



Rewarding Learning

ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2011

Centre Number

71	
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Candidate Number

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# Physics

## Assessment Unit AS 3

*assessing*

Practical Techniques (Internal Assessment)

Session 1

[AY131]



THURSDAY 12 MAY, MORNING

### TIME

1 hour 30 minutes.

### INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.  
Turn to page 2 for further Instructions and Information.

Question Number	Marks	
	Teacher Mark	Examiner Check
1		
2		
3		
4		
5		
<b>Total Marks</b>		



## INSTRUCTIONS TO CANDIDATES

Answer **all** the questions in this booklet. Rough work and calculations must also be done in this booklet. Except where instructed, do **not** describe the apparatus or experimental procedures.

The Teacher/Supervisor will tell you the order in which you are to answer the questions.

One hour is to be spent on Section A and 30 minutes on Section B.

Section A consists of four short experimental tests. **You will have access to the apparatus for 13 minutes for each of the tests.** At the end of this 13-minute experimental period there is a 2-minute changeover to the area set aside for the next test. Any spare time before the start of the next test may be used to write up anything you have not yet completed.

At the end of your Section A work you will be told to move to the area set aside for Section B.

Section B consists of one question in which you will analyse a set of experimental results.

## INFORMATION FOR CANDIDATES

The total mark for this paper is 40.

Section A and Section B carry 20 marks each.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each part question.

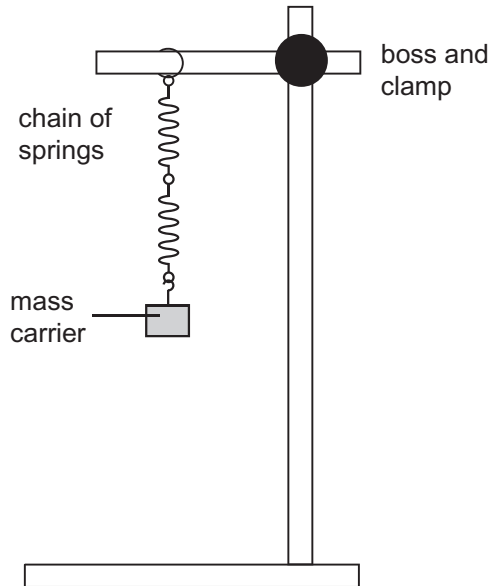
You may use an electronic calculator.

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**(Questions start overleaf)**

## Section A

- 1 In this experiment you are to investigate how the period of oscillation of a loaded chain of springs varies as the number of springs in the chain is increased.
- (a) The apparatus with a chain of two springs has already been set up for you, see **Fig. 1.1**. Chains of three and four springs have also been provided on the bench.



**Fig. 1.1**

Displace the mass carrier a small distance, release and allow it to oscillate. Take readings that will allow you to determine  $T$ , the period of the oscillation. Record **all** your results in **Table 1.1**.

Replace the chain of two springs with the chain of three springs and repeat the above procedure.

Finally replace the chain of three springs with the chain of four springs and repeat the above procedure.

**Table 1.1**

Number of springs	$T/s$
2	
3	
4	

[3]

Teacher Mark	Examiner Check	Remark

(b) It is suggested that the relationship between the period  $T$  of the oscillations of the spring system and the number of springs  $N$  is one of the following:

(i)  $T = 2\pi\sqrt{\frac{Nm}{k}}$

(ii)  $T = 2\pi\sqrt{\frac{m}{Nk}}$

(iii)  $T = 2\pi\sqrt{\frac{m}{k}}$  i.e.  $T$  is independent of  $N$

where  $m$  and  $k$  are constants.

Using your results in **Table 1.1**, choose which of the equations best describes the trend of your results. Explain your answer.

Equation \_\_\_\_\_

Explanation:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

Teacher Mark	Examiner Check	Remark

- 2 In this experiment you are to obtain a value for the focal length of a converging lens.

Fig. 2.1 shows the arrangement of the apparatus which has already been set up for you.

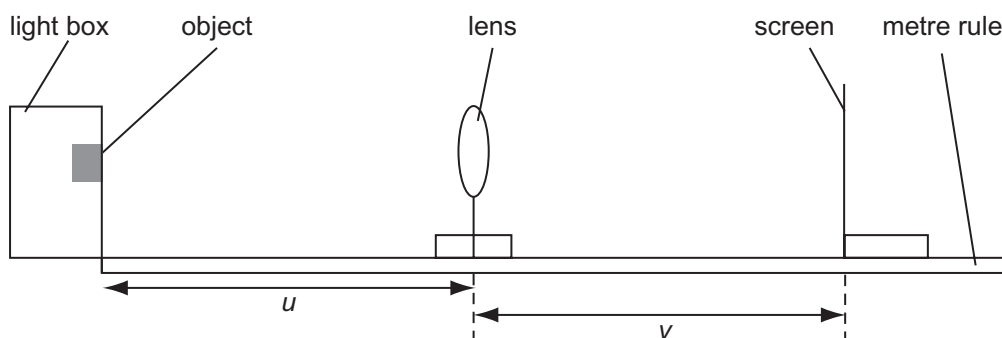


Fig. 2.1

The distance  $u$  has been set at 25.0 cm for your first reading.

- (a) **Without moving the object or the lens**, adjust the position of the screen until a focused image is seen on the screen. Measure the distance  $v$  between lens and screen. Record the value of  $v$  in **Table 2.1**.

Repeat this procedure for  $u = 30.0$  and 40.0 cm and record the corresponding values of  $v$  in **Table 2.1**.

Table 2.1

$u/\text{cm}$	$v/\text{cm}$
25.0	
30.0	
40.0	

[1]

Teacher Mark	Examiner Check	Remark

(b) A relationship between  $u$  and  $v$  is given by **Equation 2.1**.

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \quad \text{Equation 2.1}$$

- (i) Use **Equation 2.1** and the result for  $u = 25.0$  cm in **Table 2.1**, to calculate a value of  $f$ .

$f =$  \_\_\_\_\_ cm [2]

- (ii) Explain how you could obtain a more accurate value for  $f$  using the results from **Table 2.1**.

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (iii) What is the major source of uncertainty in this experiment?

\_\_\_\_\_  
\_\_\_\_\_ [1]

Teacher Mark	Examiner Check	Remark

3 In this experiment you are to measure the diameter and thickness of a 50g slotted mass and find the diameter to thickness ratio.

You are provided with two measuring instruments, a vernier calliper and a micrometer screw gauge.

- (a) Which of the two measuring instruments are you going to choose to measure the **thickness** of the slotted mass? Give a reason for your choice and state the uncertainty in a measurement using the instrument.

Instrument: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Uncertainty:  $\pm$  \_\_\_\_\_ mm [2]

For this question you are not expected to take repeat readings.

- (b) Measure the thickness of the 50g slotted mass. Give your answer to an appropriate number of decimal places.

Thickness = \_\_\_\_\_ mm [1]

- (c) Measure the diameter of the 50g slotted mass. Give your answer to an appropriate number of decimal places.

Diameter = \_\_\_\_\_ mm [1]

- (d) Hence, calculate the ratio diameter/thickness of the 50g slotted mass.

Ratio = \_\_\_\_\_ [1]

Teacher Mark	Examiner Check	Remark

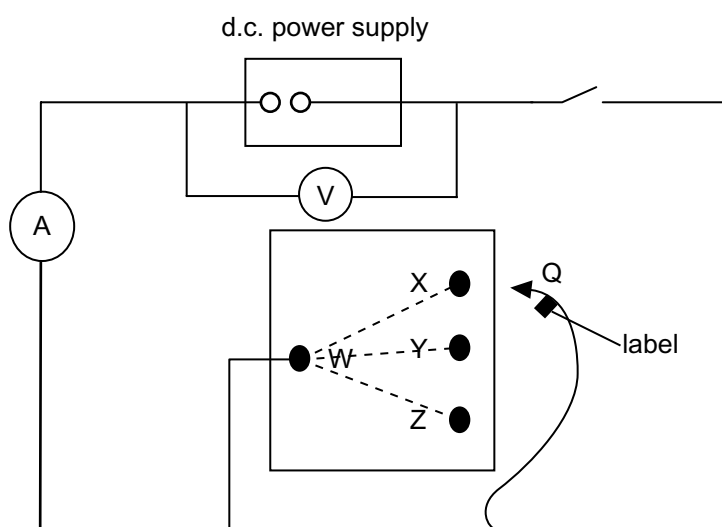


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**(Questions continue overleaf)**

- 4 In this experiment you are to calculate the resistance of three wires of the same thickness, made of the same material and of lengths 10cm, 15cm and 20cm. The wires are inside a sealed box. You are then to establish which wire has been connected to which pair of terminals.

**Fig. 4.1** shows the circuit containing the sealed box, a power supply, switch, ammeter and voltmeter. The meters can be used to determine the resistance between selected pairs of terminals. One of the wires is soldered between terminals W and X, another is soldered between W and Y and the final wire is soldered between W and Z.



**Fig. 4.1**

- (a) Connect lead Q to terminal X. Hold the switch closed and record the value of current and voltage, shown on the meters, in **Table 4.1**. Repeat this process for lead Q connected to Y and then Z.  
**Note:** the switch should only be closed as a reading is being taken.

**Table 4.1**

terminals	V/V	I/A	R/ $\Omega$
W and X			
W and Y			
W and Z			

[2]

Teacher Mark	Examiner Check	Remark

(b) Hence calculate the resistance of each length of wire and record your results in **Table 4.1**. [1]

(c) By examining your results, establish between which terminal a particular wire is soldered. Explain your reasoning.

10 cm wire connected between W and \_\_\_\_\_

15 cm wire connected between W and \_\_\_\_\_

20 cm wire connected between W and \_\_\_\_\_

Explanation:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ [2]

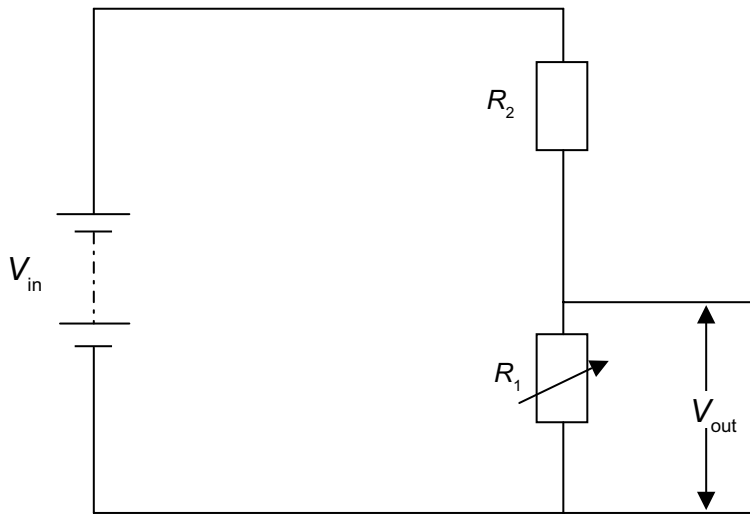
Teacher Mark	Examiner Check	Remark

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## Section B

### 5 The potential divider circuit

A circuit diagram of a potential divider circuit is shown in **Fig. 5.1**.



**Fig. 5.1**

$R_1$  is a variable resistor. The values of  $V_{in}$  and  $R_2$  are not known. A student uses the apparatus to measure  $V_{out}$  for several values of  $R_1$ . The results obtained are recorded in **Table 5.1**.

**Table 5.1**

$R_1/\Omega$	$V_{out}/V$		
$5.0 \times 10^1$	3.8		
$1.0 \times 10^2$	6.0		
$1.5 \times 10^2$	7.2		
$2.0 \times 10^2$	8.0		
$2.5 \times 10^2$	9.1		

The relationship between  $R_1$  and  $V_{out}$  is given by **Equation 5.1**.

$$\frac{1}{V_{out}} = \frac{R_2}{V_{in} R_1} + \frac{1}{V_{in}} \quad \text{Equation 5.1}$$

Teacher Mark	Examiner Check	Remark

- (a) Use **Equation 5.1** to show that a graph of  $\frac{1}{V_{\text{out}}}$  plotted against  $\frac{1}{R_1}$  will result in a straight line graph of gradient  $\frac{R_2}{V_{\text{in}}}$  and intercept  $\frac{1}{V_{\text{in}}}$ .

[2]

### Data Processing

- (b) (i) Head the blank columns of **Table 5.1** with the quantities that should be plotted to draw the graph in (a) and include appropriate units for each. [1]
- (ii) Calculate the numerical values required to complete the blank columns in **Table 5.1** to an appropriate number of significant figures. [3]
- (iii) On the grid of **Fig. 5.2** opposite, draw the graph of the processed data in **Table 5.1**. Label the axes and choose suitable scales. Plot the points and draw the best fit straight line. [5]

### Analysis

- (c) (i) Determine the value of  $V_{\text{in}}$ .

$V_{\text{in}} = \text{_____ V}$  [2]

Teacher Mark	Examiner Check	Remark

- (ii) Determine the experimental uncertainty in  $V_{in}$  by drawing a line of extreme fit on Fig 5.2.

Uncertainty =  $\pm$  \_\_\_\_\_ V [3]

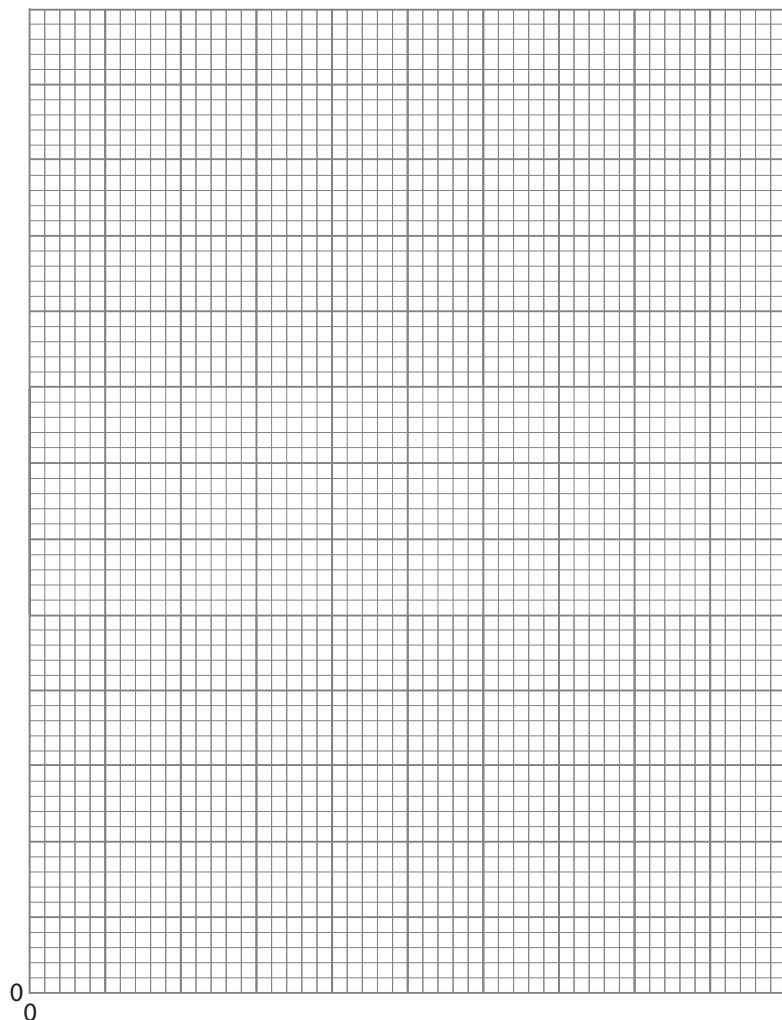


Fig. 5.2

- (iii) Calculate the value of  $R_2$

$R_2 =$  \_\_\_\_\_  $\Omega$  [4]

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**THIS IS THE END OF THE QUESTION PAPER**

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Teacher Mark	Examiner Check	Remark

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