $V_b$  across the wire.

**[2 marks]**

$$I_b = \dots\dots\dots$$

$$V_b = \dots\dots\dots$$

**When you have completed parts (a) and (b) remove the plug from the socket.**

**Unclip the two crocodile clips from the copper contacts and place these and the resistance wire arrangement to one side.**

**Question 1 continues on the next page**

**Turn over ►**

**1 (c) (i)** Determine  $r_a$ , the resistance per metre of the resistance wire based on your readings from part (a).

.....  
.....  
.....

$$r_a = \dots\dots\dots$$

**1 (c) (ii)** Determine  $r_b$ , the resistance per metre of the resistance wire based on your readings from part (b).

**[2 marks]**

.....  
.....  
.....

$$r_b = \dots\dots\dots$$

**1 (d)** Explain, without calculation, why the percentage uncertainty in  $r_a$  is less than the percentage uncertainty in  $r_b$ .

**[3 marks]**

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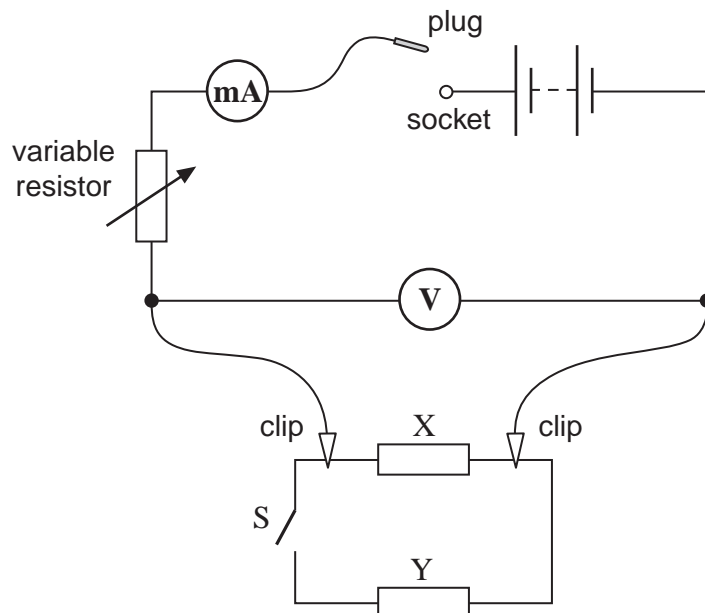
**Turn over for the next question**

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

**Turn over ►**

- 2 You are to investigate a circuit containing resistors X and Y of unknown resistance and a switch S.  
Connect the circuit consisting of X and Y so that the clips are **attached directly** to the ends of X, as shown in **Figure 2**.

Figure 2



- 2 (a) (i) With S in the off (open) position, connect the plug to the socket.  
Adjust the variable resistor until the current in the circuit is a **minimum**.
- 2 (a) (ii) Read and record in **Table 1** the current  $I_1$  and potential difference  $V_1$ .
- 2 (a) (iii) Without adjusting the variable resistor, turn S on.  
Read and record in **Table 2** the current  $I_2$  and potential difference  $V_2$ .
- 2 (a) (iv) Turn S off.  
Adjust the variable resistor so that the current in the circuit increases.  
Using the procedure as before obtain new values of  $I_1$  and  $V_1$  and of  $I_2$  and  $V_2$ .  
Continue until you have **five** sets of readings.  
**Disconnect the plug from the socket.**

[2 marks]

Table 1

$I_1 / \text{mA}$	$V_1 / \text{V}$

Table 2

$I_2 / \text{mA}$	$V_2 / \text{V}$

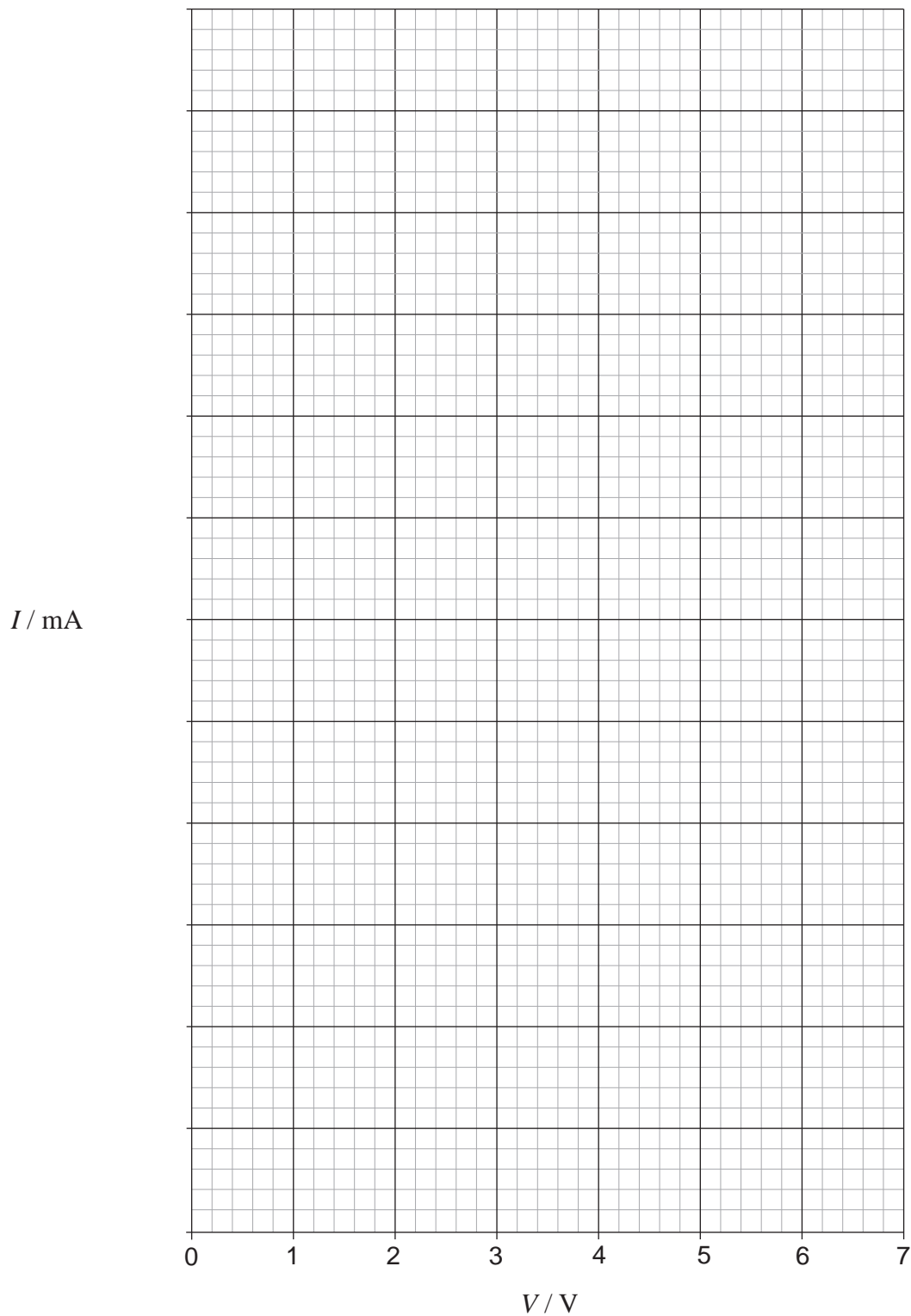
2 (b) Add a suitable **single** scale to the vertical axis on **Figure 3** below and plot,

[2 marks]

2 (b) (i) a graph of  $I_1$  against  $V_1$ ,

2 (b) (ii) a graph of  $I_2$  against  $V_2$ .

Figure 3



Turn over ►

2 (c) Use your graphs (**Figure 3**) to determine

2 (c) (i) the resistance of X,

[2 marks]

.....  
.....  
.....

resistance of X = .....

2 (c) (ii) the resistance of Y.

[3 marks]

.....  
.....  
.....  
.....  
.....  
.....

resistance of Y = .....

9
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**END OF QUESTIONS**