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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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* 0 0 1 8 1 3 1 6 8 5 *

PHYSICAL SCIENCE **0652/61**

Paper 6 Alternative to Practical **October/November 2024**

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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1 A student investigates the neutralisation of the alkali aqueous sodium hydroxide by dilute hydrochloric acid.

When methyl orange is added to aqueous sodium hydroxide it turns yellow.

As dilute hydrochloric acid is added to the aqueous sodium hydroxide, the aqueous sodium hydroxide has just been neutralised when a permanent pink colour appears.

M is a unit of concentration. The higher the value of M the higher the concentration.
2 M is two times more concentrated than 1 M.

(a) **Procedure**

The student:

- puts 1.00 M dilute hydrochloric acid into a burette
- records in Table 1.1 the initial reading on the burette to the nearest 0.05 cm^3
- uses a measuring cylinder to measure 25 cm^3 of 0.10 M aqueous sodium hydroxide and pours it into a clean conical flask
- adds 5 drops of methyl orange indicator to the conical flask
- slowly adds dilute hydrochloric acid to the sodium hydroxide in the conical flask with swirling until the pink colour of the indicator does **not** disappear
- records in Table 1.1 this final reading on the burette.

The apparatus is shown in Fig. 1.1.

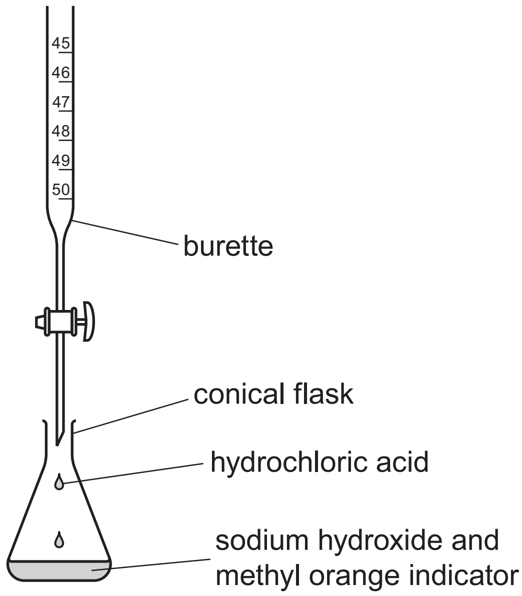

Fig. 1.1

The student repeats the procedure with 0.20 M, 0.40 M and 0.60 M aqueous sodium hydroxide instead of 0.10 M and uses the 1.00 M dilute hydrochloric acid in the burette.

Table 1.1

	concentration of aqueous sodium hydroxide			
	0.10 M	0.20 M	0.40 M	0.60 M
initial reading of dilute hydrochloric acid in burette / cm^3	11.55	15.75	22.10	32.55
final reading of dilute hydrochloric acid in burette / cm^3	14.05	....	....	47.55
volume of dilute hydrochloric acid added to the aqueous sodium hydroxide / cm^3	2.50	....	....	....

(i) The readings on the burette, when 0.20 M aqueous sodium hydroxide and 0.40 M aqueous sodium hydroxide are used, are shown in Fig. 1.2.

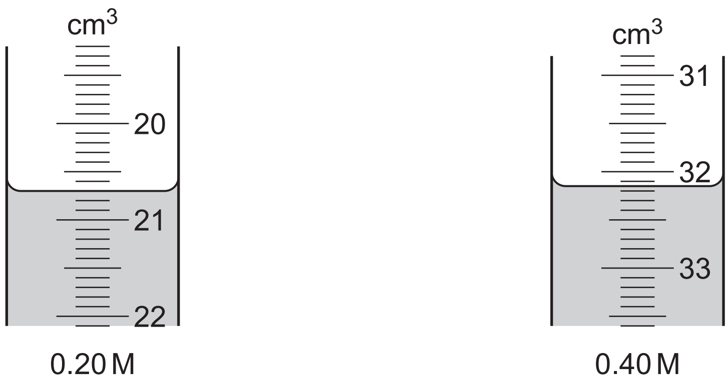

Fig. 1.2

Record in Table 1.1 these values to the nearest 0.05 cm^3. [2]

(ii) State the name of a piece of apparatus suitable for measuring the 25 cm^3 of aqueous sodium hydroxide more accurately.

.... [1]

(b) (i) Calculate the volume of dilute hydrochloric acid added for each concentration of aqueous sodium hydroxide.

Record these values in Table 1.1. [2]

DO NOT WRITE IN THIS MARGIN

(ii) Suggest **one** improvement to the **procedure** to give more confidence in the volume of dilute hydrochloric acid added.

Explain why this improves the procedure.

improvement ....

....

explanation ....

.... [2]

(c) **(i)** On the grid, plot the data points of volume of dilute hydrochloric acid added (vertical axis) against concentration of aqueous sodium hydroxide. Start the axes at the origin (0,0).

[3]

(ii) Draw the best-fit straight line.

Extend the line until it crosses an axis.

[2]

(iii) State the relationship between concentration of aqueous sodium hydroxide and volume of dilute hydrochloric acid added.

....

.... [1]

(iv) Use your graph to predict the volume of 1.00 M dilute hydrochloric acid needed to exactly neutralise 25 cm^3 of 0.50 M aqueous sodium hydroxide.

Show on your graph how you arrived at your answer.

volume of dilute hydrochloric acid = ... cm^3 [1]

(v) Another student repeats this procedure but uses 2.00 M dilute hydrochloric acid in the burette instead of 1.00 M dilute hydrochloric acid.

Draw a line on the grid to show the results the student gets.

Label this line **E**.

[2]

[Total: 16]

2 A student investigates the solution made when dilute hydrochloric acid exactly neutralises aqueous sodium hydroxide.

Procedure

The student:

- does a flame test on the solution
- does a chloride test on the solution
- identifies the solution as aqueous sodium chloride.

(a) Describe how to do a flame test on the aqueous sodium chloride.

State the colour of the flame the student observes.

procedure for flame test ....

....

....

colour of flame ....
[2]

(b) Describe how to do a chloride test.

State the observation for the positive result.

procedure for chloride test ....

....

....

observation ....
[2]

[Total: 4]

3 A student investigates how the length of a pendulum affects the time taken for it to oscillate.

Fig. 3.1 shows the apparatus used.

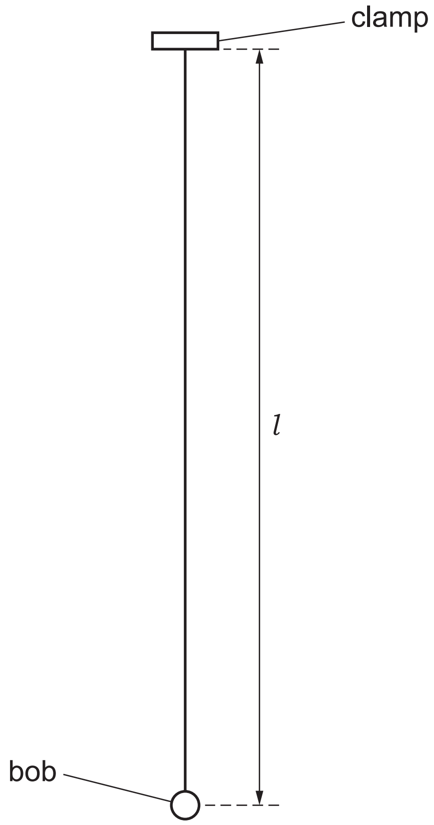

Fig. 3.1

(a) **(i)** Measure the pendulum length l on Fig. 3.1 in centimetres to the nearest 0.1 cm.

l = ... cm [1]

(ii) The diagram in Fig. 3.1 is drawn to a scale of one-fifth full size.

Determine the actual length L of the pendulum used by the student.

L = ... cm [1]

DO NOT WRITE IN THIS MARGIN

(iii) It is difficult to measure from the bottom of the clamp to the centre of the pendulum bob accurately.

Describe how to make an accurate measurement.

You may draw a diagram to help explain your answer.

....

.... [1]

(b) The student:

- displaces the pendulum bob and releases it so that it swings
- measures the time *t* taken for 10 complete oscillations.

Explain why timing 10 oscillations gives a more accurate value for the period *T* than timing 1 oscillation.

....

.... [1]

(c) The procedure in **3(b)** is repeated for two other pendulum lengths. The measurements are shown in Table 3.1.

Table 3.1

L / cm	t / s	T / s	T^2 / ....
20.0	8.9	0.89	0.79
40.0	12.7	....	....

(i) Calculate the time period T for one complete oscillation for length L = 40.0 cm.

Record this value in Table 3.1.

[1]

(ii) Complete the table heading with the unit for T^2. [1]

(iii) Calculate the value of T^2 for length L = 40.0 cm.

Record in Table 3.1 this value to **two** significant figures.

[2]

(iv) Use the information in Table 3.1 to estimate the time t for 10 oscillations for a pendulum of length L = 30.0 cm.

time for 10 oscillations = ... s [1]

(d) A student suggests that the value for T^2 will double when you double the length l of the pendulum.

State if the data support this suggestion.

Justify your answer by reference to the data in Table 3.1.

....

....

....

.... [2]

(e) The student wants to plot a graph to investigate the relationship between the pendulum length l and T^2.

(i) Suggest additional values of length l larger than 10.0 cm that the student uses.

....

.... [1]

(ii) Suggest why lengths smaller than 10.0 cm are not used.

....

.... [1]

[Total: 13]

4 When an object falls through a liquid, the liquid causes a force resisting the motion of the object. This force affects the time taken for the object to fall through the liquid.

Plan an experiment to investigate the relationship between the density of a liquid and the time taken for a plasticine ball to fall through the liquid.

The following apparatus is available:

- the apparatus shown in Fig. 4.1
- a selection of different liquids, each liquid labelled with its density value.

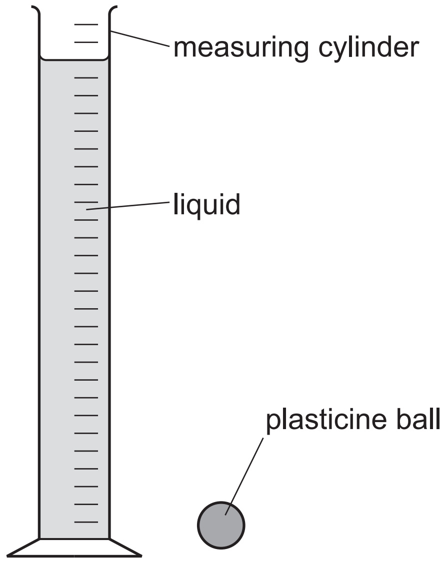

Fig. 4.1

You may also use any apparatus commonly found in a school laboratory.

Your plan should include:

- a brief description of the method including any additional apparatus you will use
- the variables you will control
- the measurements you will make and how you will ensure they are as accurate as possible
- the table you will draw to record your results, with column headings (you are not required to enter any readings into the table)
- an explanation of how you will use your results to reach a conclusion.

[7]

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