www.dynamicpapers.com

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

7338861122

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **May/June 2023**

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.

© UCLES 2023

[Turn over

www.dynamicpapers.com

1 **(a)** A student estimates the concentration of vitamin C in a sample of fruit juice.

When iodine solution is added to a mixture of starch and fruit juice the starch turns the iodine blue-black. The vitamin C turns the iodine colourless.

The amount of iodine needed to keep the blue-black colour is an indicator of the concentration of vitamin C.

The student has four different concentrations of vitamin C and a fruit juice with an unknown vitamin C concentration.

Procedure

The student:

Step 1 Uses a syringe to add 10 cm^3 of 1.00% vitamin C solution to a clean test-tube.

Step 2 Adds 0.5 cm^3 of starch solution to the test-tube and mixes well.

Step 3 Fills a 10 cm^3 syringe with 10 cm^3 of iodine solution.

Step 4 Adds drops of iodine solution to the starch-vitamin C mixture until the blue-black colour remains.

Step 5 Records in Table 1.1 the volume of iodine solution **remaining** in the syringe.

Step 6 Refills the syringe to contain 10 cm^3 of iodine solution.

Step 7 Repeats **Step 1** to **Step 6** using 0.75%, 0.50% and 0.25% concentrations of vitamin C.

(i) Fig. 1.1 shows the syringe after adding iodine solution to the 0.25% concentration of vitamin C.

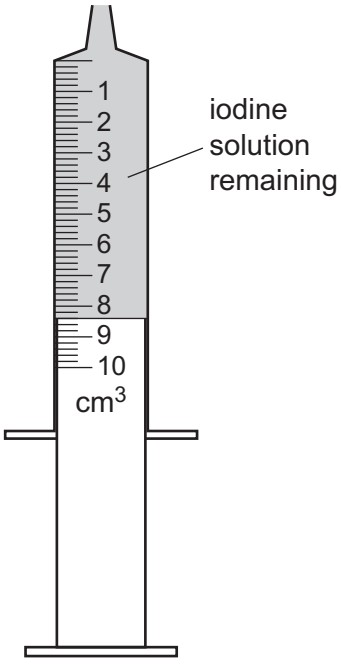


Fig. 1.1

© UCLES 2023

www.dynamicpapers.com

Record in Table 1.1, the volume of iodine solution **remaining** in the syringe.

Table 1.1

percentage concentration of vitamin C	volume of iodine solution **remaining** / cm^3	volume of iodine solution **added** / cm^3
1.00	2.2	7.8
0.75	4.0	6.0
0.50	6.2	3.8
0.25		

[1]

(ii) Calculate the volume of iodine solution **added** to the 0.25% vitamin C solution.

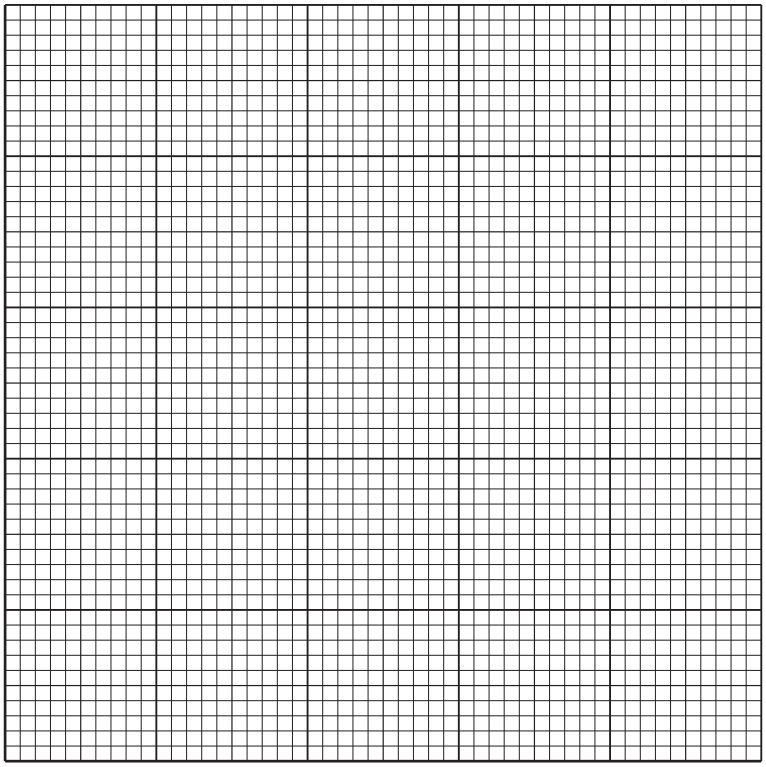
Use the equation shown.

volume of iodine solution **added** = 10 – volume of iodine solution **remaining**

Record this value in Table 1.1. [1]

www.dynamicpapers.com

(iii) On the grid, plot a graph of the volume of iodine solution **added** (vertical axis) against the percentage concentration of vitamin C.



[3]

(iv) Draw the line of best-fit. [1]

(v) The student repeats **Step 1** to **Step 4** of the procedure in **(a)** using 10 cm^3 of fruit juice instead of the vitamin C solutions.

Fig. 1.2 shows the syringe after adding the iodine solution to the fruit juice.

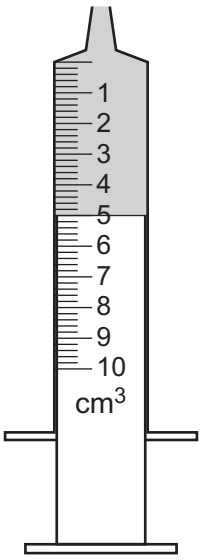


Fig. 1.2

© UCLES 2023

www.dynamicpapers.com

Record the volume of iodine solution **remaining** and the volume **added** when the student tests the fruit juice.

volume of iodine solution **remaining** = ... cm^3

volume of iodine solution **added** = ... cm^3

[1]

(vi) Use your graph to estimate the percentage concentration of vitamin C in the fruit juice.

percentage concentration of vitamin C in the fruit juice = ... [1]

(vii) The student uses the same syringe for **Step 1** and **Step 7**.

Suggest why this is a possible source of error.

.....

..... [1]

(b) Repeating the procedure increases confidence in the results.

(i) Suggest one **other** reason why the procedure for each concentration should be repeated.

.....

..... [1]

(ii) Suggest one **other** way to improve confidence in your estimate in **(a)(vi)**.

.....

..... [1]

(c) State the reagent that is used to test for protein. Include the observation for a positive result.

reagent .....

observation .....

[2]

[Total: 13]

© UCLES 2023

[Turn over

www.dynamicpapers.com

2 A student investigates the components of a fertiliser.

The fertiliser contains insoluble sand and a soluble salt.

The student has 5.00 g of the fertiliser.

Procedure

The student:

Step 1 adds distilled water to the fertiliser in a beaker

Step 2 stirs the mixture for two minutes

Step 3 filters the mixture into a boiling tube

Step 4 washes the residue of sand on the filter paper with distilled water

Step 5 dries the sand on the filter paper in an oven.

Step 6 records in Table 2.1 the mass of the sand and filter paper.

Step 7 removes the sand and measures the mass of the filter paper.

(a) Fig. 2.1 shows the balance reading from **Step 7**.

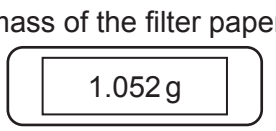


Fig. 2.1

Record in Table 2.1 the mass of the filter paper to **two** decimal places.

Table 2.1

	mass / g
sand and filter paper	3.87
filter paper	

[1]

(b) (i) Calculate the mass of sand in the sample of fertiliser.

Use the equation shown.

mass of sand = 3.87 – mass of filter paper

mass of sand = ... g [1]

© UCLES 2023

www.dynamicpapers.com

(ii) Calculate the percentage of sand in the fertiliser.

Use the equation shown.

$$\text{percentage of sand} = \frac{\text{mass of sand}}{5.00} \times 100$$

percentage of sand = ... [1]

(c) Explain why the mixture is stirred in **Step 2**.

.....

..... [1]

(d) Explain why the residue of sand is washed with distilled water in **Step 4**.

.....

..... [1]

(e) The student does a flame test on the filtrate.

A lilac flame is observed.

(Circle) the cation (positive ion) in the filtrate.

lithium **copper(II)** **potassium** **sodium**

[1]

(f) The student adds dilute nitric acid followed by aqueous barium nitrate to the filtrate.

A white precipitate is observed.

Identify the anion (negative ion) in the filtrate.

..... [1]

[Total: 7]

© UCLES 2023

[Turn over

www.dynamicpapers.com

3 Cetyl alcohol is a white solid with a melting point of 49 °C. If salt is mixed with cetyl alcohol the melting point decreases.

Some of the apparatus needed to determine the melting point of cetyl alcohol is shown in Fig. 3.1.

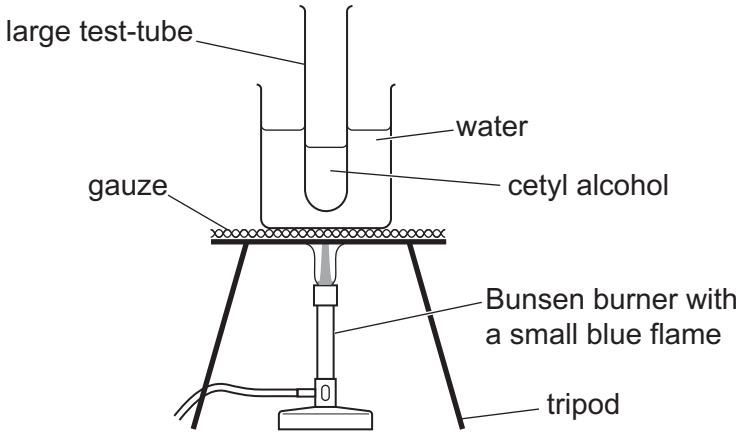


Fig. 3.1

Plan an investigation to find the relationship between the mass of salt added and the decrease in the melting point of cetyl alcohol.

You may use any common laboratory apparatus in your plan.

You are provided with:

- powdered cetyl alcohol
- powdered salt
- the apparatus shown in Fig. 3.1.

In your plan include:

- the additional apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure
- which variables you will keep constant
- how you will process your results to draw a conclusion.

You may include a table that can be used to record the results if you wish.

You do **not** need to include any results in the table.

© UCLES 2023

www.dynamicpapers.com

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

www.dynamicpapers.com

4 A student investigates the resistance of different combinations of two identical lamps **L** and **M**.

(a) Fig. 4.1 shows a circuit using lamp **L**.

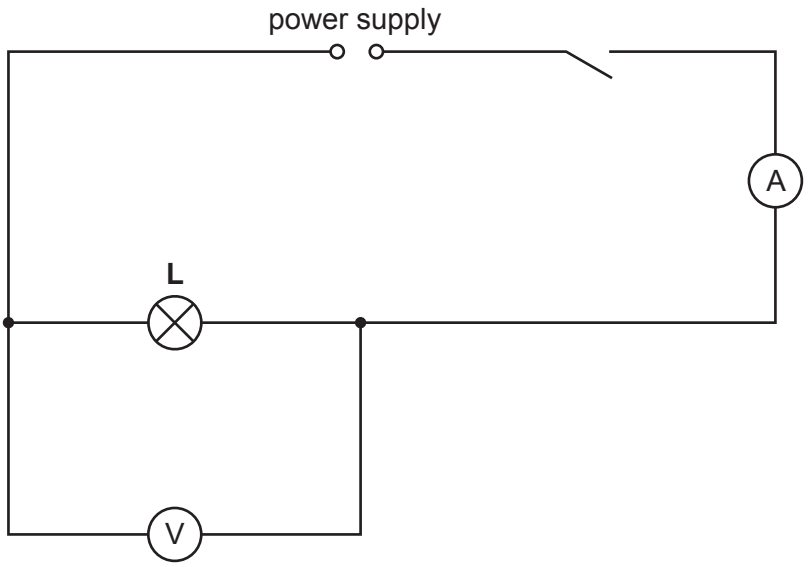


Fig. 4.1

The student closes the switch. Lamp **L** lights up.
Fig. 4.2 shows the readings on the voltmeter and ammeter.

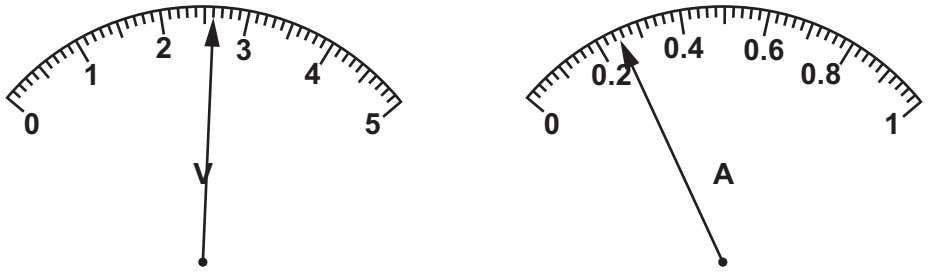


Fig. 4.2

(i) Record the potential difference V_L across lamp **L**.

V_L .....V [1]

(ii) Record the current I_L in the circuit.

I_L .....A [1]

(iii) The student opens the switch.
Calculate the resistance R_L of lamp **L**.
Use the equation shown.

$$R_L = \frac{V_L}{I_L}$$

R_L ..... [1]

© UCLES 2023

www.dynamicpapers.com

(b) Procedure

The student:

- disconnects the voltmeter
- adds a second identical lamp **M** to the circuit in series with lamp **L**, as shown in Fig. 4.3
- reconnects the voltmeter to measure the combined potential difference across lamps **L** and **M**.

(i) Complete the circuit diagram in Fig. 4.3 to show how the student connects the voltmeter.

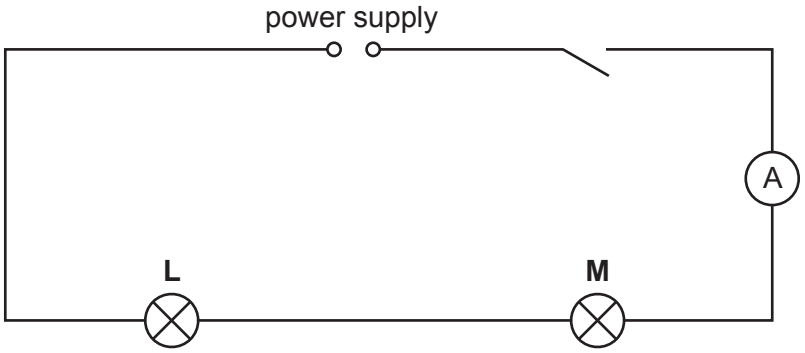


Fig. 4.3

[1]

(ii) The student closes the switch.

The lamps light up.

Fig. 4.4 shows the readings on the voltmeter and ammeter.

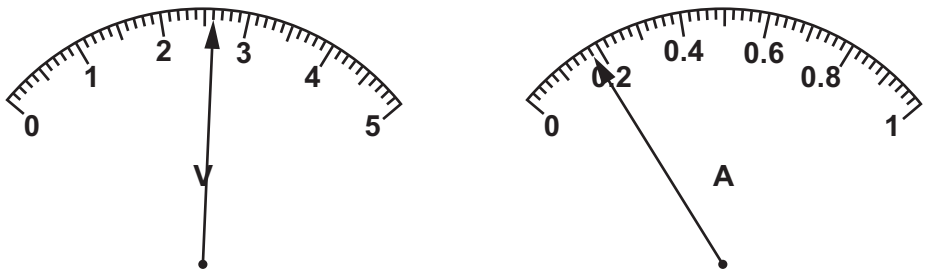


Fig. 4.4

Record the combined potential difference V_S across lamps **L** and **M**.

V_S V

Record the current I_S in the circuit.

I_S ..... A

[1]

www.dynamicpapers.com

(iii) The student opens the switch.

Calculate the combined resistance R_S of lamps **L** and **M** in series.

Use the equation shown.

$$R_S = \frac{V_S}{I_S}$$

Include the unit in your answer.

R_S ..... unit ..... [1]

(c) Procedure

The student:

- disconnects the **voltmeter**
- disconnects the two lamps and reconnects lamp **L** in parallel with lamp **M**
- connects the ammeter to measure the total current through the circuit
- reconnects the voltmeter to measure the potential difference across the **parallel** lamps.

(i) Complete the circuit diagram in Fig. 4.5 to show the parallel circuit. The power supply and switch are already shown.

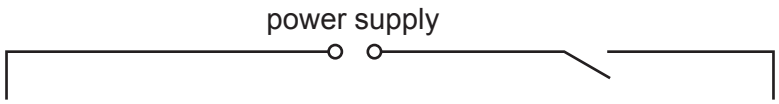


Fig. 4.5

[2]

© UCLES 2023

www.dynamicpapers.com

(ii) The student closes the switch. The lamps light up.
The combined potential difference V_P across lamps **L** and **M** is 2.25 volts.
The total current I_P read by the ammeter in the circuit is 0.50 amps.
The student opens the switch.

Calculate the power, P_P produced by lamps **L** and **M** in parallel.
Use the equation shown.

$$P = V \times I$$

P_P ..... W [1]

(iii) The power, P_S produced by lamps **L** and **M** in series is 0.47 W.

A student predicts the power of the lamps **L** and **M** in parallel is greater than the power of the lamps **L** and **M** in series.

Describe an observation of the lamps that would confirm the student's prediction.

.....

..... [1]

(d) Suggest why the student opens the switch after each measurement.

.....

..... [1]

(e) Another student predicts that the combined resistance of lamps **L** and **M** in series is twice the resistance of lamp **L**.

State if the values from **(a)(iii)** and **(b)(iii)** support the student's prediction.

Explain your answer.

statement .....

explanation .....

.....

..... [2]

[Total: 13]

© UCLES 2023

www.dynamicpapers.com

BLANK PAGE

© UCLES 2023

www.dynamicpapers.com

BLANK PAGE

© UCLES 2023

www.dynamicpapers.com

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

© UCLES 2023