Cambridge International AS & A Level	Cambridge International Examinations Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME		
CENTRE NUMBER	CANDIDATE NUMBER	
PHYSICS		9702/35

## PHYSICS

Paper 3 Advanced Practical Skills 1

Candidates answer on the Question Paper.

As listed in the Confidential Instructions. Additional Materials:

# **READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen. You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer both questions.

You will be allowed to work with the apparatus for a maximum of one hour for each question. You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them. You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used only if it becomes necessary to do so.

At the end of the examination, fasten all your work securely together. The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use		
1		
2		
Total		

**October/November 2016** 

2 hours

This document consists of **11** printed pages and **1** blank page.

#### You may not need to use all of the materials provided.

- 1 In this experiment, you will investigate the motion of a bottle in water.
  - (a) You have been provided with a bottle with a mass attached, a measuring cylinder, a jug of water and a large cylindrical container of water.
    - (i) Use water from the jug and the measuring cylinder to determine the maximum volume  $V_{\rm F}$  of water held by the bottle.

Record  $V_{\rm F}$ . (1 ml = 1 cm<sup>3</sup>)

- (ii) Return any water to the jug.Do not change the volume of water in the large cylindrical cylinder.
- (b) (i) Add volume V of water to the bottle where V is approximately  $100 \text{ cm}^3$ .
  - (ii) Record V.

*V* = ..... cm<sup>3</sup>

- (iii) Screw the cap on the bottle so that no water leaks out of the bottle when the bottle is inverted.
- (c) (i) Place both rubber bands around the top of the large cylindrical container.
  - (ii) Gently push the bottle into the water in the large cylindrical container until the top is just on the water surface as shown in Fig. 1.1.

Keep the bottle in this position using one hand.

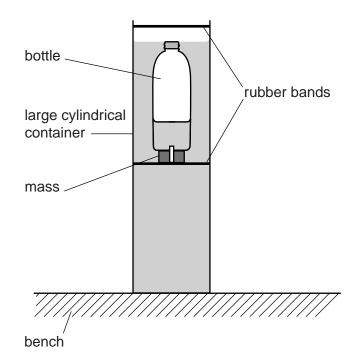
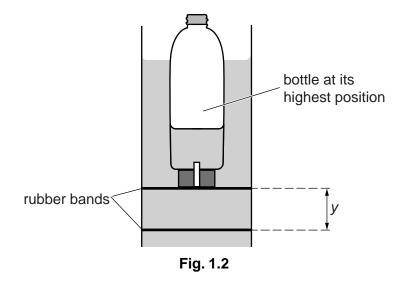


Fig. 1.1

(iv) Release the bottle. The bottle will move upwards and then move downwards.

Place the other rubber band so that it is level with the highest position of the bottom of the mass as shown in Fig. 1.2. You should repeat this several times before you decide on the position of this rubber band.



The maximum distance moved upwards by the bottle is y as shown in Fig. 1.2.

(v) Measure and record y.

*y* = ..... cm [1]

[Turn over

(d) (i) Calculate  $\frac{2V_{\rm F}}{3}$ .

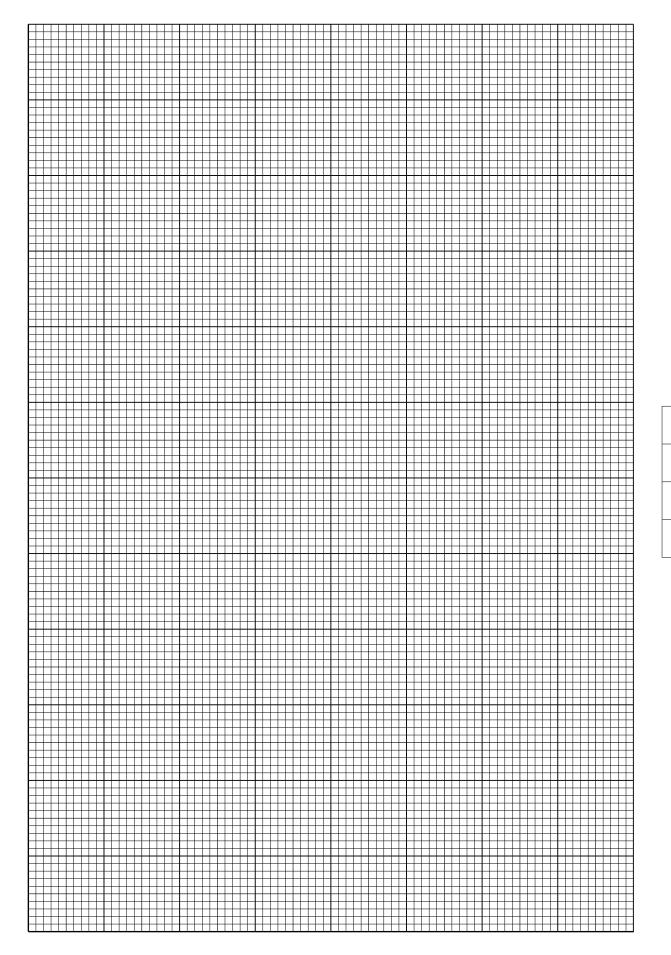
(ii) Increase V and repeat (b)(ii), (b)(iii), (c)(ii), (c)(iv) and (c)(v) until you have six sets of values of V and y.

Do **not** use a value of V greater than  $\frac{2V_F}{3}$ .

			[8]
(e)	(i)	Plot a graph of y on the y-axis against V on the x-axis.	[3]
	(ii)	Draw the straight line of best fit.	[1]

(iii) Determine the gradient and *y*-intercept of this line.

gradient =	
3	
y-intercept =	
[2]	



(f) The quantities y and V are related by the equation

$$y = PV + Q$$

where *P* and *Q* are constants.

Using your answers in **(e)(iii)**, determine the values of *P* and *Q*. Give appropriate units.

		<i>P</i> =	
		Q =[2]	
(g)	(i)	Use your values from (f) to calculate the value of V when $y = 0$ .	
		$V = \dots cm^{3}[1]$	
	(ii)	Explain why it is impossible to repeat the experiment using the value of V calculated in <b>(g)(i)</b> .	
		[1]	
		[Total: 20]	

## You may not need to use all of the materials provided.

- 2 In this experiment, you will investigate the deflection of a loaded wooden strip.
  - (a) (i) Clamp the wooden strip as shown in Fig. 2.1.

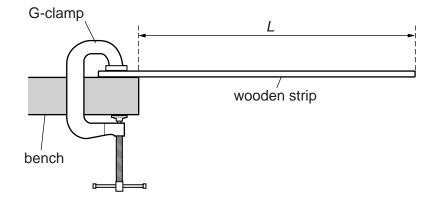


Fig. 2.1 (not to scale)

The distance L that the wooden strip extends beyond the edge of the bench should be approximately 80 cm.

(ii) Measure and record *L*.

*L* = .....[1]

(iii) Estimate the percentage uncertainty in your value of *L*.

percentage uncertainty = .....[1]

(b) (i) Place the 100g mass on the end of the wooden strip as shown in Fig. 2.2.

The vertical distance between the floor and the bottom of the end of the wooden strip is  $d_1$ .

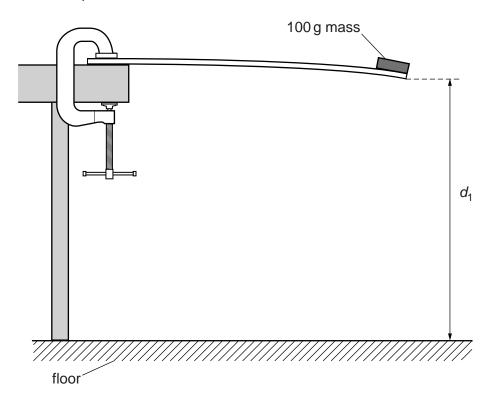


Fig. 2.2 (not to scale)

(ii) Measure and record  $d_1$ .

*d*<sub>1</sub> = .....[1]

(iii) Remove the 100g mass from the wooden strip.

- (c) (i) Use ten 10g masses to evenly distribute a total mass of 100g along the length of the wooden strip.
  - (ii) The distance between the floor and the bottom of the end of the wooden strip is  $d_2$ . Measure and record  $d_2$ .

*d*<sub>2</sub> = .....[1]

(iii) Calculate  $(d_2 - d_1)$ .

 $(d_2 - d_1) = \dots [1]$ 

(iv) The mass per unit length *M* added to the wooden strip is given by

$$M = \frac{m}{L}$$

where the total added mass *m* is 0.100kg.

Calculate M.

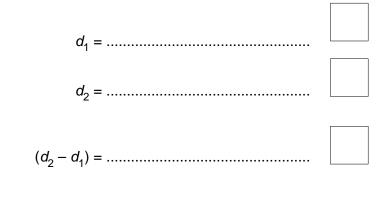
*M* = .....[1]

(d) Justify the number of significant figures that you have given for your value of *M*.

.....[1]

(e) Repeat (b) using the 50 g mass and repeat (c) using five 10 g masses to evenly distribute 50g along the length of the wooden strip.

For this mass the value of *m* is 0.050kg.



*M* = ..... [3]

It is suggested that the relationship between  $(d_2 - d_1)$  and *M* is (f)

$$(d_2 - d_1) = kM$$

where k is a constant.

Using your data, calculate two values of k. (i)

> first value of *k* = ..... second value of *k* = ..... [1]

(ii) Explain whether your results support the suggested relationship.

..... .....[1]

9702/35/O/N/16

Describe four sources of uncertainty or limitations of the procedure for this (g) (i) experiment. 1. ..... ..... 2..... ..... 3. ..... 4..... \_\_\_\_\_ [4] (ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures. 1..... 2. .... 3. ..... .....

4. .....

[4]

[Total: 20]

### **BLANK PAGE**

12

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.