Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

PHYSICAL SCIENCE **0652/51**

Paper 5 Practical Test **October/November 2024**

1 hour 15 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
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4	
Total	

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

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1 You are going to investigate 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) (i) Procedure

- Add at least 40 cm^3 of 1 M dilute hydrochloric acid to the burette.
- Record in Table 1.1 for 0.1 M sodium hydroxide this initial reading on the burette to the nearest 0.1 cm^3.
- Use a measuring cylinder to measure 25 cm^3 of 0.1 M aqueous sodium hydroxide and pour it into a clean conical flask.
- Add 5 drops of methyl orange indicator to the conical flask.
- Slowly add dilute hydrochloric acid to the sodium hydroxide in the conical flask with swirling until the pink colour of the indicator does **not** disappear.
- Record in Table 1.1 this final reading of hydrochloric acid in the burette.

Repeat the procedure with 0.2 M, 0.4 M and 0.6 M aqueous sodium hydroxide and 1 M dilute hydrochloric acid.

Table 1.1

	concentration of aqueous sodium hydroxide			
	0.1 M	0.2 M	0.4 M	0.6 M
initial reading of dilute hydrochloric acid in burette / cm^3				
final reading of dilute hydrochloric acid in burette / cm^3				
volume of dilute hydrochloric acid added to the aqueous sodium hydroxide / cm^3				

[5]

(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. [1]

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

Explain why this improves the method.

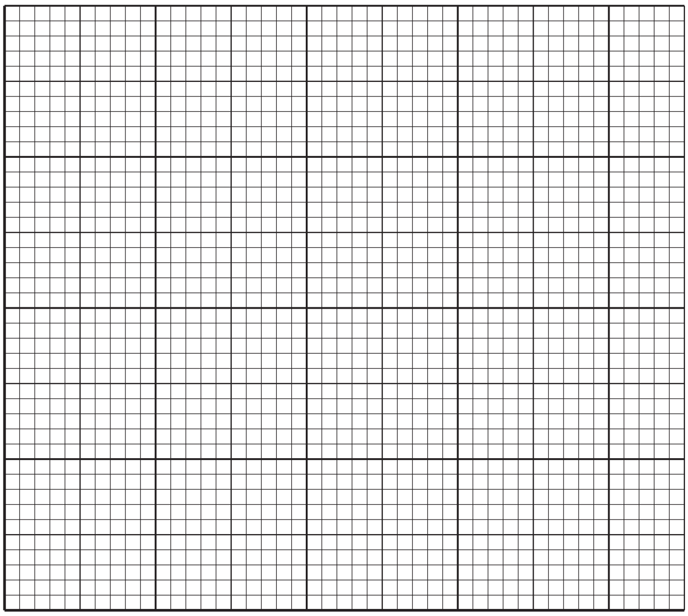
improvement ....

....

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 M dilute hydrochloric acid needed to exactly neutralise 25 cm^3 of 0.5 M aqueous sodium hydroxide.

Show on your graph how you arrived at your answer.

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

(v) A student repeats your experiment but uses 2 M dilute hydrochloric acid in the burette instead of 1 M dilute hydrochloric acid.

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

Label this line **E**. [2]

[Total: 18]

2 You are going to investigate the solution made when dilute hydrochloric acid exactly neutralises aqueous sodium hydroxide.

Procedure

- Use a measuring cylinder to measure 25 cm^3 of 1.0 M aqueous sodium hydroxide and pour it into a clean conical flask.
- Use a measuring cylinder to measure 25 cm^3 of 1.0 M dilute hydrochloric acid.
- Add the 25 cm^3 of 1.0 M dilute hydrochloric acid to the 25 cm^3 of 1.0 M aqueous sodium hydroxide in the conical flask.
- Place approximately 2 cm depth of this solution into each of two test-tubes.
- Place a wooden splint into one of the test-tubes.
- Do the tests in Table 2.1.
- Record your observations in Table 2.1.

Table 2.1

test	observation	ion present
add 1 cm depth of nitric acid followed by 6 drops of aqueous silver nitrate		
place the wooden splint into the top of a blue Bunsen burner flame		

- State the ion shown to be present by each test.
- Record the ion in Table 2.1. [2]

3 In this experiment you are going to investigate how the length of a pendulum affects the time taken for it to oscillate.

A pendulum has been set up for you as shown in Fig. 3.1.

Refer to Fig. 3.1 and Fig. 3.2 when following the instructions.

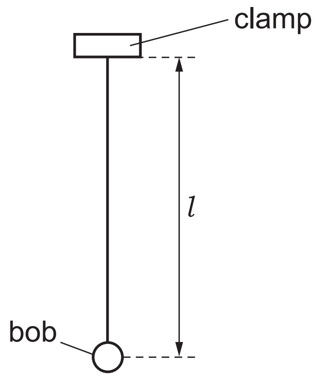


Fig. 3.1

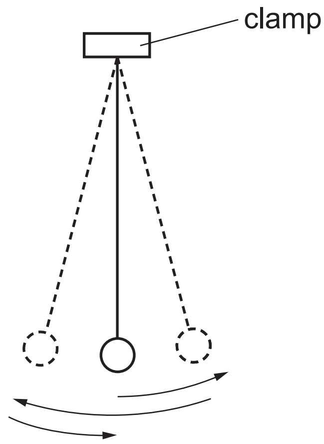


Fig. 3.2

(a) Procedure

- Adjust the length of the pendulum until the length l measured from the bottom of the clamp to the centre of the bob is 50.0 cm.
- Displace the bob a few centimetres from its rest position and release it so that it swings. Fig. 3.2 shows one complete oscillation of the pendulum.
- Measure the time t for 10 complete oscillations. Record in Table 3.1 time t to the nearest 0.01 s.
- Adjust the length of the pendulum until the length l is 25.0 cm.
- Displace the bob and measure the time t for 10 complete oscillations. Record in Table 3.1 time t to the nearest 0.01 s.

Table 3.1

l / cm	t / s	T / s	T^2 / ....
50.0			
25.0			

[3]

(b) **(i)** Calculate the period T of the pendulum for both values of l. The period is the time for one complete oscillation.

Record, in Table 3.1, your values of T. [1]

(ii) Calculate the values of T^2.

Record, in Table 3.1, your values of T^2 to **two** significant figures. [2]

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

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

....

.... [1]

(c) 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]

(d) 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]

(e) 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]

[Total: 13]

Question 4 starts on page 10

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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.

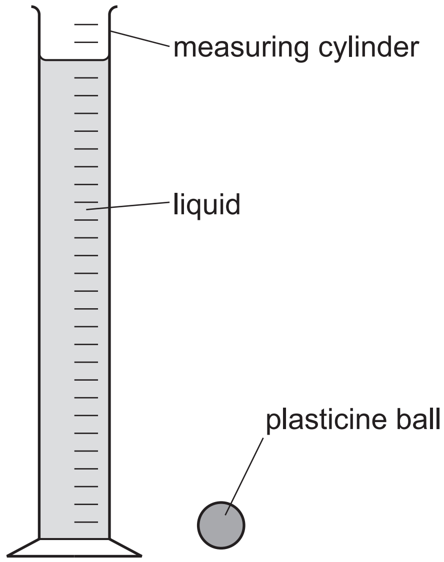

Fig. 4.1

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

You are **not** required to do the experiment.

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.

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[7]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt. or very slight white ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	‘pops’ with a lighted splint
oxygen (O_2)	relights a glowing splint

Flame tests for metal ions

metal ion	*flame colour*
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green

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