

Candidate
Number

Centre Number

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Candidate Name _____

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

**Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level**

PHYSICS

5054/4

PAPER 4 Alternative to Practical

OCTOBER/NOVEMBER SESSION 2001

1 hour

Candidates answer on the question paper.
No additional materials are required.

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
TOTAL	

This question paper consists of 11 printed pages and 1 blank page.

- 1 A chemical known as polyacrylamide can be obtained in the form of small off-white granules. The size of the granules is between 0.5 mm and 2 mm.

When immersed in water, the chemical **absorbs** water but does not dissolve. Each tiny piece of the substance swells up and becomes a piece of transparent gel. The manufacturer says that each piece of polyacrylamide absorbs **400** times its own mass of water. If this figure were correct, then 1 g of the substance would absorb 400 g of water.

A student attempts to check the manufacturer's claim and performs the following experiment.

Some pieces of the chemical are weighed in a dry container. They are then immersed in *London drinking water* for 2 hours. The surplus water is drained away and the pieces of the gel are put in a dry container and weighed. The mass of the gel and the mass of the dry substance are determined and the ratio

$$R = \frac{\text{mass of gel}}{\text{mass of polyacrylamide used}}$$

is calculated. R is a measure of the mass of water absorbed by 1 g of polyacrylamide.

The readings obtained are given in the tables.

Experiment (i) using London drinking water

mass of polyacrylamide		
mass of container/g	mass of container plus polyacrylamide/g	mass of polyacrylamide/g
2.07	2.58	

mass of gel obtained		
mass of container/g	mass of container plus gel/g	mass of gel/g
20.01	67.06	

- (a) Complete the third column of the two tables above. [2]
- (b) Calculate R for this experiment.

$R =$

[1]

(c) Experiment (ii)

The experiment is repeated using London drinking water and common salt to make a saturated salt solution.

Experiment (iii)

The experiment is repeated again, this time using *purified water*. London drinking water contains dissolved substances, some of these are removed when making purified water.

Experiment (iv)

The experiment is repeated again, this time using deionised water. This water is used in car batteries.

For each experiment, the corresponding value of R is determined. The values are given in the table below.

'water' used	R
saturated salt solution	22.3
London drinking water	
purified water	196
deionised water	301

- (i) Complete the table using your answer from (b).
- (ii) Write a conclusion to this experiment. In your conclusion, draw attention to the factor that increases the amount of water absorbed by 1 g of polyacrylamide.
-
-
-
-[2]
- (iii) The manufacturer obtains a value for R of 400. Suggest a reason why this value is much higher than the value obtained in this experiment.
-

[1]

- 2 Fig. 2.1 shows a converging lens arranged to produce, on a screen, a real and magnified image of an object. The object is a circular hole in a card. This hole is covered with tissue paper and is well lit by a lamp.

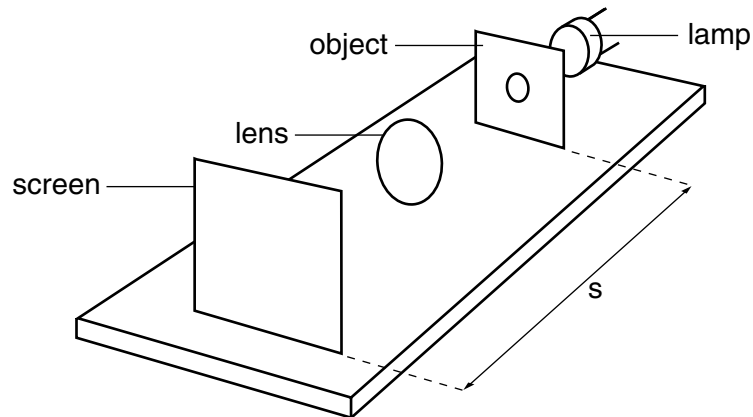


Fig. 2.1

- (a) Explain how a metre rule is used to determine the distance s between the object and the screen. Your answer should
- (i) state where the rule should be placed,
 - (ii) describe how you would avoid making a parallax error,
 - (iii) state the smallest divisions on the rule,
 - (iv) give the name of one piece of additional equipment you would like to have, and say how you would use it, to help you make an accurate measurement of s .

You may draw diagrams if you wish.

- 3 When the steel string of a guitar is plucked, the string vibrates. The frequency of vibration depends on the length of the string. The graph on Fig. 3.1 shows how the frequency varies with the length.

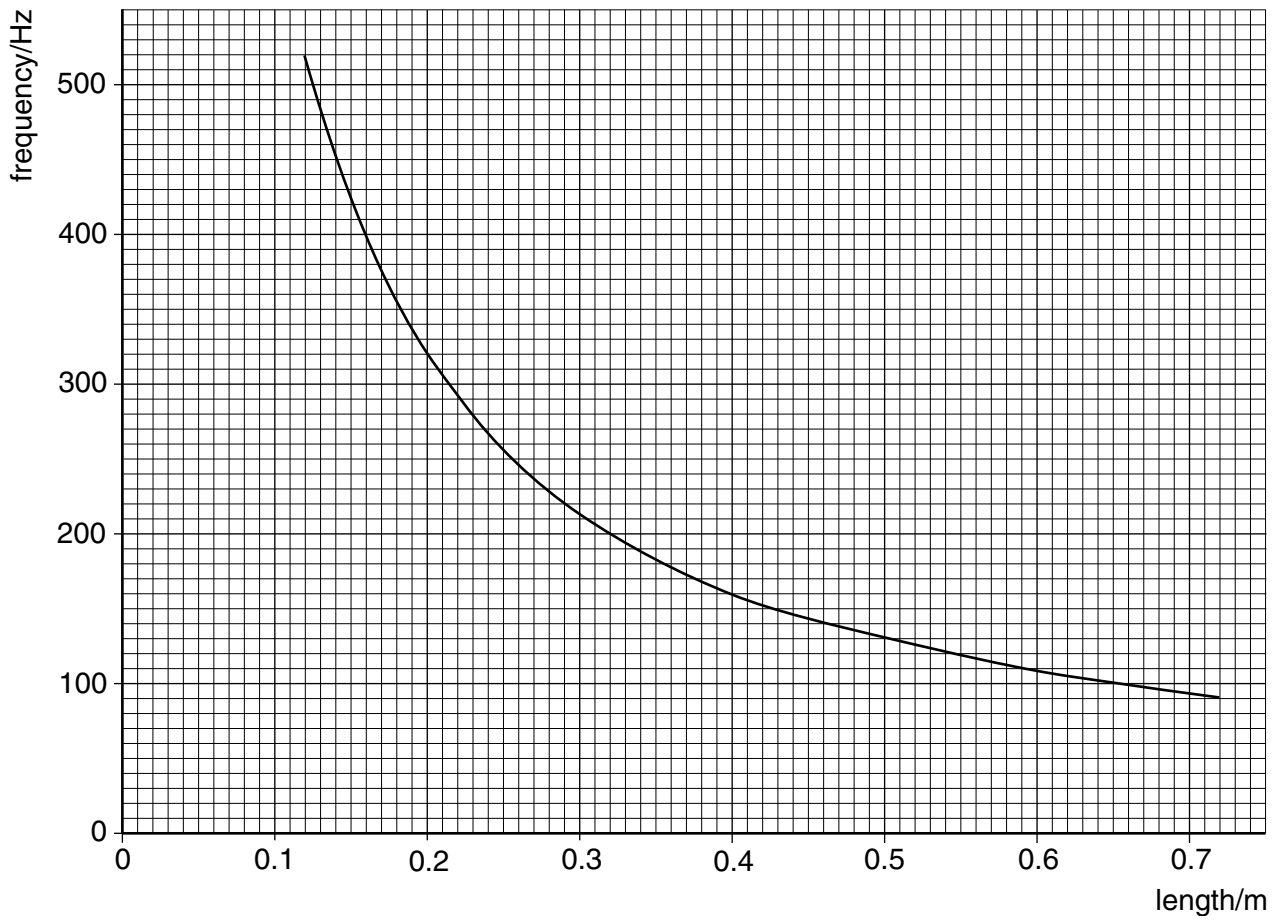


Fig. 3.1

- (a) Use information from the graph to complete the following table.

frequency/Hz	length/m	frequency x length / (m/s)
100	0.644	64.4
	0.322	
400		

[4]

(b) Describe how the frequency changes as the length is increased.

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

(c) Listed below are some equations linking frequency and length. Tick the box next to the correct equation for the guitar string.

frequency = a constant x length

frequency = a constant x (length)²

frequency x length = a constant

frequency x (length)² = a constant

[1]

- 4 A new material has been made for use in thermal insulation. The material is to be tested by a simple cooling experiment.

Some of the apparatus used is shown in Fig. 4.1. Hot water is contained in two identical metal cans. One of the cans is lagged with the insulation material that is being tested. Both cans are allowed to lose heat to the atmosphere.

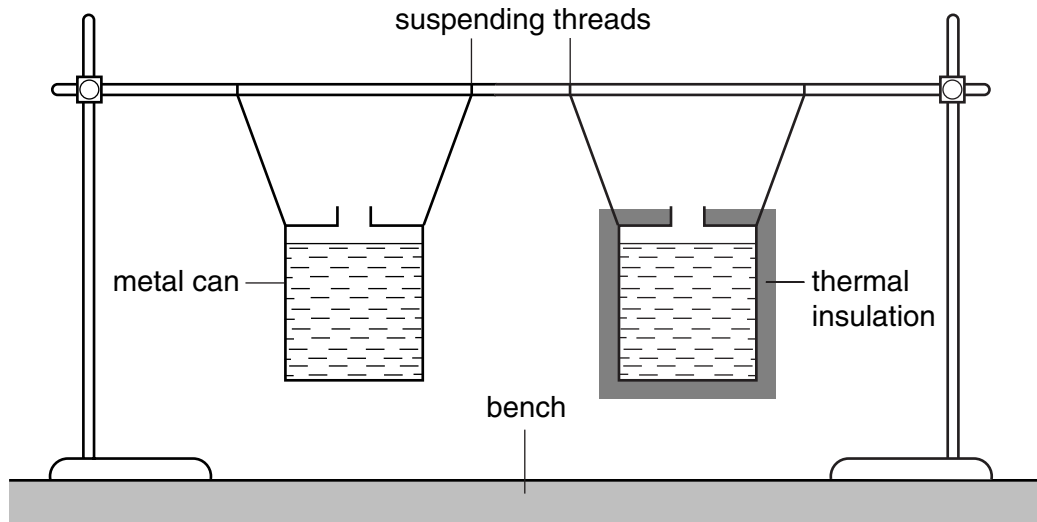


Fig. 4.1

Other items of equipment are needed to obtain reliable cooling curves. Name **three** of these items and explain how each would be used.

name	use
(i)	
(ii)	
(iii)	

[6]

QUESTION 5 IS ON PAGE 10

- 5 A small lamp is connected to a constant low-voltage power supply and placed a fixed distance d from a light-dependent resistor (LDR), as shown in Fig.5.1. The LDR is connected to a milliammeter and a dry cell.

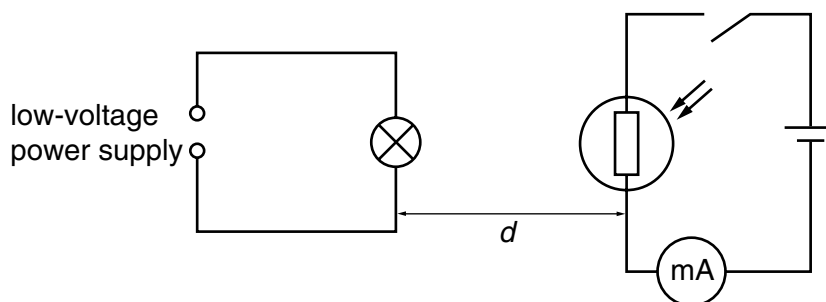


Fig. 5.1

The apparatus is placed in a completely dark room and the reading on the milliammeter recorded.

Additional identical lamps are placed, one at a time, as close as possible to the original lamp and directly facing the LDR. The lamps are connected in parallel across the low-voltage supply.

For each extra lamp, the reading of the current I given on the milliammeter and the number N of lamps are recorded. The values obtained are shown in the table below.

N	0	1	2	3	4	5	6
I/mA	0	0.22	0.54	0.75	1.03	1.30	1.60

- (a) On the graph grid on page 11, plot the graph of I/mA (y -axis) against N (x -axis). [3]

Draw a best-fit line for the points.

- (b) (i) How does the current I in the LDR vary with the number N of lamps used?

.....

- (ii) When 2 lamps are used, the resistance of the LDR is $3000\ \Omega$. Determine the resistance of the LDR when 6 lamps are used.

resistance =

[3]

