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| 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 | | | | | |



General Certificate of Education
Advanced Subsidiary Examination
June 2015

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>For this paper you must have</p> <ul style="list-style-type: none"> your completed Section A Task 2 question paper / answer book. a ruler a pencil a calculator. | <p>Instructions</p> <ul style="list-style-type: none"> 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. |
| <p>Time allowed</p> <ul style="list-style-type: none"> 1 hour 15 minutes | <p>Information</p> <ul style="list-style-type: none"> The marks for questions are shown in brackets. The maximum mark for this paper is 25. |
| <p>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.</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/></p> | |

| | |
|---------------------|--|
| For Examiner's Use | |
| Examiner's Initials | |
| Section A Task 1 | |
| 1(a)/(b) | |
| 1(c) | |
| 1(d) | |
| 2(a) | |
| 2(b) | |
| 2(c)(i) | |
| 2(c)(ii) | |
| Section A Task 2 | |
| 1(a) | |
| 1(b)/(c) | |
| 1(d) | |
| Section B | |
| 1(a) | |
| 1(b)(i) | |
| 1(b)(ii) | |
| 1(c) | |
| 2(a) | |
| 2(b)(i) | |
| 2(b)(ii) | |
| 2(b)(iii) | |
| 3(a)(i) | |
| 3(a)(ii) | |
| 3(b) | |
| 3(c)(i) | |
| 3(c)(ii) | |
| Total | |

| | |
|---|-------------------------------------|
| <p>Practical Skills Verification</p> <p>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> |
|---|-------------------------------------|

Signature of teacher Date

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| <p>As part of AQA's commitment to assist students, AQA may make your coursework available on a strictly anonymous basis to teachers, examining staff and students in paper form or electronically, through the Internet or other means, for the purpose of indicating a typical mark or for other educational purposes. In the unlikely event that your coursework is made available for the purposes stated above, you may object to this at any time and we will remove the work on reasonable notice. If you have any concerns please contact AQA.</p> <p>To see how AQA complies with the Data Protection Act 1988 please see our Privacy Statement at aqa.org.uk.</p> |
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Section B

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

Time allowed 1 hour 15 minutes.

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

1 (a) (i) Determine the gradient G_1 in the region on your graph where $m = 250$ g.

.....
.....

$G_1 =$

1 (a) (ii) Determine the gradient G_2 in the region on your graph where $m = 750$ g.

.....
.....

$G_2 =$

1 (a) (iii) Evaluate $\frac{G_1}{G_2}$.

[4 marks]

$\frac{G_1}{G_2} =$

1 (b) (i) Explain by referring to the spring system why G_1 changes to G_2 as m is increased beyond a certain value.

[2 marks]

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

- 1 (b) (ii)** Describe how you could use your graph to determine the mean vertical distance between the top of the clamped beam and the top of the suspended beam **before** the mass hanger was suspended from wire loop B. You may use a diagram to illustrate your answer.

[1 mark]

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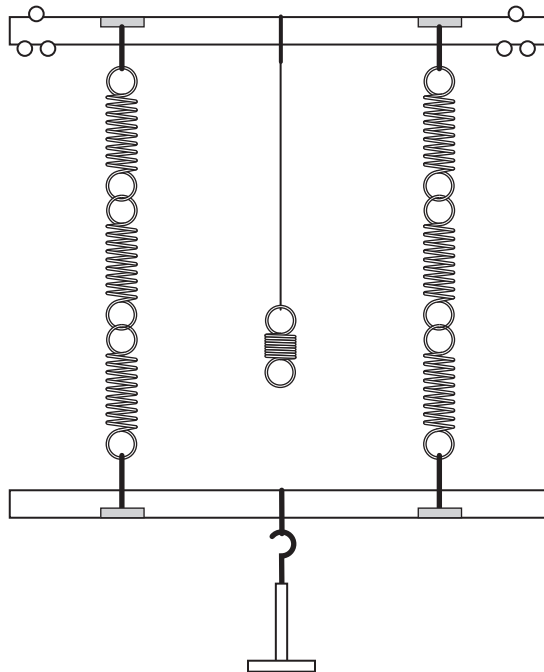
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- 1 (c) A student carries out the experiment using identical springs to those which you used but with no thread attached to the lower end of the central (single) spring. The student's apparatus is shown in **Figure 7**.

Figure 7



State how the graph obtained by this candidate will compare with your graph (**Figure 6**).
[1 mark]

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Turn to page 6 for the next question

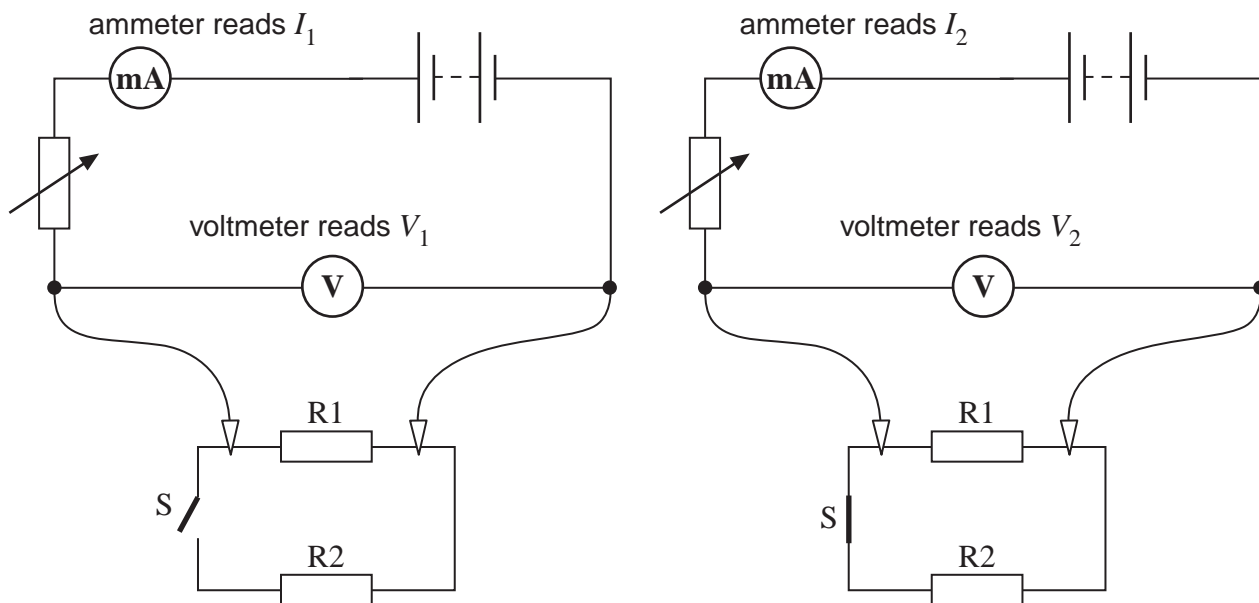
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ANSWER IN THE SPACES PROVIDED**

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2 In Section A Task 1 Question 2 you used the circuit shown in **Figure 8**.

Figure 8



2 (a) When S is turned off the ammeter reads I_1 and the voltmeter reads V_1 .

Without any change being made to the variable resistor, S is turned on. The ammeter and voltmeter now read I_2 and V_2 respectively.

[3 marks]

2 (a) (i) Explain why I_2 is greater than I_1 .

.....

.....

.....

.....

2 (a) (ii) Explain why V_1 is greater than V_2 .

.....

.....

.....

.....

.....

.....

2 (b) **Table 3** shows the results of a number of independent measurements of the resistance of a resistor.

Table 3

| | | | | | | | | | |
|---|------|------|------|------|------|------|------|------|------|
| resistance / Ω | 68.7 | 71.3 | 70.1 | 66.2 | 67.8 | 66.5 | 72.1 | 68.2 | 69.2 |
|---|------|------|------|------|------|------|------|------|------|

2 (b) (i) Calculate the mean resistance of the resistor.

[1 mark]

mean resistance =.....

2 (b) (ii) Calculate the uncertainty in the resistance of the resistor.

[1 mark]

uncertainty =.....

2 (b) (iii) The manufacturer of the resistor states the resistance is $68 \Omega \pm 5\%$.
State and explain whether the resistance of the resistor **could** be outside the range stated by the manufacturer.

[2 marks]

.....

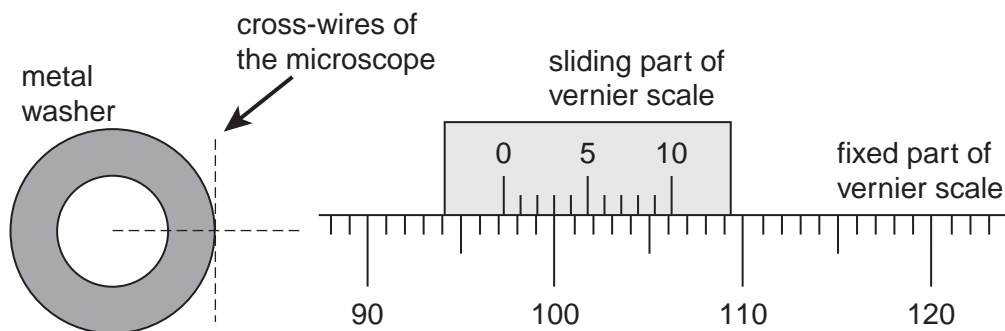
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- 3** A student uses a travelling microscope to measure the dimensions of a metal washer. The microscope is placed so that the cross-wires pass over the centre of the washer when the carriage is moved. The position of the cross-wires is determined by using the vernier scale fitted to the microscope. The fixed part of the vernier scale is graduated in millimetres.

The student aligns the cross-wires with the edge of the washer as shown in **Figure 9**.

Figure 9

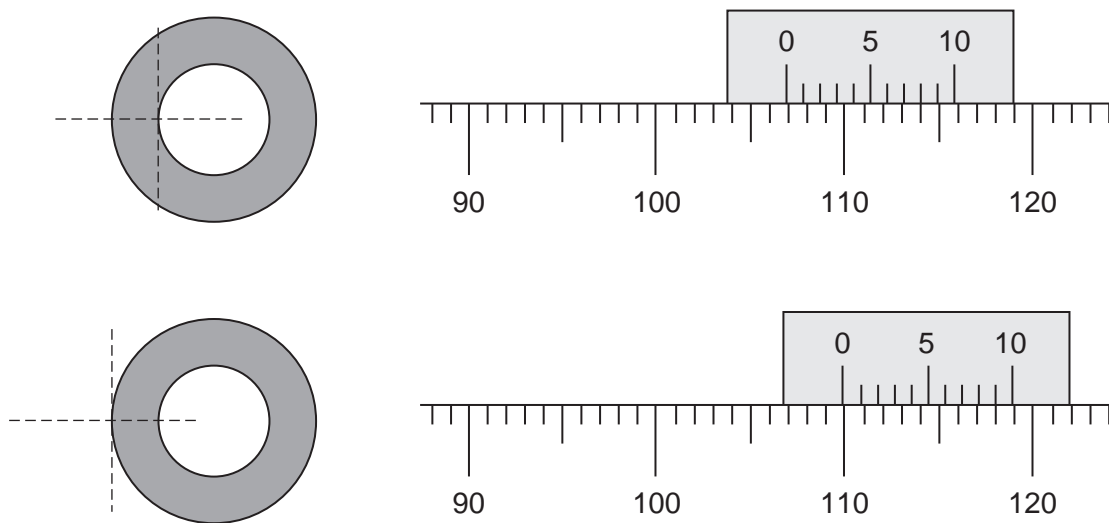


- 3 (a) (i)** Determine the vernier scale reading corresponding to the position of the cross-wires. **[1 mark]**

position of the cross-wires =

The student then aligns the cross-wires as shown in **Figure 10**.

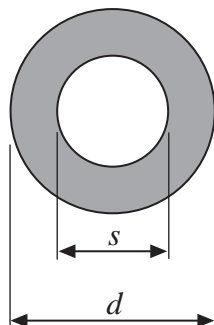
Figure 10



3 (a) (ii) Use the information in **Figures 9** and **10** to determine the outer diameter d and the inner diameter of the washer s , as defined in **Figure 11**.

[2 marks]

Figure 11



$d = \dots\dots\dots$

$s = \dots\dots\dots$

Turn over ►

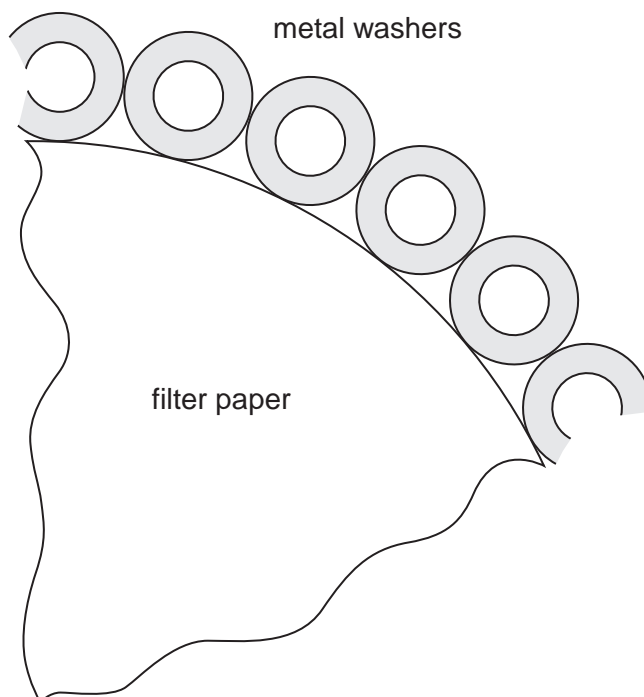
3 (b) Deduce the greatest number of washers, identical to that measured by the student in part (a), which could be placed around the edge of a circular disc of filter paper of diameter 125 mm.

The washers must maintain contact with the edge of the filter paper and must not overlap, as shown in **Figure 12**.

Show clearly how you obtain your result.

[2 marks]

Figure 12



number of washers =

3 (c) The student wishes to determine the density of the metal from which the washers are made.

3 (c) (i) Identify the **two additional** measurements that the student will need to make. For each measurement state a suitable instrument and identify a precaution that will reduce uncertainty.

[4 marks]

Measurement 1

instrument

precaution

.....

Measurement 2

instrument

precaution

.....

3 (c) (ii) Explain how the student will use s , d , and the measurements identified in part (c)(i) to determine the density of the metal.

[1 mark]

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.....

.....

.....

| |
|----|
| 10 |
|----|

END OF QUESTIONS

There are no questions printed on this page

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