



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
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COMBINED SCIENCE

0653/51

Paper 5 Practical Test

May/June 2014

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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.

Notes for Use in Qualitative Analysis for this paper are printed on page 12.

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.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **11** printed pages and **1** blank page.

1 You will be investigating the vitamin C content of a fruit juice.

DCPIP is a dark blue chemical that is decolourised by vitamin C. A solution containing a higher concentration of vitamin C will take fewer drops to decolourise DCPIP.

You are provided with a set of different concentrations of vitamin C and a fruit juice of an unknown vitamin C concentration.

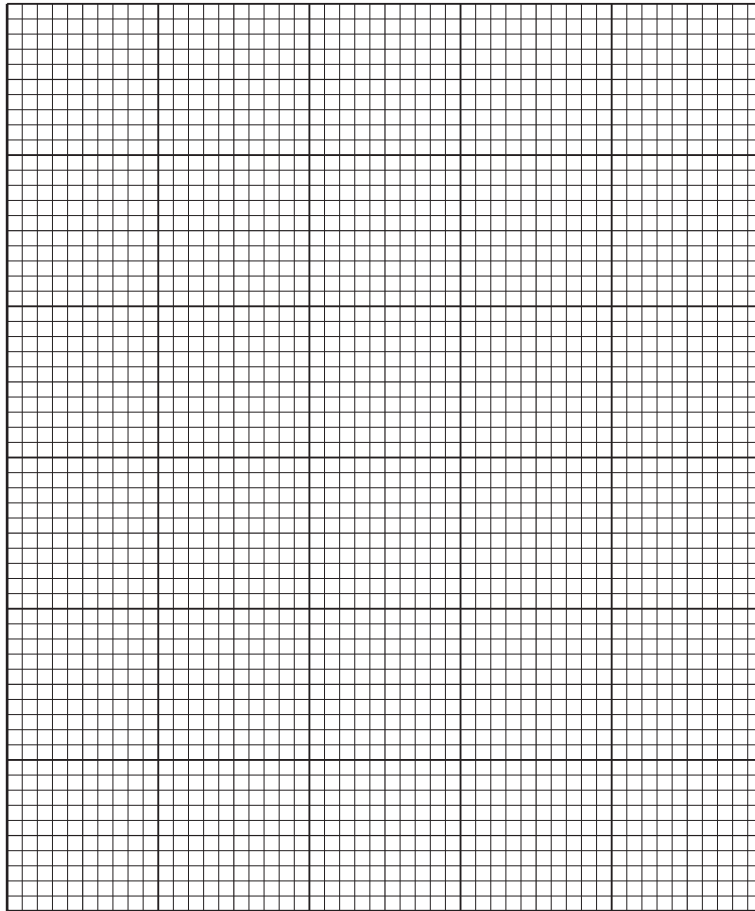
- (a)
- Using a dropping pipette, place **two** drops of DCPIP into each of five wells of a white spotting tile.
 - Start with the 1.00% solution of vitamin C. Use a clean dropping pipette to carefully add drops to one of the wells with the DCPIP and count how many drops are needed to decolourise it. **Immediately** record your result in Table 1.1.
 - Repeat with the other solutions of different concentrations of vitamin C and then the fruit juice, using a clean dropping pipette each time.
 - If a solution of vitamin C does not decolourise, stop when the well is full, record the number of drops and write maximum next to it.
 - You should ignore any colour changes seen 5 minutes after adding the vitamin C to the DCPIP.

Table 1.1

concentration of vitamin C (%)	number of drops needed to decolourise DCPIP
1.00	
0.75	
0.50	
0.25	
fruit juice	

[4]

- (b) Plot a graph on the grid below of the number of drops needed to decolourise DCPIP against vitamin C concentration. Draw the best fit straight line.



vitamin C concentration (%)

[3]

- (c) Use your graph to estimate the vitamin C concentration of the fruit juice and mark on the graph how you worked this out.

vitamin C concentration = % [2]

- (d) Suggest **one** change to the experimental method which will improve the accuracy.

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

- 2 You are going to investigate some reactions of sodium hydrogencarbonate, NaHCO_3 and sodium carbonate, Na_2CO_3 . In parts (b) and (c) you will carry out the same tests on these two substances. Be careful that you do not confuse the two white powders.

(a) Remove the stopper from the hard glass test-tube which is one-quarter full of solid **sodium hydrogencarbonate** and attach a delivery tube.

One-quarter fill a test-tube with limewater and place the other end of the delivery tube into the limewater. See Fig. 2.1.

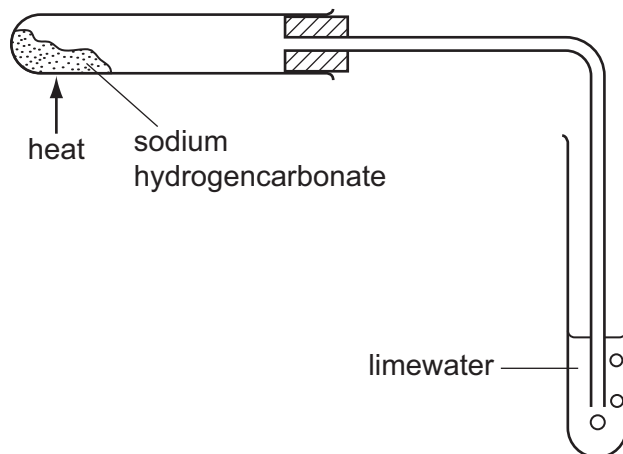


Fig. 2.1

Heat the hard glass test-tube containing the solid for at least two minutes after the limewater has returned to a colourless solution.

Immediately remove the delivery tube from the limewater, to avoid suck back.

Record your observations including what happened to the solid and to the limewater.

Keep the solid contents of the hard glass test-tube for (d)(ii).

observations

.....

..... [2]

- (b) Place one spatula load of **sodium hydrogencarbonate** into a clean test-tube and add distilled water until three-quarters full. Place the stopper in the test-tube and shake until the solid is dissolved.

Use this sodium hydrogencarbonate solution for tests (b)(i) to (b)(iii).

- (i) Place 1 cm^3 of sodium hydrogencarbonate solution into a clean test-tube and add a few drops of Universal (full range) Indicator solution.

Record the colour change.

colour change to [1]

- (ii) Place another 1 cm^3 of sodium hydrogencarbonate solution into a clean test-tube and add an equal volume of dilute hydrochloric acid.

Record your observations.

observations
..... [1]

- (iii) Place 2 cm^3 of sodium hydrogencarbonate solution into a clean test-tube and add an equal volume of copper sulfate solution.

Record your observations.

observations
..... [1]

- (c) Thoroughly wash out the test-tubes used in (b)(i) to (iii).
Do NOT wash out the hard glass test-tube from (a) which is needed for (d)(ii).

Place one spatula load of **sodium carbonate** into a clean test-tube and add distilled water, until three-quarters full. Place the stopper in the test-tube and shake until the solid is dissolved. It does not matter if a small amount of solid will not dissolve.

Use this sodium carbonate solution for tests (c)(i) to (c)(iii).

- (i) Place 1 cm^3 of sodium carbonate solution into a clean test-tube and add a few drops of Universal (full range) Indicator solution.

Record the colour change.

colour change to [1]

- (ii) Place 1 cm^3 of sodium carbonate solution into a clean test-tube and add an equal volume of dilute hydrochloric acid.

Record your observations.

observations
 [1]

- (iii) Place 2 cm^3 of sodium carbonate solution into a clean test-tube and add an equal volume of copper sulfate solution.

Record your observations.

observations
 [1]

- (d) (i) Look at your results for (b) and (c) and suggest which **two** tests could be used to distinguish between sodium hydrogencarbonate and sodium carbonate.

test 1

test 2 [1]

- (ii) Now dissolve a spatula load of the solid remaining in the hard glass test-tube from (a) in distilled water in a clean test-tube.

Use portions of this solution to carry out **one** of the two tests you have chosen in (d)(i).

Record the test used and your observations below.

test used

observation [1]

Please turn over for Question 3.

3 You are going to find the density of plasticine (modelling clay).

- (a) (i) Mould the piece of plasticine into a shape that approximates to a cube, as shown in Fig. 3.1.

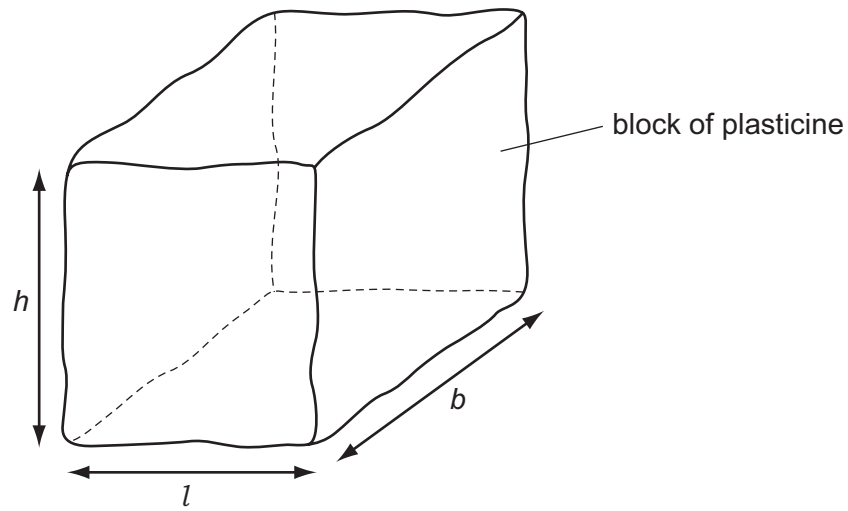


Fig. 3.1

Measure the length l , breadth b , and height h , of the cube to the nearest 0.1 cm and record your results below.

$l =$ cm

$b =$ cm

$h =$ cm [2]

- (ii) Calculate the volume, V of your cube by using the equation:

$$V = l \times b \times h$$

$V =$ cm³ [1]

A 50 g mass has been secured to the metre rule. Its position is fixed with its centre over the 10.0 cm mark. Do not attempt to move the mass during the experiment.

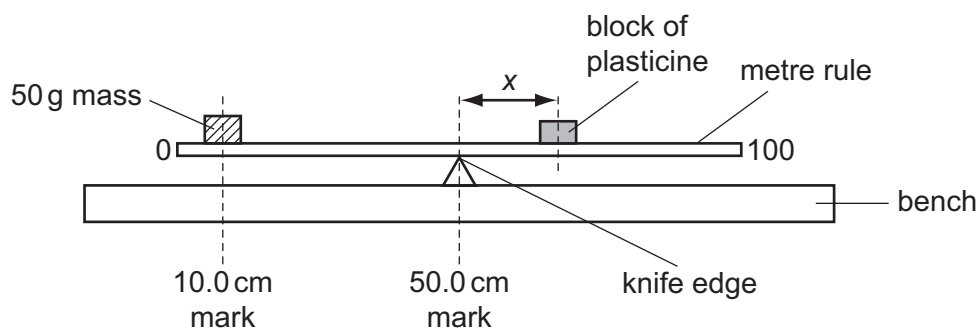


Fig. 3.2

- (b) (i)** Place the knife edge directly under the 50.0 cm mark, as shown in Fig. 3.2.

Take the cube of plasticine and place it on the metre rule.

Adjust its position until the rule is just balanced.

Measure, to the nearest 0.1 cm, the distance, x from the centre of the cube to the 50.0 cm mark on the rule.

Record the distance x .

$$x = \dots\dots\dots \text{ cm} \quad [2]$$

- (ii)** Calculate the mass, m of the cube of plasticine using the equation:

$$m = \frac{2000}{x}$$

$$m = \dots\dots\dots \text{ g} \quad [1]$$

- (iii)** Calculate the density, d of the plasticine to an appropriate number of significant figures using the equation:

$$d = \frac{m}{V}$$

$$d = \dots\dots\dots \text{ g/cm}^3 \quad [2]$$

(c) Consider the experimental set-up you used for determining the density of plasticine.

Suggest **two** reasons why the value you have obtained for the density of plasticine may be inaccurate.

reason 1

.....

reason 2

..... [2]

NOTES FOR USE IN QUALATIVE ANALYSIS

Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
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.
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 chloride <i>or</i> aqueous barium nitrate	white ppt.

Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium (NH_4^+)	ammonia produced on warming	-
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

Test for gases

<i>gas</i>	<i>test and test results</i>
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

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