Centre Number						Candidate Number					

Surname	
Other Names	
Candidate Signature	

AQA

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Physics   **PHA3/B3/XPM1**
(Specifications A and B)

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 12.

PHA3/B3/XPM1
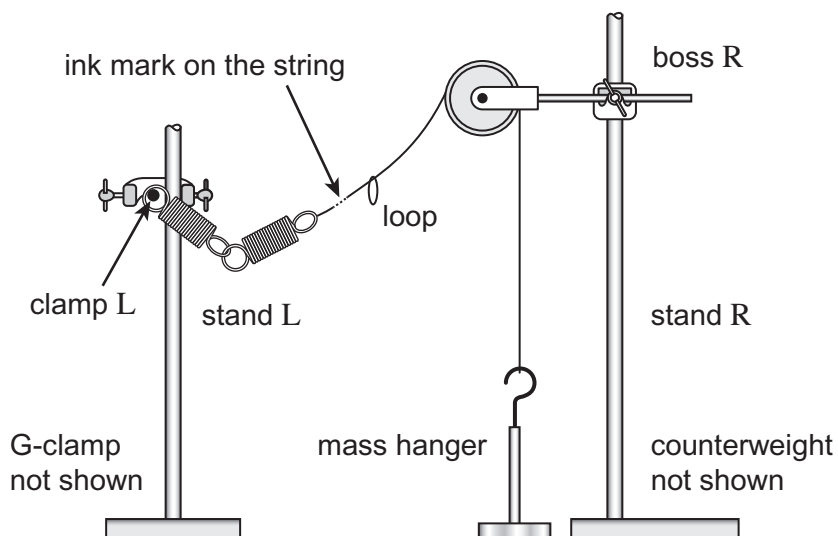
Section A Task 1

Follow the instructions given below.

Give the information required in the spaces provided.

No description of the experiment is required.

1 You are to investigate the extension of a mass-spring system.

**1 (a)** You are provided with the apparatus shown in **Figure 1**.

Figure 1

Stand L has been clamped to the bench and a mass hanger has been securely fastened to the free end of the string.

An ink mark has been made on the string between the end of the spring and the loop tied in the string.

You must not move stand L, or adjust the height of clamp L, or unfasten the string from the mass hanger during the experiment.

1 (a) (i) Add mass to the hanger so that m, the total mass fastened to the string, is $200\,g$.
Move stand R to the right until the hanger is lifted clear of the bench.
Adjust the height of boss R until the part of the string between the spring and the pulley is horizontal, as shown in **Figure 2**.
Check that the system is in equilibrium.

Figure 2
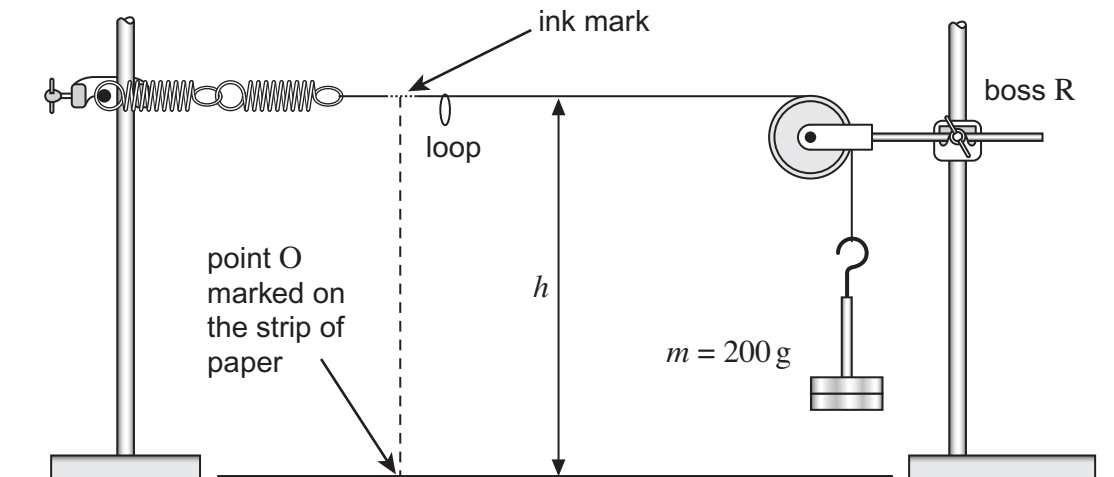
Measure and record h, the vertical distance between the horizontal part of the string and the table.

$h =$ ....

1 (a) (ii) A point has been marked on the string between the end of the spring and the loop; a strip of paper has been taped to the bench below the horizontal part of the string. Mark the point O on the strip of paper directly below the ink mark.

Question 1 continues on the next page

Turn over ▶

1 (a) (iii) Add mass to the hanger until $m = 600\,g$.
Without adjusting the height of boss R, move stand R further to the right until the mass is once again lifted clear of the bench, as shown in **Figure 3**.

Figure 3
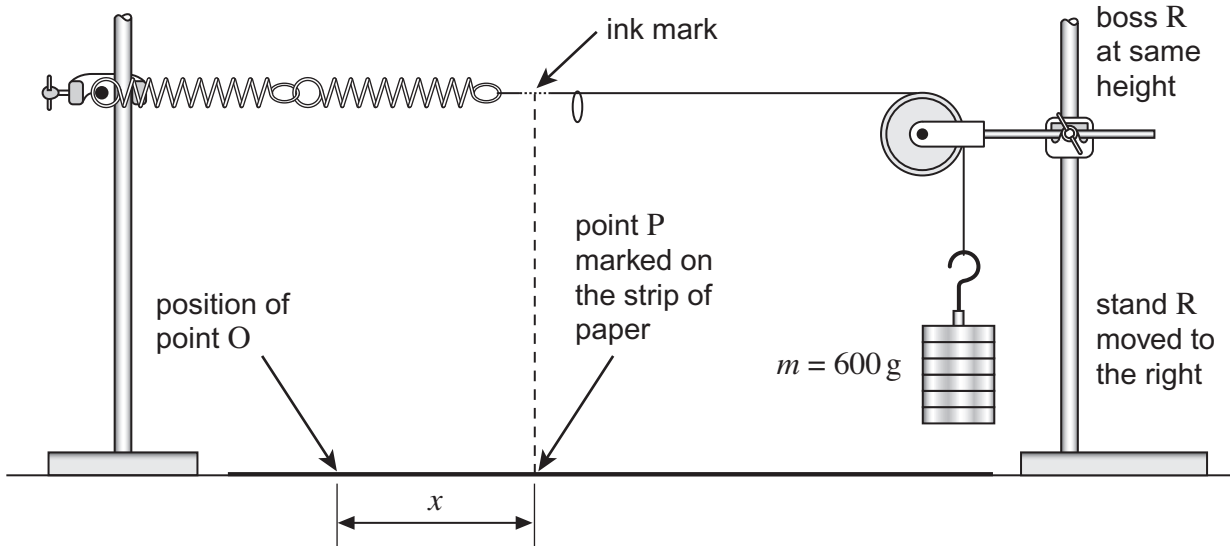
Check that the system is in equilibrium, then mark the point P on the strip of paper directly below the ink mark.
Mark a straight line joining the points O and P.
Measure and record x, the distance along the line between O and P.

$x = $ ....

1 (a) (iv) Remove mass from the hanger so that $m = 500\,g$.
If necessary move stand R to the left so that the hanger does not touch the pulley, while remaining clear of the bench.
Check that the ink mark is directly above the line between O and P.

Check that the system is in equilibrium then locate the point on OP that is directly below the ink mark then measure and record the new value of x.
Repeat the procedure until you have the values of x when $m = 400\,g$ and $m = 300\,g$.

Record all your measurements in **Table 1** on page 6.

Question 1 continues on the next page

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Measurements

[1 mark]

Table 1

m / g	x/mm
200	
600	
500	
400	
300	

1 (b) Adding a suitable scale to the vertical axis plot, on **Figure 4**, a graph of x against m.

[2 marks]

1 (c) Explain how you ensured that the part of the string between the spring and the pulley was horizontal.
You may wish to illustrate your answer with a sketch.

[2 marks]

....

....

....

....

Figure 4

x / mm

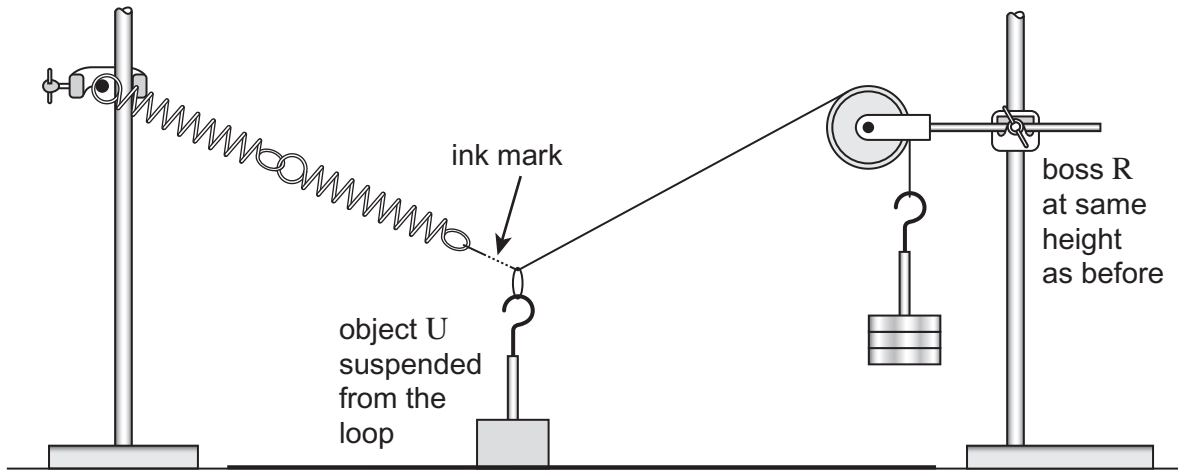m / g
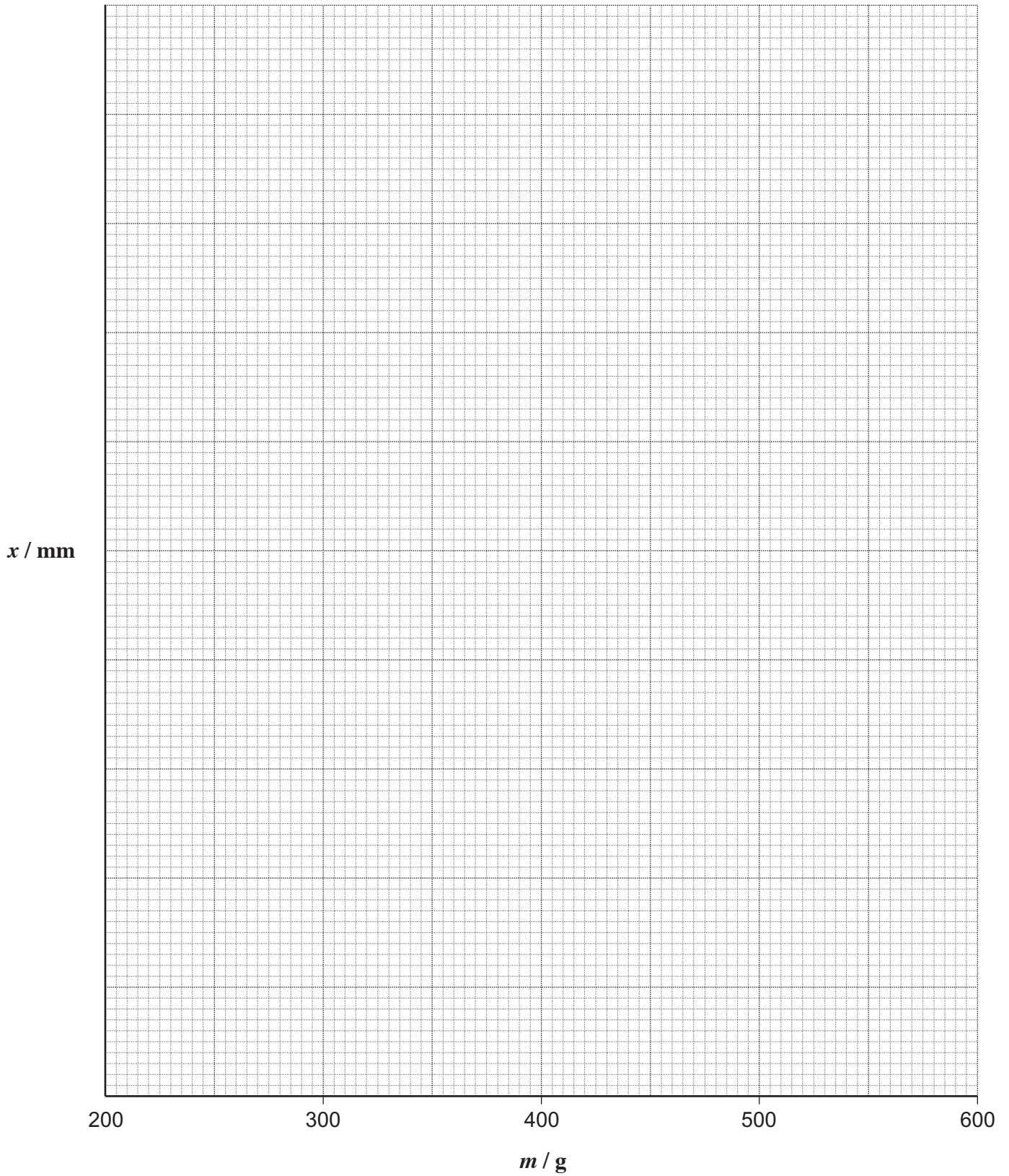
Question 1 continues on the next page

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1 (d)   You are provided with an object U, the mass of which you are to find.
Suspend U from the loop tied in the string.
The apparatus will now appear as in **Figure 5**.

Figure 5

Add mass to the hanger so that $m = 500\,\text{g}$.
Raise boss R so that both masses are lifted clear of the bench and the part of the
string between the spring and the loop is approximately horizontal.
Make small adjustments to the position of stand R, moving this stand either left or
right, until the ink mark is at a height h, as measured in part (a)(i), and is directly over
the line between O and P, as shown in **Figure 6**.

Figure 6
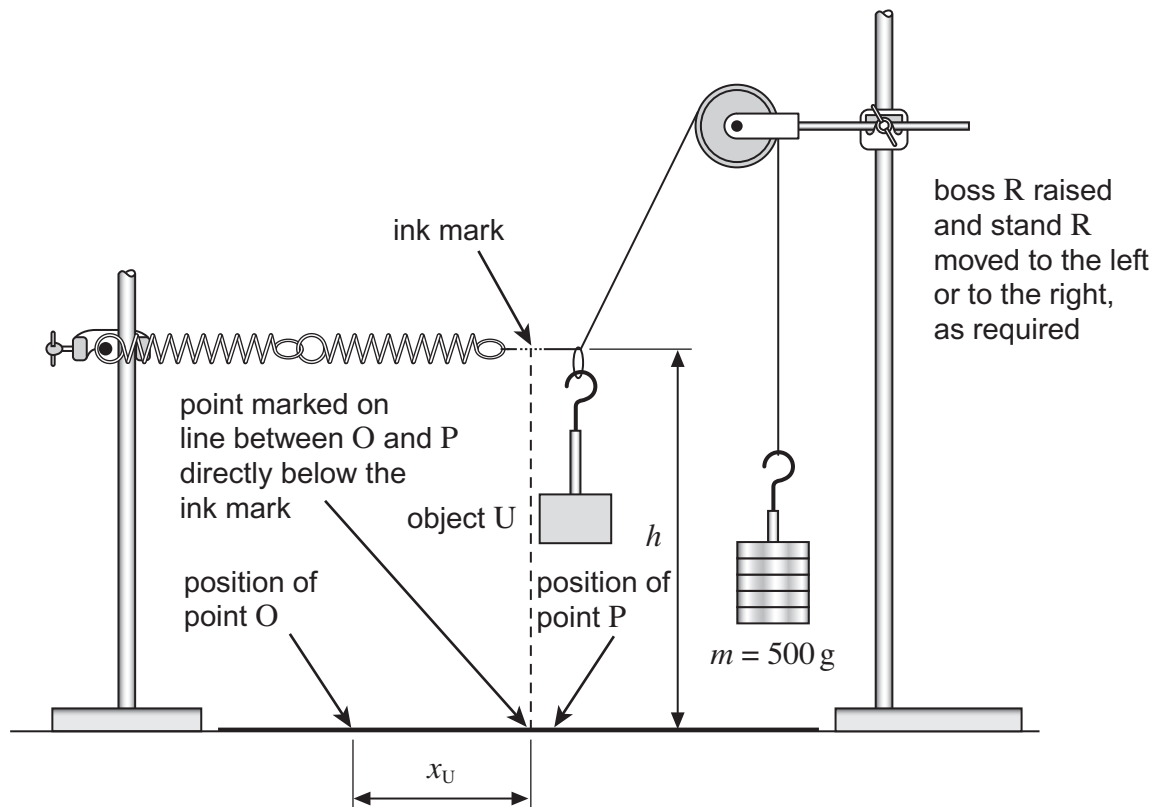
1 (d) (i) Check that the system is in equilibrium then locate the point between O and P that is directly below the ink mark.
Measure and record the distance x_U that is defined in **Figure 6**.

$$x_U = \text{...}$$

1 (d) (ii) Showing your working clearly, use your graph from part (b) of this question to determine m_H, the mass in g, that would produce the distance x_U on the graph.

$$m_H = \text{...}$$

1 (d) (iii) Evaluate the mass of U which is given by $\sqrt{500^2 - m_H^2}$

[3 marks]

$$\text{mass of } U = \text{...}$$

Question 1 continues on the next page

1 (e) A student is provided with the apparatus shown in **Figure 7**.

Figure 7
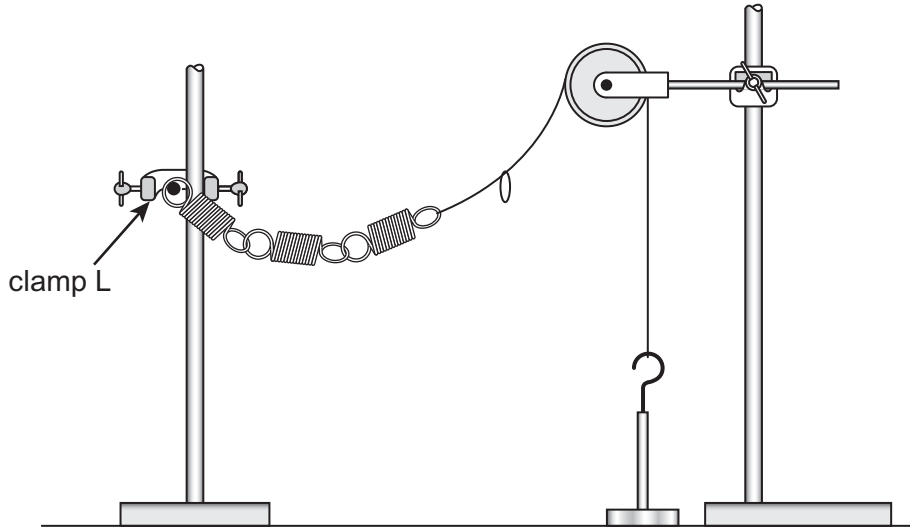
clamp L

This apparatus is identical to that which you used except that an extra spring has been connected between clamp L and the string.

1 (e) (i) State and explain what effect, if any, this has on the graph of x against m that this student produced compared with that which you produced.

[3 marks]

....

....

....

....

....

....

....

1 (e) (ii) Suggest how the result the student obtains for the mass of U is likely to compare with the result you obtained.

[1 mark]

....

END OF QUESTIONS

12

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