

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

PHYSICS **5054/04**

Paper 4 Alternative to Practical May/June 2005

1 hour

Candidates answer on the Question Paper.
No Additional Materials are required.

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
3	
4	
Total	

- 1 A student finds a bag of glass marbles and decides to find out the type of glass from which they are made. The densities of four different types of glass are shown in Fig. 1.1.

type of glass	density / (g / cm ³)
zinc crown	2.49
light barium crown	2.87
medium barium crown	3.12
dense barium crown	3.56

Fig. 1.1

The student chooses six marbles from the bag. The marbles are added one at a time to a beaker on a balance, as shown in Fig. 1.2. The readings are recorded each time in a table.

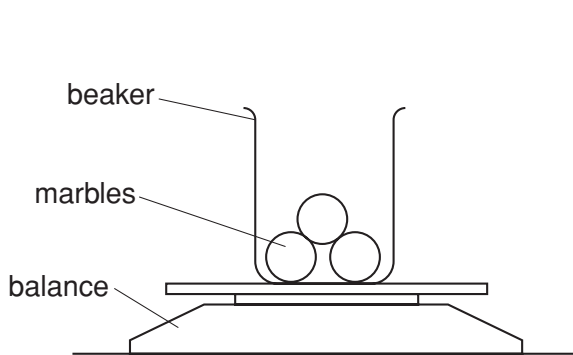


Fig. 1.2

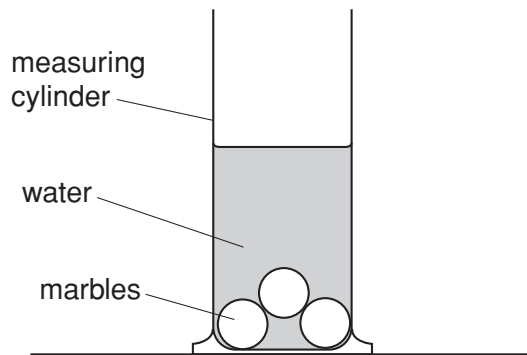


Fig. 1.3

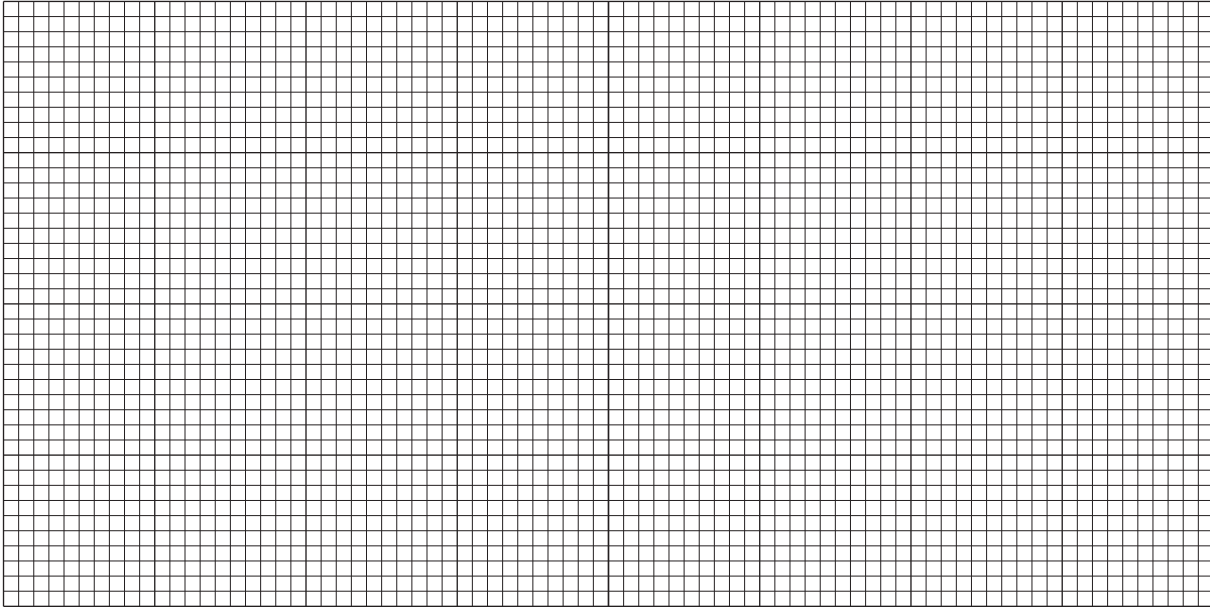
One at a time and in the same order, the marbles are added to a 100 cm³ measuring cylinder containing 40 cm³ of water, as shown in Fig. 1.3. The new volume is recorded each time.

The readings are shown in Fig. 1.4.

number of marbles in the beaker	reading of balance / g	reading of measuring cylinder / cm ³	total mass of marbles in the beaker / g	total volume of marbles in the measuring cylinder / cm ³
0	17.60	40.0	0	0
1	23.27	42.0		
2	29.31	45.0		
3	34.50	47.0		
4	39.54	49.0		
5	45.12	51.0		
6	51.13	53.5		

Fig. 1.4

- (a) Complete Fig. 1.4 to show the values for the total mass of the marbles in the beaker and the total volume of the marbles in the measuring cylinder. [2]
- (b) On the grid below, plot a graph of the total mass of the marbles on the y-axis against the total volume of the marbles on the x-axis. [4]



- (c) Given that

$$\text{density} = \frac{\text{mass}}{\text{volume}},$$

use the graph to determine the density of the glass. Show clearly how you obtain your answer.

density = [3]

- (d) Use Fig. 1.1 to identify the type of glass used to make the marbles.

..... [1]

Question 1 continues on page 4

(e) The student had planned the experiment carefully.

(i) Suggest a reason for measuring the mass of the marbles before measuring the volume of the marbles.

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

(ii) Suggest a reason for choosing a 100 cm³ measuring cylinder.

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

(f) The masses are measured more precisely than the volumes.

The volume *V* of a sphere is given by

$$V = \frac{4}{3}\pi r^3,$$

where *r* is the radius of the sphere.

Suggest an accurate method of obtaining the volume of a marble using this equation. Name the measuring instrument used, the physical quantity measured and how the volume is obtained from the measurement.

measuring instrument used

physical quantity measured

how the volume is obtained

.....

.....

..... [3]

- 2 A student sets up a circuit to investigate how the resistance of a lamp varies with the current in it. The circuit is set up as shown in Fig. 2.1. The ammeter and voltmeter are **not** positioned correctly.

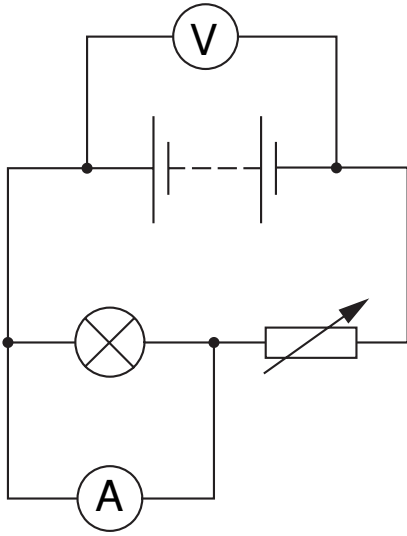


Fig. 2.1

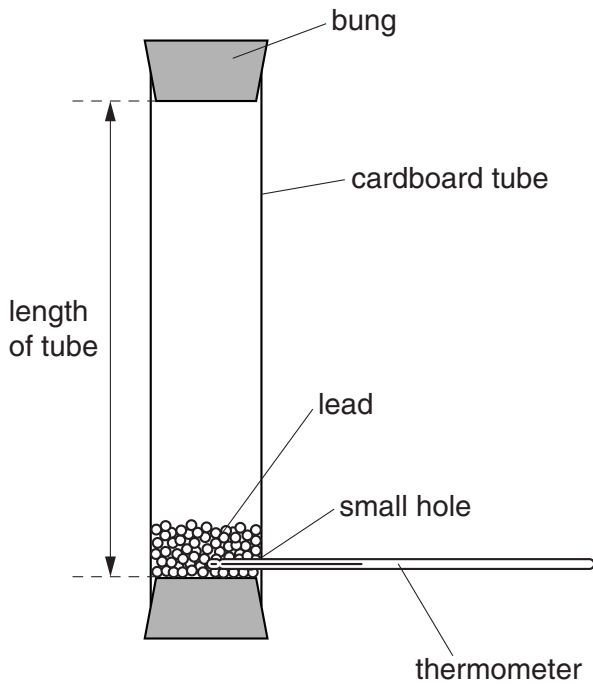
- (a) In the space above, redraw Fig. 2.1 with the ammeter and voltmeter positioned correctly. [2]
- (b) In the table below, write the column headings for the readings and for the calculated values of resistance. [2]

- (c) The student draws a graph of resistance against current. State and explain whether you would expect the line of this graph to pass through the origin.

.....

..... [1]

- 3 In an experiment to calculate the specific heat capacity of lead, a long cardboard tube is used with about 100 g of small pieces of lead. The lead is placed inside the tube and the ends are closed with bungs. The tube is turned upside down many times, allowing the lead to fall to the bottom each time, as shown in Fig. 3.1.



Readings taken during the experiment:

initial temperature θ_1 of lead = 20.1 °C

final temperature θ_2 of lead = 21.5 °C

length l of tube = 0.483 m

number of times tube turned upside down = 100

Fig. 3.1

Theory suggests that the potential energy lost by the lead when it falls is equal to the thermal energy gained by the lead when it stops at the bottom of the tube.

- (a) Give a reason for turning the tube upside down a large number of times.

.....
 [1]

- (b) Explain why the thermometer is removed before the tube is turned upside down.

.....
 [1]

- (c) It is suggested that the experiment can be improved by using a longer tube.

Give one advantage and one disadvantage of using a longer tube.

advantage

disadvantage

[2]

(d) Theory suggests that the specific heat capacity c in $\text{J}/(\text{kg } ^\circ\text{C})$ is given by

$$c = \frac{1000l}{\theta_2 - \theta_1} .$$

(i) Use the results of the experiment to calculate the specific heat capacity of lead.

.....

 [1]

(ii) The value obtained in this experiment for the specific heat capacity of lead is higher than the correct value. Suggest one reason for this.

.....
 [1]

Copyright Acknowledgements:

Question 1 (Fig. 1.1) George William C Kaye, T H Laby; *Tables of Physical and Chemical Constants*; Longman; 1973 © Chance-Pilkington Optical Glass Catalogue.

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- 4 A group of students perform an investigation into the way seeds fall from some types of tree. A piece of paper with a weight on the bottom is used to represent a seed, as shown in Fig. 4.1.

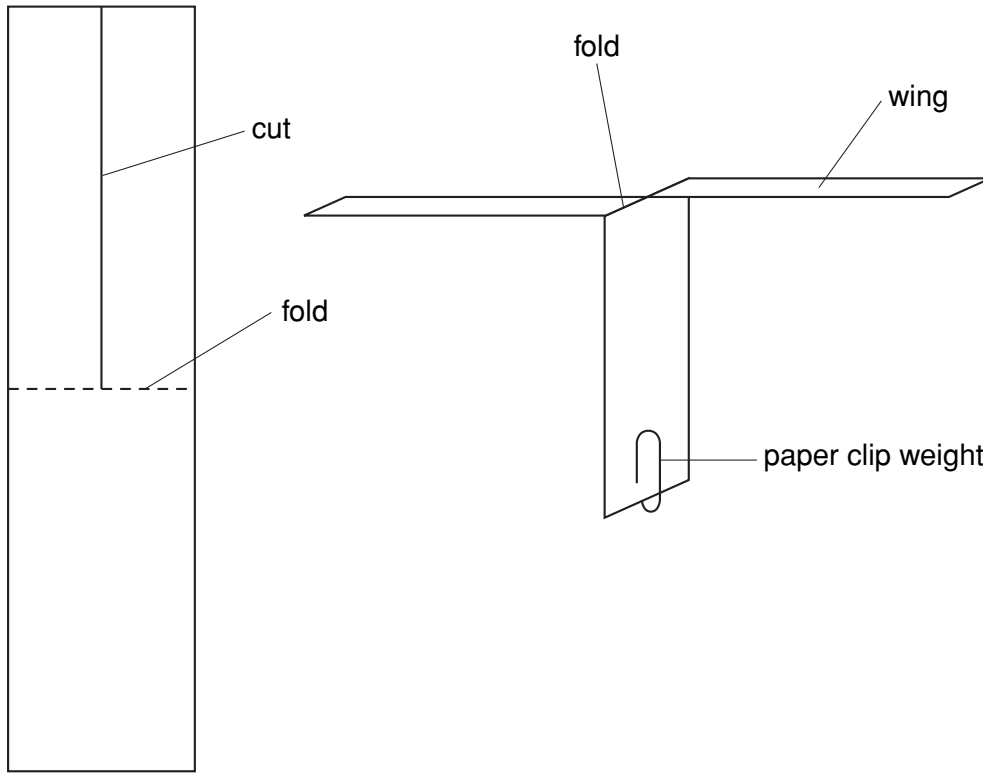


Fig. 4.1

When released from a height, the paper spins and falls slowly to the ground.

A student suggests varying the length of the wings to see the effect this has on the time taken to fall to the ground.

- (a) Suggest two other variables that could affect the time of the fall.

1

2 [2]

- (b) Suggest how changing the length of the wings affects the time taken for the paper to fall to the ground.

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

- (c) Suggest one way in which the measurement of the time taken can be made as accurate as possible.

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