



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
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PHYSICAL SCIENCE

0652/06

Paper 6 Alternative to Practical

October/November 2008

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.

You may use a soft pencil for any diagrams or graphs.

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

DO **NOT** WRITE IN ANY BARCODES.

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.

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Total	

This document consists of **18** printed pages and **2** blank pages.



- 1 This question is about the use of a dropping (teat) pipette, shown in Fig. 1.1. The teacher gives it to a student to use in several experiments.

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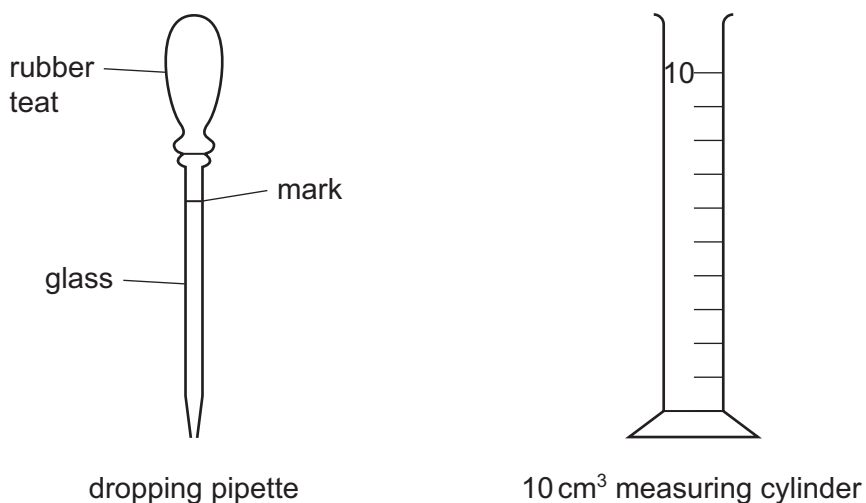


Fig. 1.1

- (a) (i) Explain how the student can fill the teat pipette with liquid up to the mark.

.....
 [1]

- (ii) The teat pipette holds between 1 and 2 cm³ when filled up to the mark.

Suggest how the student can find this volume to the nearest 0.1 cm³ using the apparatus in Fig. 1.1.

.....

 [2]

- (iii) The student finds out that the teat pipette has an accurate volume of 1.8 cm^3 .

Explain how, using this information, he can find the volume of one drop of liquid that is delivered by the teat pipette.

.....
 [1]

The student uses the teat pipette to investigate the reaction between hydrochloric acid and aqueous sodium hydroxide. The apparatus is shown in Fig. 1.2.

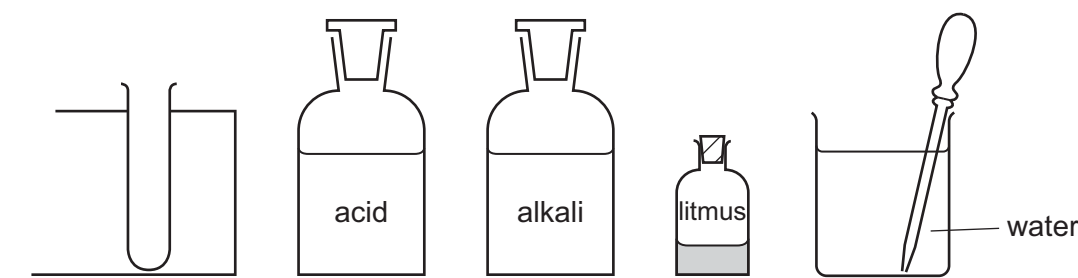


Fig. 1.2

He places twenty drops of the acid in the test-tube using the teat pipette. He adds one drop of litmus solution.

He fills the teat pipette with the alkali then adds it, one drop at a time, to the acid containing the litmus.

- (b) (i) The student adds 16 drops of the alkali to the acid, then the colour changes. State the colour change that will be seen.

from to [1]

He knows that one drop has a volume of 0.08 cm^3 .

- (ii) What volume of alkali has he added?

..... [1]

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- (iii) Which is the more concentrated solution, the hydrochloric acid or the sodium hydroxide? Explain your answer.

..... is more concentrated than the

explanation

.....

..... [2]

- (iv) Suggest what the beaker of water is used for during this experiment.

.....

..... [1]

- (v) Name the salt formed in the test-tube.

..... [1]

- 2 A student is doing an experiment with a spring to which a weight hanger is attached. This is shown in Fig. 2.1.

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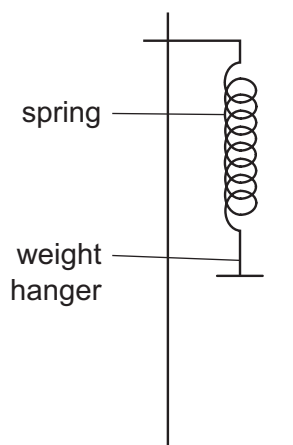


Fig. 2.1

A 200 g mass is attached to the weight hanger. When the mass is pulled down and then released, it oscillates (bounces up and down). This is shown in Fig. 2.2.

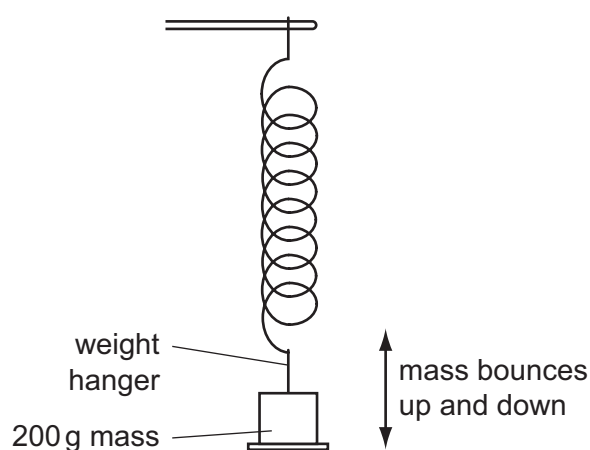


Fig. 2.2

- Using a stopclock, the student finds the time in seconds taken for 20 oscillations.
- He records the results in Fig. 2.3.
- He increases the mass to 300 g and finds the new time.
- The student repeats the experiment using 400 g and 500 g masses.

mass on weight hanger/g	time for 20 oscillations/s	time T , for one oscillation/s	T^2/s^2
200	13.0	0.65	0.42
300			
400			
500	19.0	0.95	0.90

Fig. 2.3

(a) Fig. 2.4 shows the missing times for 20 oscillations of the 300 g and 400 g masses.

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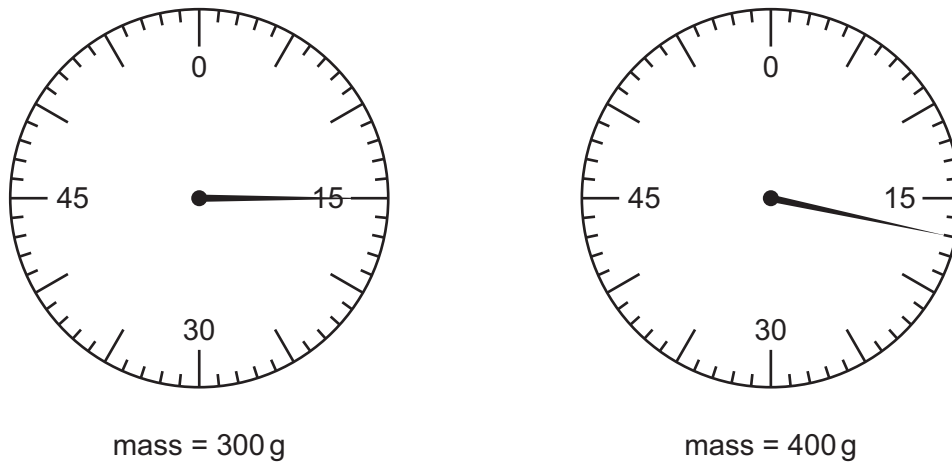


Fig. 2.4

- (i) Read the times and record them in column 2 of Fig. 2.3. [2]
- (ii) Complete column 3 of Fig. 2.3 by calculating T , the time for one oscillation. [1]
- (iii) Find the values of T^2 for the 300 g and 400 g masses and complete column 4. [1]
- (b) On the graph grid, Fig. 2.5, plot T^2 (vertical axis) against the mass. Draw the best straight line. It will **not** pass through the point (0, 0). [2]

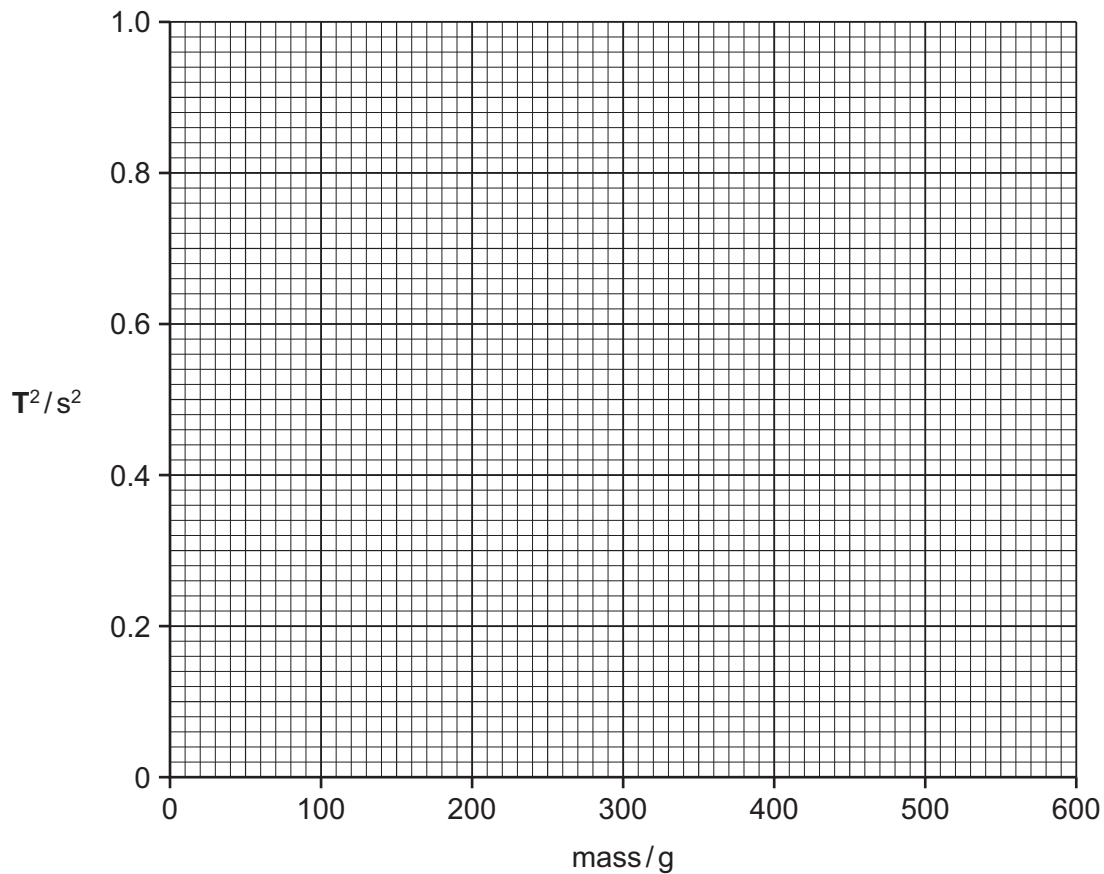


Fig. 2.5

- (c) Find **f**, the gradient of the line, showing on the graph how you did this.

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$$f = \dots\dots\dots s^2/g \quad [2]$$

- (d) A mass of 200 g extended the spring by 75 mm.
Use the gradient, **f**, from (c) and the equation below to calculate a value for **g**, the acceleration of free fall. (The extension of 75 mm produced by the 200 g mass has been included in the equation.)

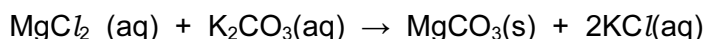
$$g = \frac{75 \times 0.0002}{f}$$

[1]

- (e) Suggest a reason why the straight line of the graph does **not** pass through the point (0,0).

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

- 3 The science class is making magnesium carbonate by the process of precipitation. The teacher gives them this equation for the reaction.



(a) State the meaning of the symbols

(i) (aq)

(ii) (s) [2]

The teacher gives a student 50 cm³ of magnesium chloride solution and a beaker of potassium carbonate solution. The teacher says that the potassium carbonate solution is more concentrated than the magnesium chloride solution.

- (b) What volume of potassium carbonate solution will the student need to react with all the 50 cm³ of the magnesium chloride solution? Tick the correct answer.

☐ less than 50 cm³

☐ exactly 50 cm³

☐ more than 50 cm³

[1]

The student begins to add potassium carbonate solution, a few drops at a time, to the magnesium chloride solution. She stirs the mixture. This is shown in Fig. 3.1.

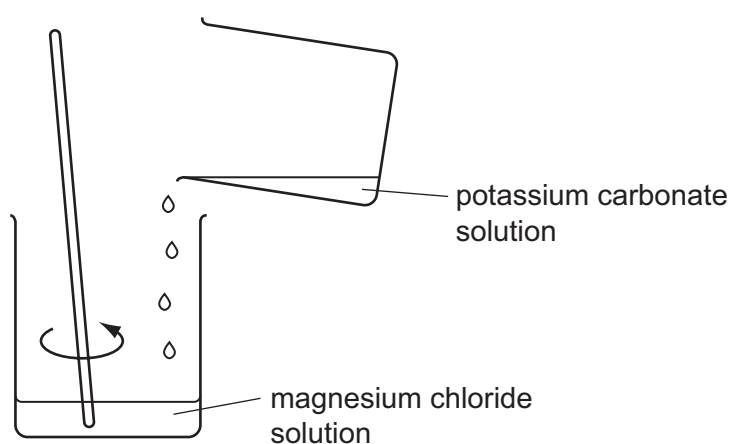


Fig. 3.1

The student decides that she has added enough potassium carbonate to react with all of the magnesium chloride. She wants to filter the mixture to remove the magnesium carbonate. This is shown in Fig. 3.2.

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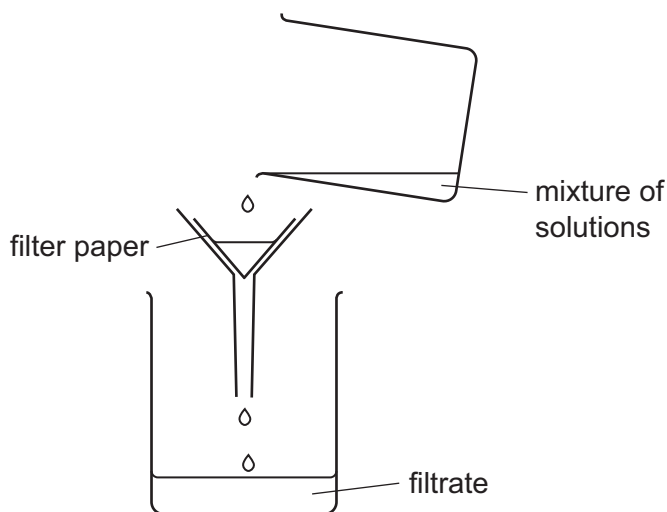


Fig. 3.2

- (c) Here is her filter paper circle. Show by completing the diagram, **or** by describing, how to fold the filter paper to fit it into the filter funnel.

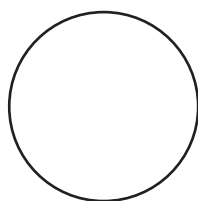


Fig. 3.3

.....
..... [2]

The student collects the magnesium carbonate in the filter paper. The filtrate is collected in the beaker.

- (d) The student wants a pure sample of magnesium carbonate. She does **not** take the magnesium carbonate out of the filter paper. What does she do next?

..... [1]

- (e) The student wants to find out if, in Fig. 3.1, enough potassium carbonate was added to the magnesium chloride solution. Explain how she can do this, using the filtrate from (c) and a few more drops of potassium carbonate solution.

.....

.....

.....

..... [2]

- (f) Suggest a way of getting a pure sample of potassium chloride crystals from the filtrate.

.....

.....

..... [2]

- 4 The teacher is showing the class how electrical energy is changed into heat energy. Fig. 4.1 shows the apparatus he is using.

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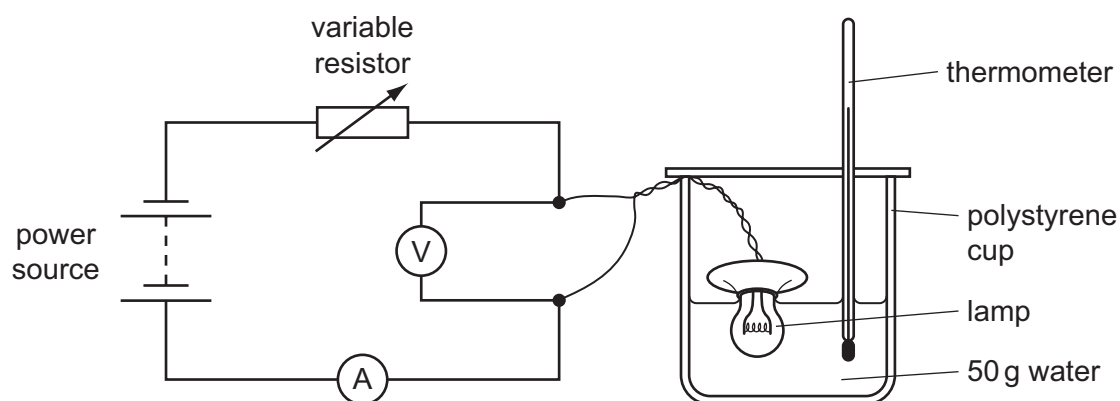


Fig. 4.1

- The teacher places 50 g of water in the polystyrene cup.
 - He adjusts the variable resistor to give a steady current.
 - He reads the thermometer and records the initial temperature.
 - He starts the clock and reads the temperature after every minute.
- (a) The ammeter and voltmeter are shown in Fig. 4.2. Read and record the readings in Fig. 4.3. [2]

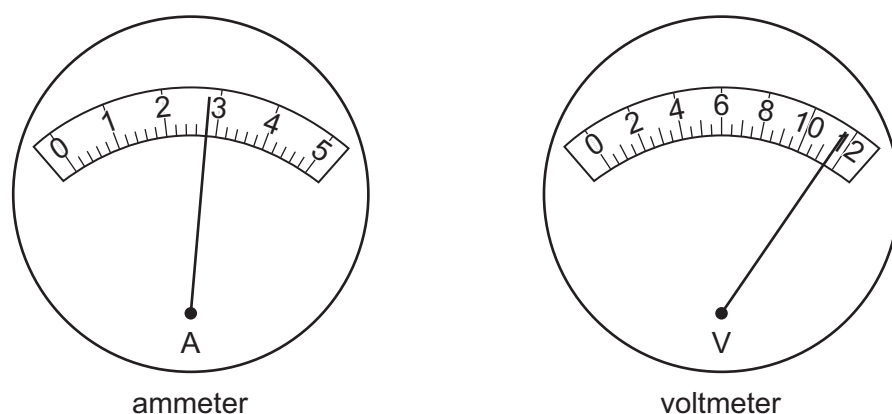


Fig. 4.2

ammeter reading / A	voltmeter reading / V

Fig. 4.3

Fig. 4.4 shows the thermometer readings at one minute intervals.

time / minutes	0	1	2	3	4	5
T, thermometer reading / °C	$T_0 = 20.0$	$T_1 = 27.3$	$T_2 =$	$T_3 =$	$T_4 =$	$T_5 = 55.8$

Fig. 4.4

- (b) The missing thermometer readings are shown in Fig. 4.5. Read the temperatures and record the readings, to the nearest 0.1 °C, in Fig. 4.4. [3]

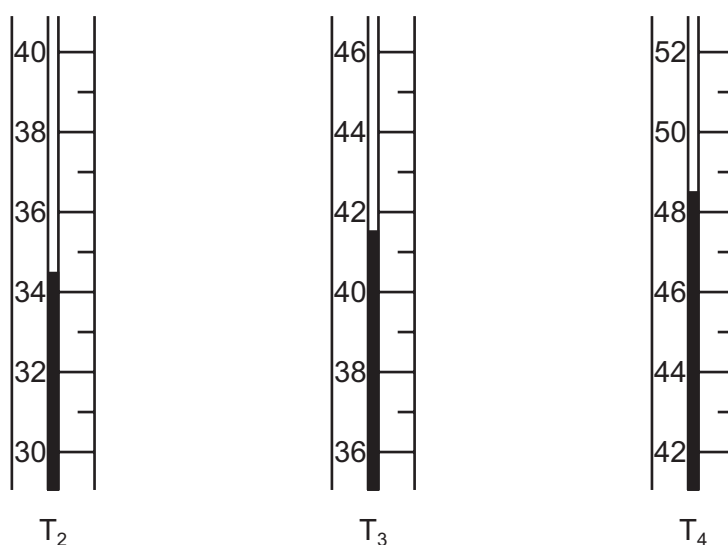


Fig. 4.5

- (c) Calculate **E**, the amount of electrical energy used by the lamp in 5 minutes.

Use data from Fig. 4.3 and the equation shown below.

$$E = \text{current} \times \text{voltage} \times 5 \times 60 \text{ joules}$$

E = J [2]

- (d) (i) Calculate C_p , the amount of energy used in raising the temperature of 1 g of water by 1 degree Celsius.

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Use the equation shown below, the result from (c) and data from Fig. 4.4.

$$C_p = \frac{E}{50 \times (T_5 - T_0)} \text{ joules per gram per degree C}$$

$$C_p = \dots\dots\dots \text{J g}^{-1} \text{ } ^\circ\text{C}^{-1} \quad [2]$$

- (ii) The teacher's text-book gives the value 4.2 J for the energy needed to raise the temperature of 1 gram of water by 1 degree.

Suggest a source of error in this experiment that might make the value in (d)(i) inaccurate. All the thermometer readings and the ammeter and voltmeter readings are accurate.

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

- 5 The science class is doing an experiment to demonstrate the expansion of liquids. They are comparing the expansion of water, ethanol and methanol. The apparatus is shown in Fig. 5.1.

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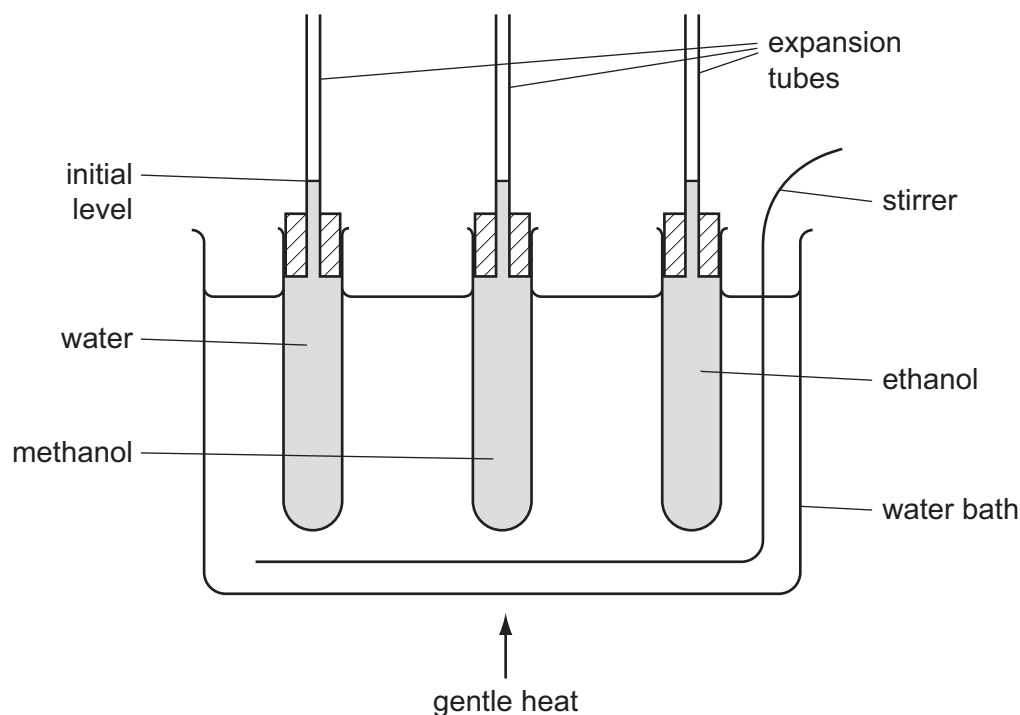


Fig. 5.1

- Each test-tube is filled with liquid and the expansion tube is inserted so that there is no air in the tube.
- The initial level of the liquid in the expansion tube is marked.
- The water-bath is gently heated and stirred.
- After a few minutes, the new levels of the liquids in the expansion tubes are noted.

Fig. 5.2 shows the levels of the liquids in the expansion tubes before and after heating.

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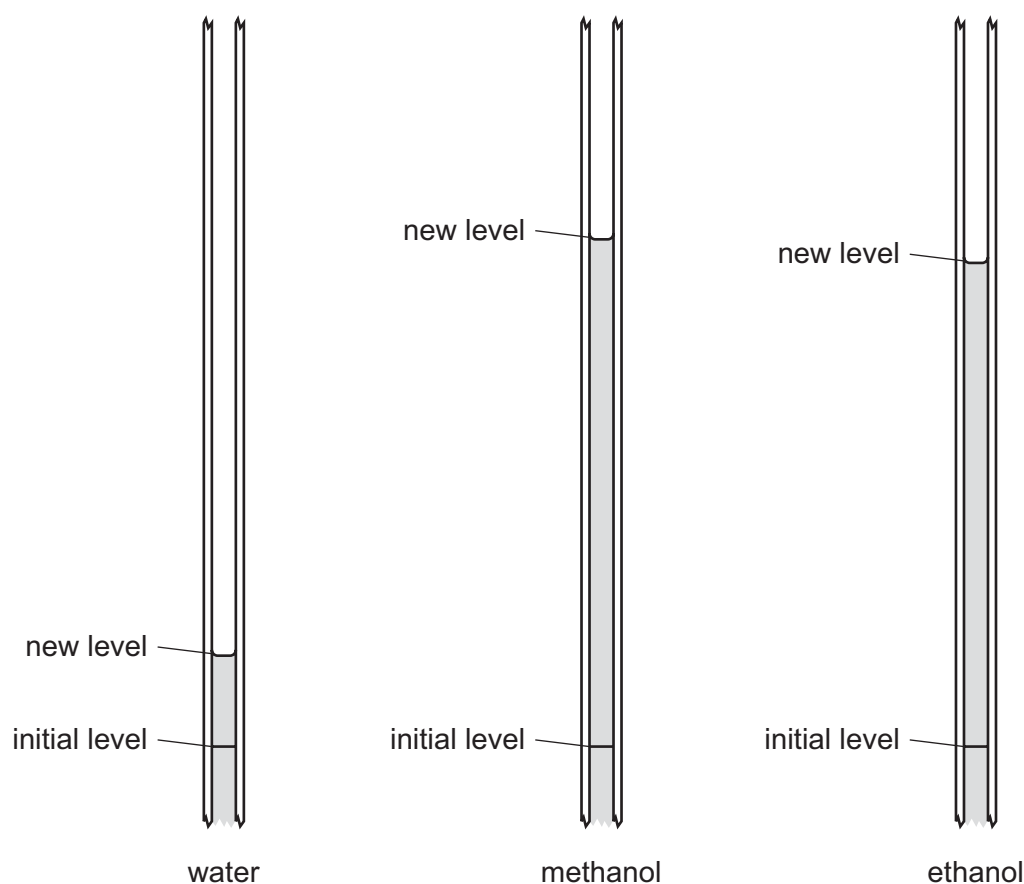


Fig. 5.2

- (a) (i) Use a ruler to measure, to the nearest millimetre, the increase in height of the liquid in each tube. Record your results in Fig. 5.3.

liquid	water	methanol	ethanol
increase in height/millimetres			

Fig. 5.3

[3]

- (ii) Explain the importance of placing all three tubes in the same water-bath.

.....
 [1]

- (iii) Explain the importance of stirring the water in the water-bath during heating.

.....
 [1]

- (b) A student obtained an unexpected result from one of his tubes. The teacher saw that there was air in the tube, shown in Fig. 5.4.

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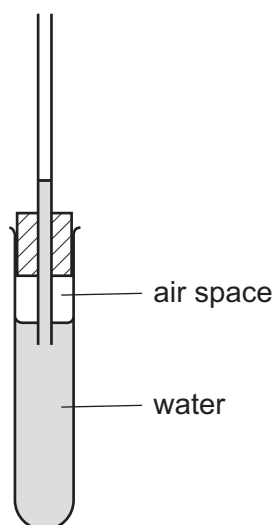


Fig. 5.4

Explain why this would give a different result.

.....

.....

..... [2]

- (c) (i) The teacher told the class that the glass of the test-tubes also expands when heated. Did the glass expand **more than, the same as** or **less than** the liquids? Explain your answer.

.....

.....

..... [2]

- (ii) Use the results of the experiment to suggest how the forces of attraction between molecules in water compare with the forces between molecules in ethanol.

.....

..... [1]

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Please turn over for Question 6.

- 6 The class is given a sample of solid **A**. They are also given solution **B** and solution **C**. They carry out the experiments described below.

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Complete Figs. 6.1, 6.2 and 6.3 to show the tests, observations and conclusions.

(a) experiments on solid A

test	observation	conclusion
Dissolve solid A in water and divide the solution into three parts.		
(i) To the solution of solid A , add aqueous barium chloride and dilute hydrochloric acid.	A precipitate is formed that has a colour [1]	Solid A contains ions [1]
(ii) To the solution of solid A , add a piece of magnesium ribbon. Test the gas given off with a lighted spill. [1] [1]	The solution is acid. The gas is hydrogen.
(iii) To the solution of solid A , add solid sodium carbonate.		
Test the gas given off with 1. a lighted spill 2. limewater. [1] [1]	The gas is carbon dioxide.

Fig. 6.1

(b) experiments on solution B

test	observation	conclusion
(i) To solution B , add aqueous sodium hydroxide. [1]	Solution B contains iron(III) ions.
(ii) To solution B , add dilute nitric acid and aqueous [1] [1]	Solution B contains chloride ions.

Fig. 6.2**(c) experiments on solution C**

test	observation	conclusion
Acidify solution C with hydrochloric acid and add to solution B in a large test-tube. Warm the mixture.		
After cooling, add excess aqueous sodium hydroxide.	A precipitate is formed that has a [1] colour	The iron(III) ions in solution B have been changed into iron(II) ions.

Fig. 6.3

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