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 Level Examination
June 2013

Physics

PHA6/B6/XPM1

(Specifications A and B)

Unit 6 Investigative and Practical Skills in A2 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.

Do not write outside the box

Section A Task 1

Follow the instructions given below.

Give the information required in the spaces provided.

No descriptions of the experiments are required.

1 You are to perform two experiments involving the vertical oscillations of a spring-mass system.

1 (a) You are provided with a retort stand fitted with a clamp from which a spring is suspended. A metre ruler has been clamped vertically alongside the spring.
Do not adjust the positions of the clamps to which the spring and the metre ruler are attached.

You are also provided with masses labelled M_1 and M_2.

1 (a) (i) Attach M_1 to the lower end of the spring.
Record r_1, the metre ruler reading which is at the same horizontal level as the bottom of M_1 when M_1 is in equilibrium.

r_1 = ...

1 (a) (ii) Displace and then release M_1 so that it performs small amplitude vertical oscillations.
Make suitable measurements to determine T_1, the time period of the oscillations.
A fiducial mark has been provided for your use.

....

....

....

T_1 = ...

1 (a) (iii) Add M_2 to the mass already on the spring.
Record r_2, the metre ruler reading which is at the same horizontal level as the bottom of M_1 when in equilibrium.

r_2 = ...

1 (a) (iv) Displace and then release the mass on the spring and make suitable measurements to determine T_2, the time period of the oscillations.

....

....

....

T_2 = ...

(2 marks)

Do not write outside the box

1 (b) Evaluate $\dfrac{r_2 - r_1}{(T_2 - T_1)\,(T_2 + T_1)}$

....

....

....

$\dfrac{r_2 - r_1}{(T_2 - T_1)\,(T_2 + T_1)}$ = ...

(2 marks)

1 (c) Explain how you reduced uncertainty in your readings of r_1 and r_2.
You may use a sketch to illustrate your answer.

....

....

....

....

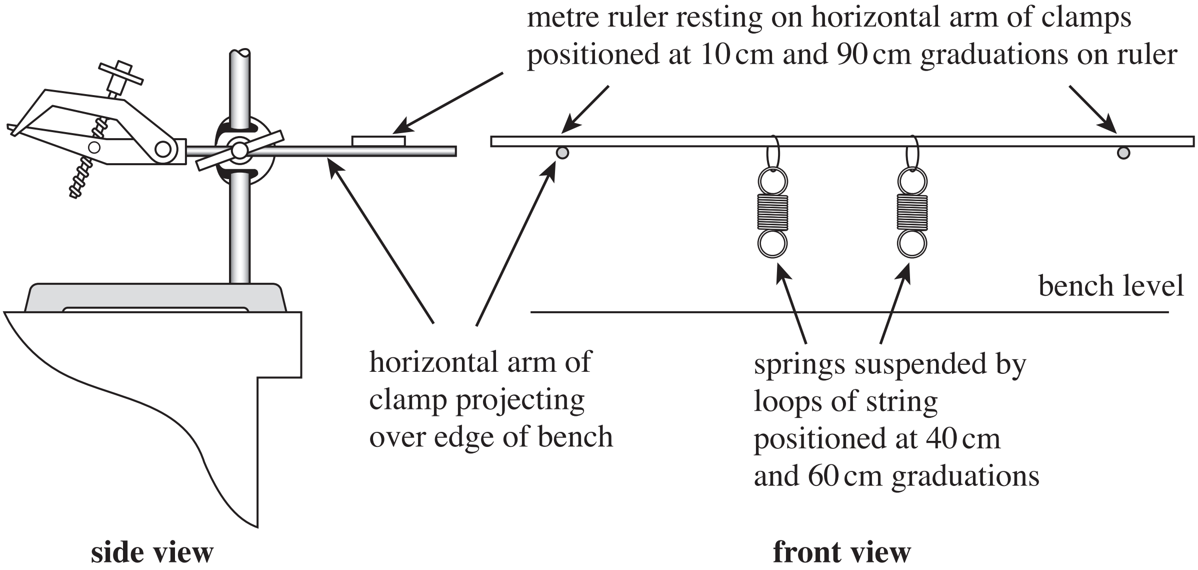
(2 marks)

Turn over ▶

Dismantle your apparatus and place M_1, M_2, and the spring to one side.
Inform the Supervisor that you require the additional apparatus to complete part (d) of this question.

1 (d) You are provided with an additional retort stand to which a clamp has been attached. Adjust the height of clamps on each retort stand so the horizontal arms of these clamps lie in the same horizontal plane, about 10 cm above the level of the bench.
Position the stands so that the arms of the clamps project over the edge of the bench, as shown in the side view in **Figure 1**.

Figure 1



Join the springs to the metre ruler using the loops of string fastened at one end of each spring, then place the ruler, with the graduated face uppermost, on the projecting arms of the clamps. Adjust the position of the stands until the ruler is supported at the 10 cm and 90 cm graduations. Move the loops of string so that the springs are positioned below the 40 cm and 60 cm graduations.

You are provided with masses M_3 and M_4.
Attach M_3 to the lower end of the spring suspended below the 40 cm graduation and attach M_4 to the lower end of the spring suspended below the 60 cm graduation.

Do not write outside the box

With M_4 held at rest at the equilibrium position, displace M_3 vertically downwards through approximately 5 cm.
Release both masses simultaneously so that M_3 performs small-amplitude vertical oscillations.

1 (d) (i) Observe and describe the subsequent motions of M_3 and M_4, with particular reference to the amplitude variations and phase relationship between the motions of the masses.

....

....

....

....

....

....

....

....

....

....

....

....

1 (d) (ii) Make suitable measurements to determine τ, the time for the energy of M_3 to transfer to M_4 and then back again.

....

....

τ = ...

(4 marks)

10

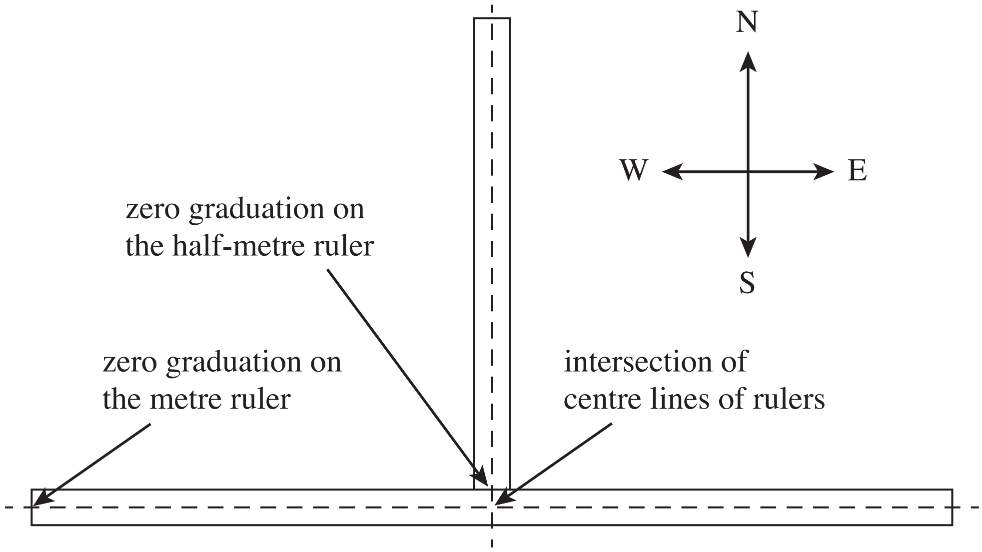
TURN OVER FOR NEXT QUESTION

Turn over ▶

2 You are to investigate how the magnetic flux density varies between two bar magnets.

You are provided with a metre ruler and a half-metre ruler.
Place the rulers with their largest faces in contact with the bench then use the compass, together with the set-square, to position the rulers with the alignment shown in **Figure 2**.

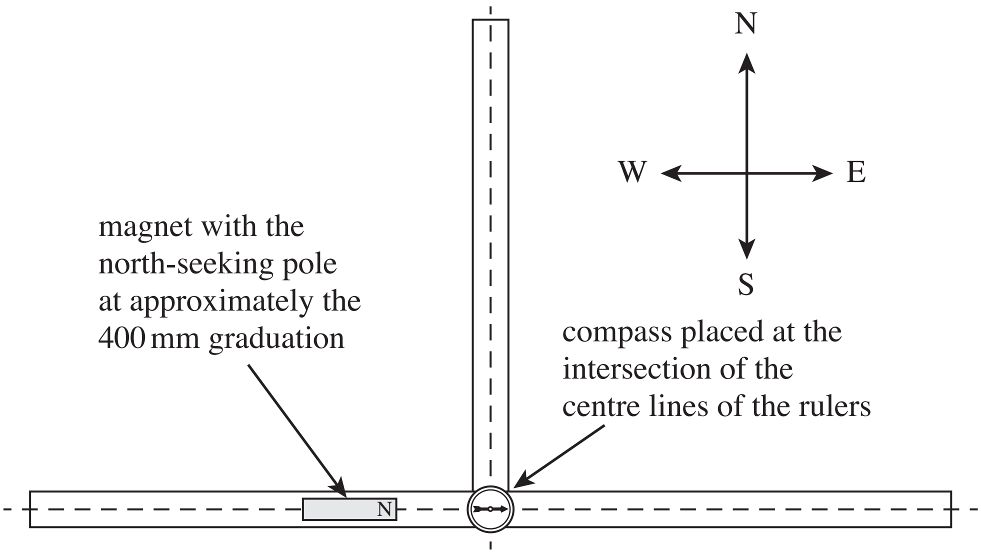
Figure 2



Place the compass at the intersection of the centre line of the rulers. Make any further small adjustment to the direction of the rulers that may be necessary so that the needle is aligned with the centre line of the half-metre ruler.
Once in position the rulers should be taped to the bench.

Place a bar magnet on the metre ruler with the north-seeking pole at approximately the 400 mm graduations. The north-seeking pole of this magnet should point eastwards. The magnet should be aligned with the centre line of the metre rule, as shown in **Figure 3.**

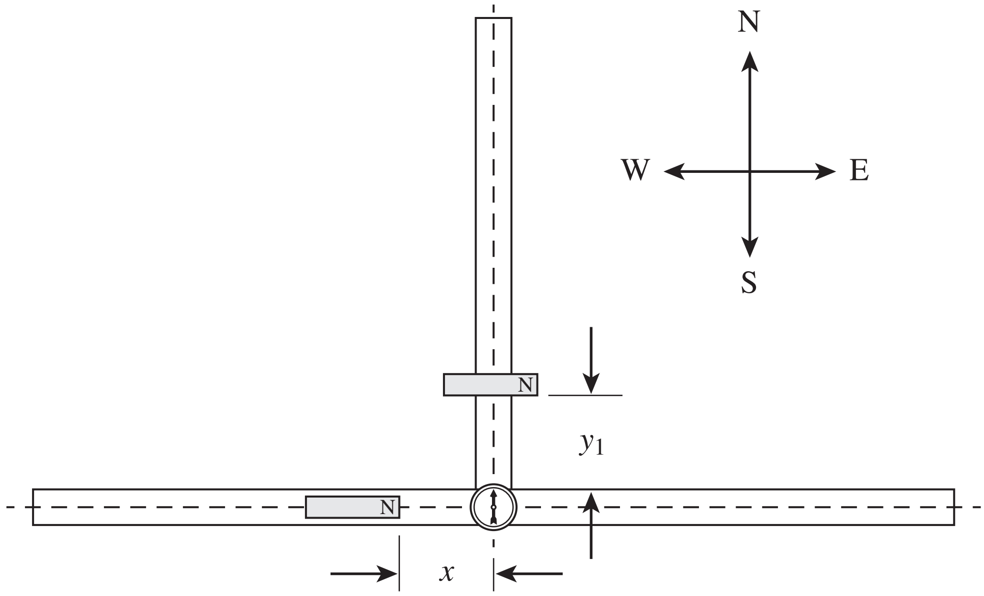
Figure 3



Place the other bar magnet at about the mid-point of the half-metre ruler with the north-seeking pole of the magnet pointing eastwards. The centre of this magnet should lie directly above the centre line of the half-metre ruler.
Move this magnet directly towards the compass until the needle points due north again.

2 (a) (i) Measure and record in **Table 1** below, the distances x and y_1 defined in **Figure 4**.

Figure 4



2 (a) (ii) Maintaining their orientation, interchange the positions of the two magnets.
With the same x value as before, adjust the position of the other magnet until the compass once again points due north.
Measure and record in **Table 1** y_2, the distance corresponding to y_1 in **Figure 4** when the magnets are interchanged.

2 (a) (iii) Calculate and record y, the mean value of the distances y_1 and y_2.

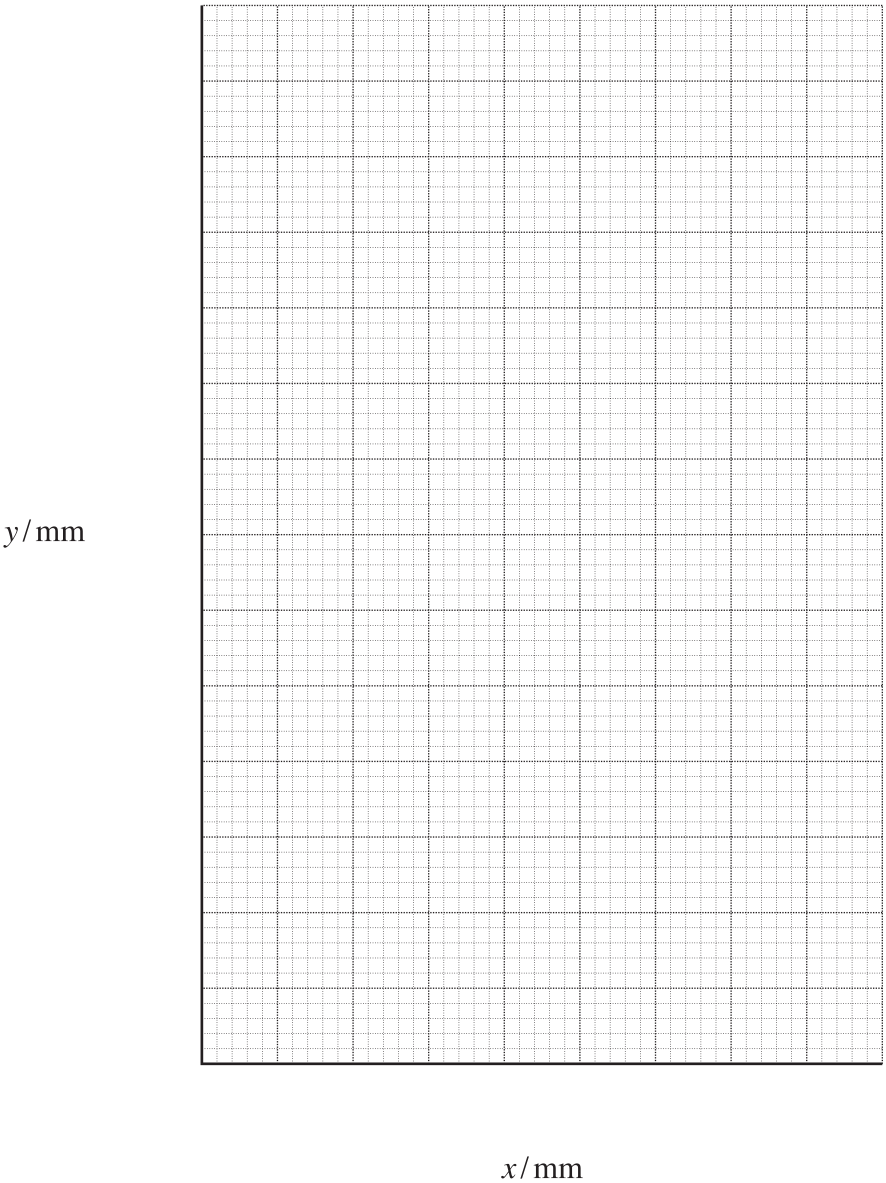
2 (a) (iv) Repeat the procedure for three **larger** values of x to complete **Table 1**.

Table 1

x / mm	y_1 / mm	y_2 / mm	y / mm

(2 marks)

2 (b) Add suitable scales to the grid below and plot a graph to show how *y* varies with *x*.



(2 marks)

2 (c) Determine the gradient, *G*, of your graph.

....

....

G = ...

(2 marks)

6

END OF QUESTIONS