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PHYSICAL SCIENCE

0652/62

Paper 6 Alternative to Practical

October/November 2015

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 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 **all** questions.

Electronic calculators may be used.

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

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.

This document consists of **22** printed pages and **2** blank pages.

- 1 The teacher gives instructions to a student to react an acid with an alkali to make a pure crystalline sample of sodium nitrate, NaNO_3 .

Read the instructions below.

Instructions

- 1 Measure 50 cm^3 of the alkali into a beaker.
- 2 Add a few drops of an indicator.
- 3 Gradually add the solution of the acid, stirring the mixture, until the indicator turns green.
- 4 Record V , the volume of acid added, to the nearest 0.5 cm^3 .
- 5 To a fresh 50 cm^3 of the alkali add the same volume, V , of the acid to make the solution of sodium nitrate.
- 6 Concentrate the sodium nitrate solution until crystals begin to form.
- 7 Filter off and dry the crystals.

- (a) Name the acid and the alkali that the student uses to make sodium nitrate crystals.

..... and [2]

- (b) Name pieces of apparatus that the student can use:

- to measure out 50 cm^3 of the alkali,

.....

- to gradually add the acid **and** accurately measure the volume added.

.....

[2]

- (c) (i) Name the indicator that the student used.

..... [1]

- (ii) When the indicator is added at the beginning of the experiment it turns purple.

Suggest the pH of the alkali. [1]

(d) Explain why the student must take a fresh 50 cm³ portion of the alkali in step 5 of the instructions before adding V, the same volume of acid as recorded in step 4, to make sodium nitrate crystals.

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

(e) Explain how the student can concentrate the solution of sodium nitrate. You should include a diagram in your answer.

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

(f) Draw a labelled diagram to show how the crystals of sodium nitrate can be separated from the solution.

[2]

2 The teacher gives a student samples of a calcium salt. The student will carry out four experiments.

(a) Fig. 2.1 shows the apparatus for **experiment 1**. Read the instructions for the experiment which are shown below the diagram.

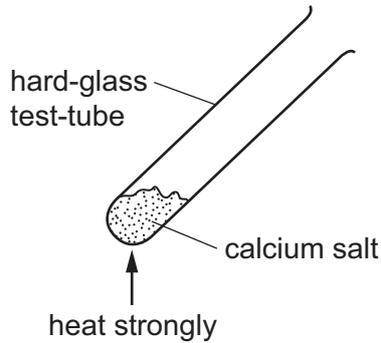
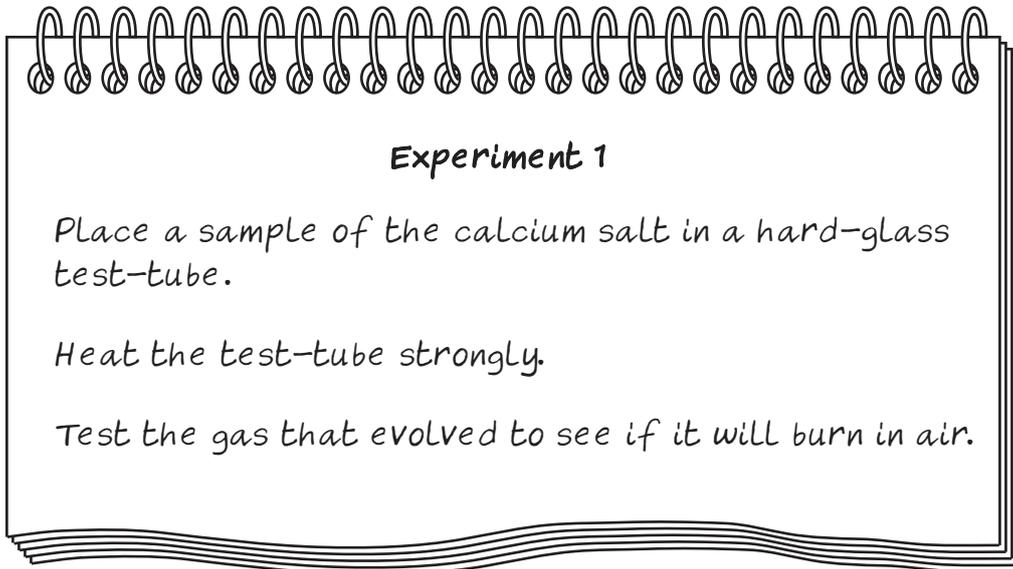


Fig. 2.1



Describe how the student can find out if the gas will burn in air.

test

result [1]

- (b) Fig. 2.2 shows the apparatus for **experiment 2**. Read the instructions for the experiment which are shown below in the diagram.

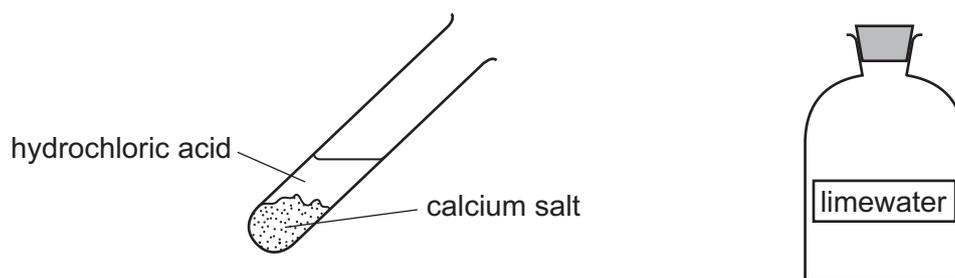
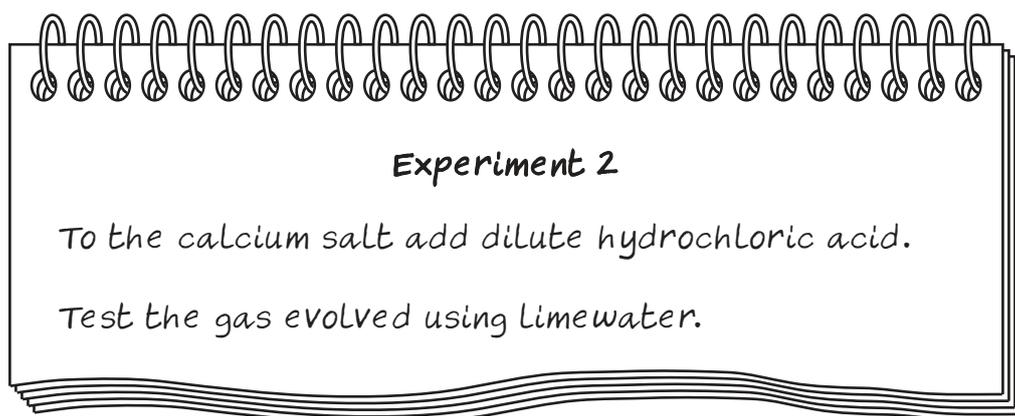


Fig. 2.2



- (i) Draw a diagram to show how the student can test the gas coming out of the test-tube using limewater. State the positive result for this test.

result

[2]

- (ii) Name the gas that gives the positive result in (b)(i).

.....

[1]

- (c) **Experiment 2** gives a positive result with limewater.

Name this calcium salt.

.....

[1]

- (d) Fig. 2.3 shows the apparatus for **experiment 3**. Read the instructions for the experiment which are shown below the diagram.

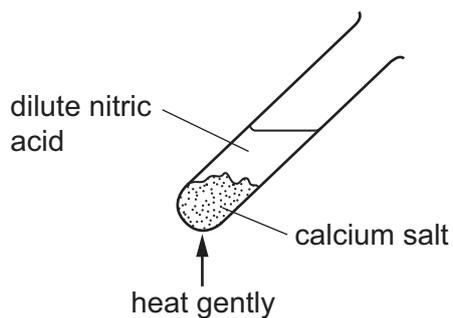


Fig. 2.3

Experiment 3

Add dilute nitric acid to a fresh sample of the calcium salt.

Warm the test-tube gently.

Test the gas that evolves to see if it is acidic.

- (i) Describe how the student can test if the gas is acidic.

test

result, [2]

- (ii) Explain why the test-tube must be warmed gently rather than heated strongly.

..... [1]

- (e) The teacher gives the student two acids of the same concentration, acid Y and acid Z.

Fig. 2.4 shows the apparatus for **experiment 4**. Read the instructions for the experiment which are shown below the diagram.

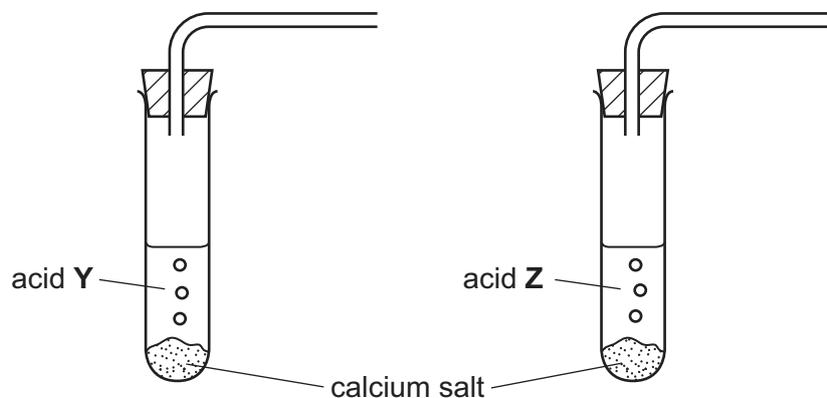
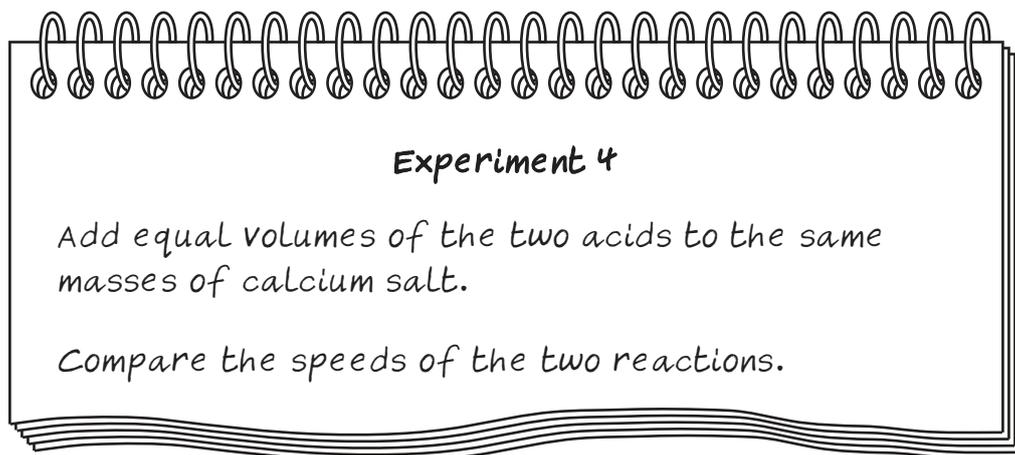


Fig. 2.4



Suggest how the student can use the gas produced by each reaction to compare the speeds of the reactions. You may draw a diagram to illustrate your answer.

.....

.....

..... [2]

3 A student is investigating different components in a circuit.

He sets up the apparatus shown in Fig. 3.1. He then carries out an experiment to measure the resistance of the power supply.

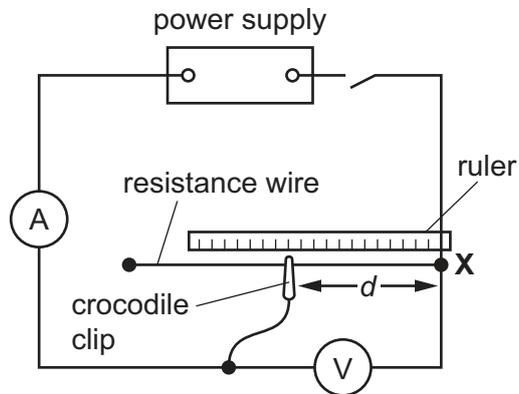


Fig. 3.1

Procedure

- Connect the crocodile clip to the resistance wire at a distance $d = 15$ cm from point **X**.
- Close the switch.
- Read the ammeter and voltmeter and then immediately open the switch.
- Record the readings in Table 3.1.
- Repeat this procedure for the other distances from point **X** shown in Table 3.1.

- (a) Fig. 3.2 shows the ammeter and voltmeter readings for the distances $d = 25$ and $d = 40$ cm. Read the meters to a suitable number of decimal places and record the readings in Table 3.1.

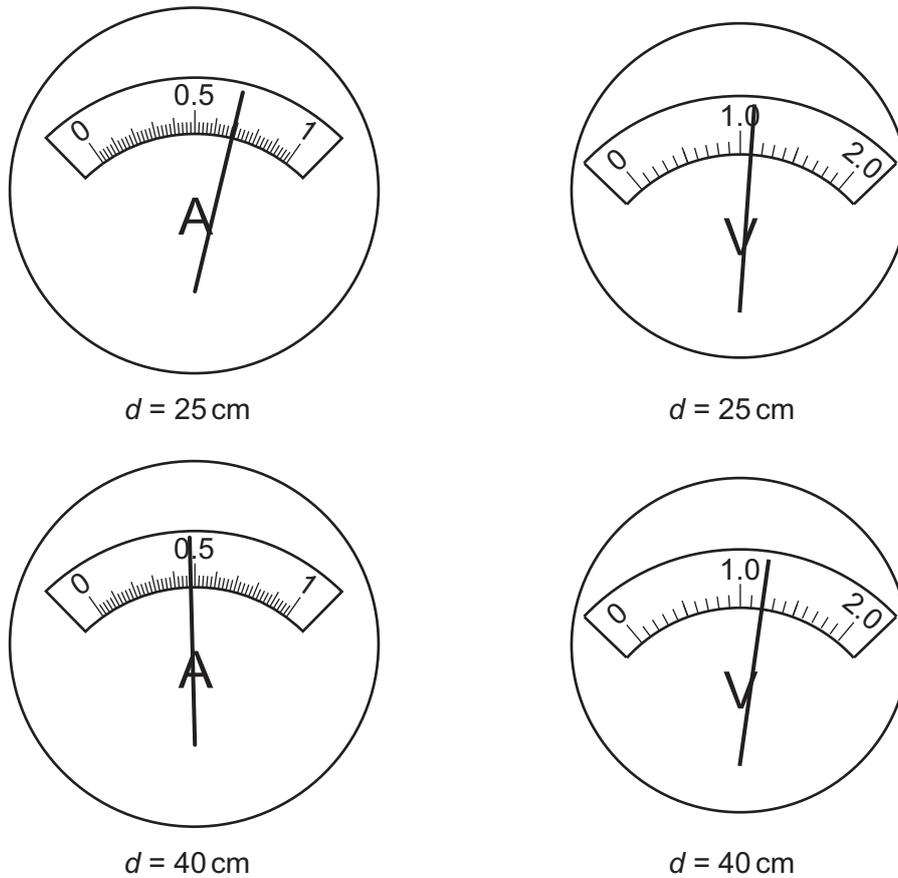


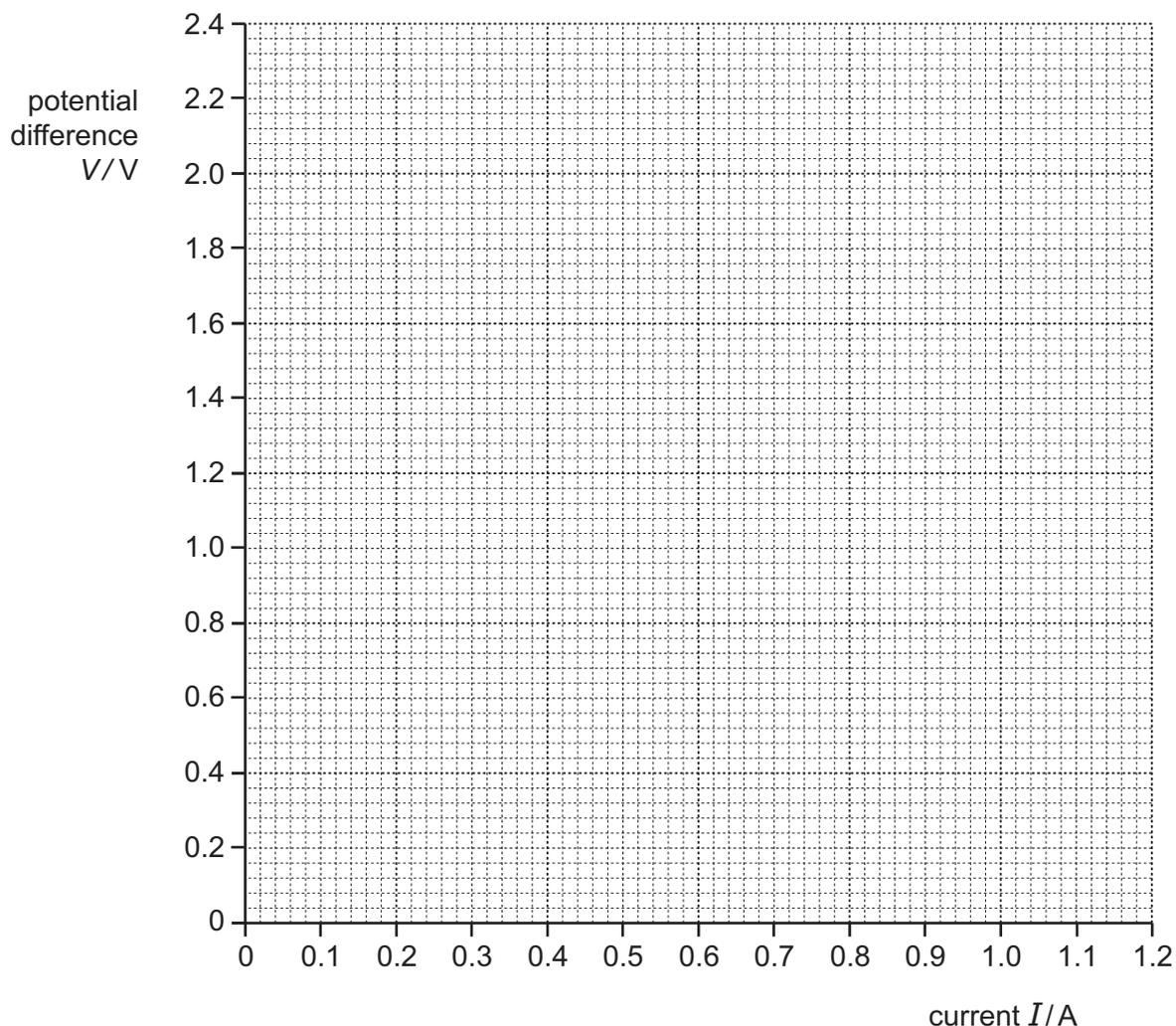
Fig. 3.2

[3]

Table 3.1

| distance d /cm | current I /amps | potential difference V /volts |
|------------------|-------------------|---------------------------------|
| 15 | 0.97 | 0.9 |
| 20 | 0.81 | 1.0 |
| 25 | | |
| 40 | | |
| 60 | 0.34 | 1.3 |
| 100 | 0.22 | 1.4 |

- (b) (i) On the grid provided, plot a graph of V against I . Draw the best-fit straight line. [2]



- (ii) Calculate the gradient of your line. Show all working and indicate on your graph the values you chose to enable the gradient to be calculated.

gradient = [2]

- (iii) The positive value of the gradient of the graph is equal to the resistance of the power supply. Write the positive value of the gradient to an appropriate number of significant figures.

resistance of power supply = Ω [1]

(c) (i) Suggest a reason why distance d must not be less than 15 cm.

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

(ii) Suggest a reason why the student must open the switch immediately after taking each reading.

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

- 4 A student investigates the stretching of a spring. He attaches a pointer to the lower end of a spring and uses a metre rule clamped vertically to record the position of the pointer above the surface of the bench, as shown in Fig. 4.1(a).

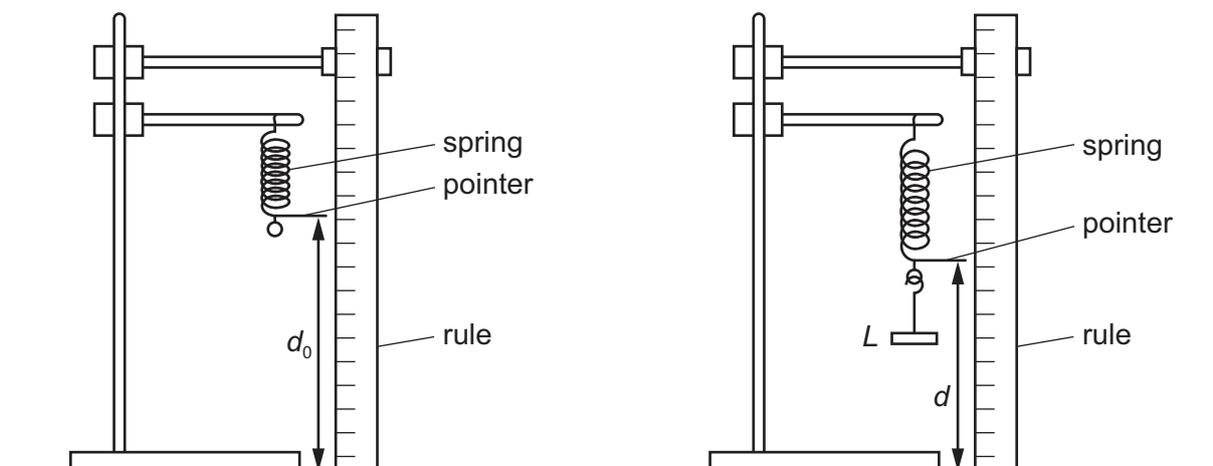


Fig. 4.1(a)

Fig. 4.1(b)

He extends the spring by hanging load L from it, as in Fig. 4.1(b).

- (a) (i) Fig. 4.2 shows the pointer and the metre rule when there is no load on the spring.

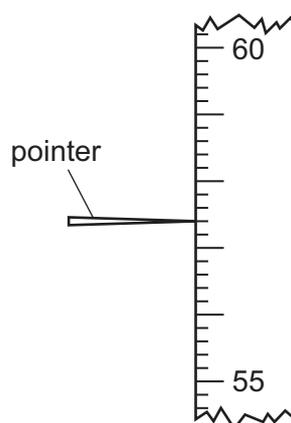


Fig. 4.2

Read the scale to the nearest 0.1 cm and record this distance d_0 below.

$d_0 =$ cm [1]

- (ii) Fig. 4.3 shows the pointer and the metre rule with a load L of 1.0 N hanging on the spring.

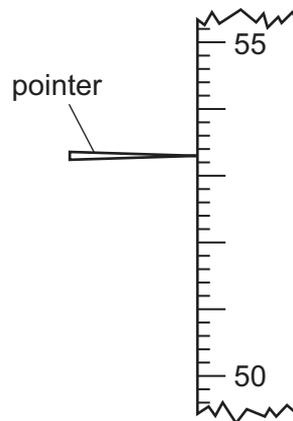


Fig. 4.3

Read the scale to the nearest 0.1 cm and record in Table 4.1 the distance d for $L = 1.0$ N. [1]

- (iii) Calculate the extension e of the spring for $L = 1.0$ N, using the equation shown.

$$e = (d_0 - d)$$

Record the value of e in Table 4.1. [1]

- (b) The student measures d for different values of L as shown in Table 4.1.

Table 4.1

| L/N | d/cm | e/cm |
|-------|--------|--------|
| 1.0 | | |
| 2.0 | 49.1 | 8.3 |
| 3.0 | 45.4 | 12.0 |
| 4.0 | 41.2 | 16.2 |
| 5.0 | 37.5 | 19.9 |

The student plots a graph of L against e . Part of his graph is shown on the grid in Fig. 4.4.

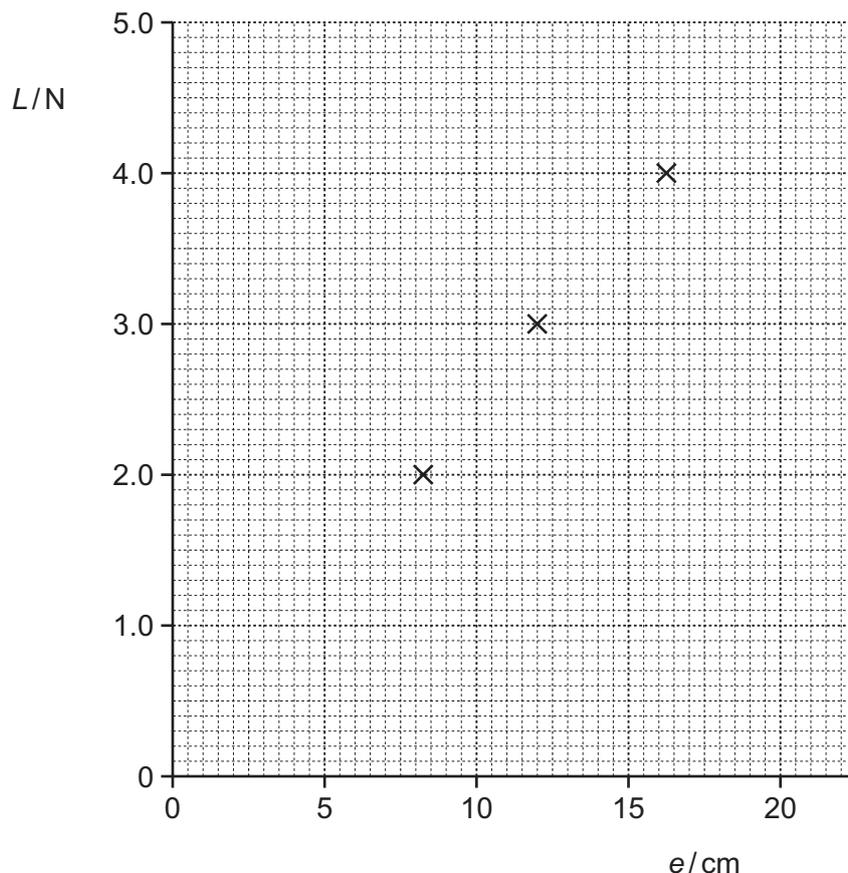


Fig. 4.4

- (i) Use the results in Table 4.1 to plot the points missing from the graph in Fig. 4.4. [1]
- (ii) Draw the best-fit straight line through the points on the graph in Fig. 4.4. [2]
- (c) The gradient of the graph in Fig. 4.4 indicates how much more force is needed to extend the spring each additional centimetre. This is called the *elastic stiffness* of a spring.
- (i) Determine the gradient of the graph. Show clearly on the graph how you obtained the necessary information for your calculation.

gradient = [2]

- (ii) Sketch, on the graph in Fig. 4.4, a second line showing the results for the same experiment using a spring with a greater elastic stiffness. [1]

Label your line with an **S**.

(d) Describe briefly **one** precaution that the student should take to obtain accurate measurements.

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

Please turn over for Question 5.

- 5 A group of students investigate some of the chemical and physical properties of iron, Fe.

Chemical properties

One student places iron nails into test-tubes, as shown in Fig. 5.1, and leaves them for one week.

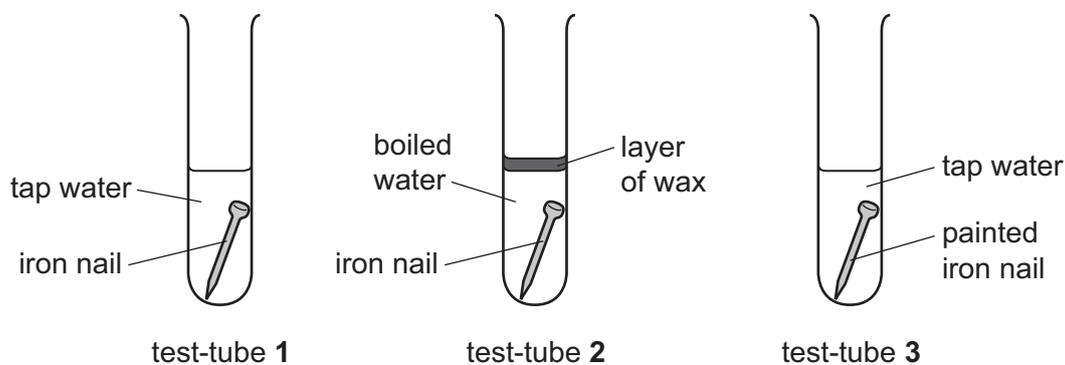


Fig. 5.1

- (a) (i) State how the appearance of the nail in test-tube 1 changes after one week.

.....
, [1]

- (ii) Describe the appearance of the nail in test-tube 2 after one week.

.....
, [1]

- (iii) Explain why there is no change to the nail in test-tube 3 after one week.

.....
, [1]

- (b) Another student adds hydrochloric acid to iron filings. He notices that bubbles of gas are formed.

- (i) He carries out a test that confirms the gas is hydrogen.

Describe the test he uses and the observation.

test

observation

....., [1]

- (ii) The iron dissolves, making a light green solution. The student thinks that the green solution contains iron(II) ions.

Explain how he proves the presence of iron(II) ions in the green solution.

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

- (iii) The student takes some of the green solution and adds a colourless oxidising agent. The mixture changes colour.

The teacher says that the iron(II) ions have been changed to iron(III) ions.

State the colour of the mixture containing iron(III) ions.

..... [1]

- (iv) Explain how the student proves the presence of iron(III) ions in this mixture.

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

- 6 A student has samples of three different liquids, **A**, **B** and **C**.

He carries out an experiment to compare the densities of these liquids. The apparatus he uses is shown in Fig. 6.1.

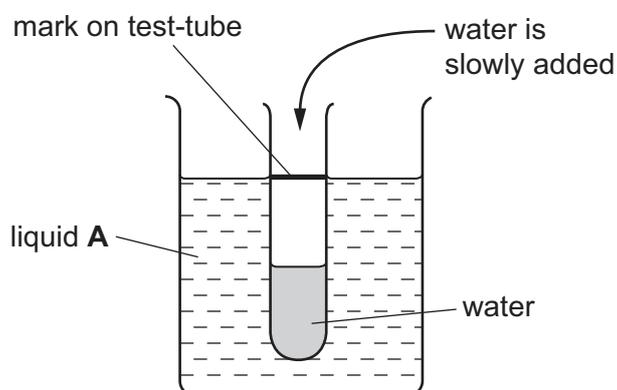


Fig. 6.1

Method

- He makes a mark on a test-tube.
- He holds the test-tube upright in the beaker and slowly adds water to it, drop by drop, until it floats in the beaker of liquid **A** and the mark on the test-tube is level with the surface of liquid **A**.
- He pours the water from the test-tube into a measuring cylinder and records the volume in Table 6.1.
- He repeats the experiment using liquids **B** and **C**.

- (a) Name the piece of apparatus that the student could use to add water, drop by drop, to the test-tube in Fig. 6.1.

..... [1]

- (b) The liquid which requires the greatest volume of water in the test-tube is the most dense. Fig. 6.2 shows the volume of water contained in each test-tube when it floats in liquids **A**, **B** and **C**.

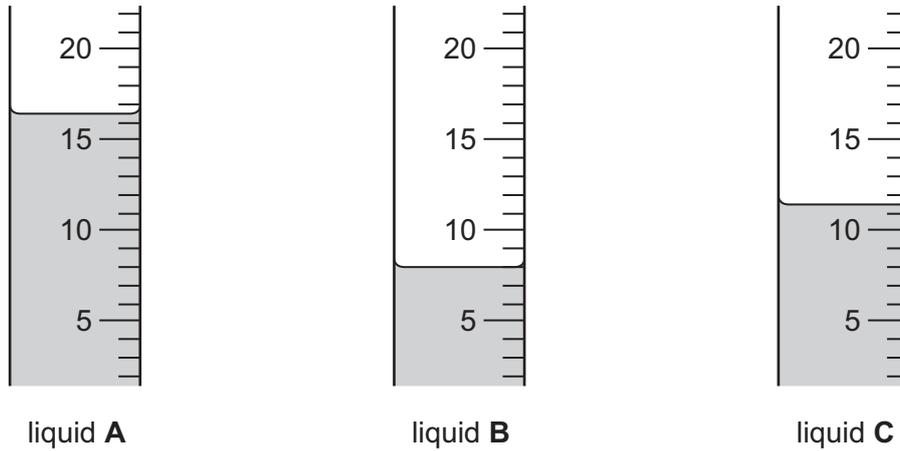


Fig. 6.2

- (i) Record, in Table 6.1, each volume of water to the nearest 0.5 cm³.

Table 6.1

| | liquid A | liquid B | liquid C |
|-----------------------------------|-----------------|-----------------|-----------------|
| volume of water / cm ³ | | | |

[3]

- (ii) Use the results from Table 6.1 to place the liquids **A**, **B**, and **C** in order of density.

most dense

.....

least dense

[1]

- (c) The teacher tells the student that one of the three liquids is water.

Suggest **one** chemical test and **one** physical test that the student can use to identify the water.

chemical test

.....

physical test

.....

[2]

- (d) Another student uses two pieces of apparatus to measure two properties of the sample of liquid **A** which he can use to calculate the density of liquid **A**.

- (i) Suggest the names of two pieces of apparatus that he uses and the property measured by each by completing the sentences.

The student uses a to measure the
of the sample of liquid **A**.

The student uses a to measure the
of the sample of liquid **A**. [2]

- (ii) State how the student uses the two measurements to calculate the density of liquid **A**.

.....

....., [1]

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