Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6978205171

COMBINED SCIENCE **0653/61**

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.

IB15 11_0653_61/FP

1 A student investigates what happens when food is burned in air.

Part 1

Using forceps, the student places a piece of dry cobalt chloride paper into a large test-tube. Cobalt chloride paper changes colour from blue to pale pink in the presence of water.

- The paper remains blue in colour when placed into the test-tube.
- She then adds 10 cm^3 of limewater to a clean, dry test-tube and shakes it.
- The limewater remains colourless.

Part 2

The student places a piece of food on a mounted needle and ignites it. She collects any gases produced by holding an inverted test-tube about 2 cm above the flame produced as shown in Fig. 1.1.

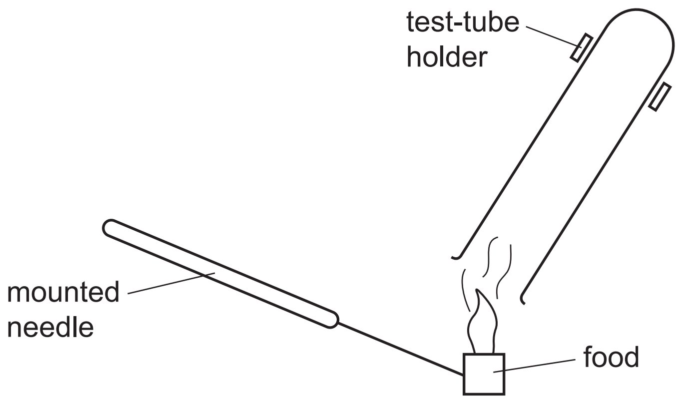


Fig. 1.1

When the sides of the test-tube mist up she places the piece of food into a beaker of water to extinguish the flames and places a stopper on the test-tube.

(a) Using forceps she places a fresh piece of dry cobalt chloride paper into the test-tube and it turns pale pink.

Explain this observation.

.... [1]

(b) She adds 10 cm^3 of limewater to the test-tube and shakes it. The limewater turns milky.

Explain this observation.

.... [1]

(c) Explain the purpose of the experiment in **part 1**.

.... [1]

(d) In **part 2** the student burns some food in air. Name the process inside living cells that this procedure models.

.... [1]

(e) State **two** additional observations made by the student in **part 2** that show that energy is released in this experiment.

1 ....

2 ....

[2]

(f) State **one** necessary precaution if the procedure in **part 2** is to be carried out safely.

.... [1]

(g) A student carries out a similar procedure to measure the energy content of different foods by measuring the temperature increase of water. The apparatus used is shown in Fig. 1.2.

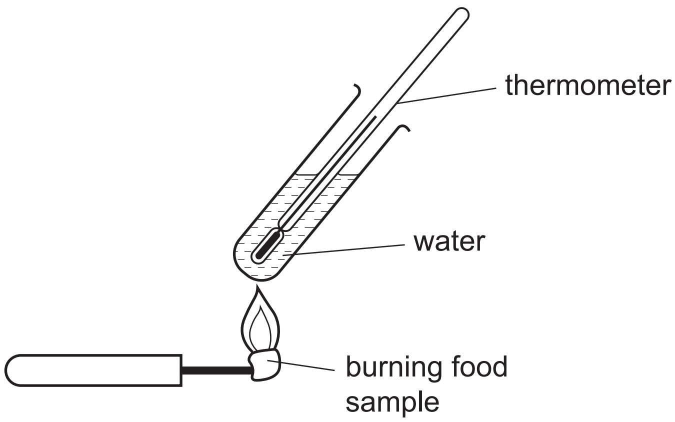


Fig. 1.2

(i) State **two** ways in which the student could make sure that the procedure shown in Fig. 1.2 is a fair comparison of the energy content of the different foods.

....

....

.... [2]

(ii) State why the procedure shown in Fig. 1.2 is not suitable for accurately measuring the total energy content of food.

....

.... [1]

2 A student investigates how the speed of the reaction between potassium iodide and an oxidising agent is changed by the presence of various catalysts.

When potassium iodide solution reacts with the oxidising agent, iodine is formed. If a particular solution **A** is added, a blue-black colour is seen.

The student first carries out the reaction without a catalyst (experiment **1**) using the procedure below.

He repeats the reaction but adds 1 cm^3 of a solution containing Fe^{3+} ions before adding the oxidising agent (experiment **2**).

He then repeats the reaction twice more, adding Fe^{2+} ions (for experiment **3**) and $\mathbf{X}^{2+}$ ions of an unknown metal, **X** (for experiment **4**).

procedure

- Place 10 cm^3 of potassium iodide solution into a conical flask.
- Add 5 drops of the solution **A**.
- Add 1 cm^3 of metal ion solution (experiments **2**, **3** and **4** only).
- Add 10 cm^3 of the oxidising agent solution. Shake well and start the stopclock.
- When the mixture in the flask turns blue-black, stop the stopclock. Record this time in Table 2.1 to the nearest second.

Table 2.1

experiment	metal ion solution added	time taken for blue-black colour / s
1	none added	
2	Fe^{3+}	
3	Fe^{2+}	
4	$\mathbf{X}^{2+}$	1

(a) Name the solution **A** that produces the blue-black colour when iodine is formed.

.... [1]

(b) **(i)** Name a piece of apparatus, other than a measuring cylinder, that can be used to measure accurately 10 cm^3 of potassium iodide solution and transfer it to the flask.

.... [1]

(ii) Name a piece of apparatus, different to your answer in **(b)(i)**, that can be used to place 5 drops of solution **A** into the flask.

.... [1]

(c) Fig. 2.1 shows the stopclock dials for the three times missing from the last column of Table 2.1.

Read the dials and record the readings in Table 2.1. [3]

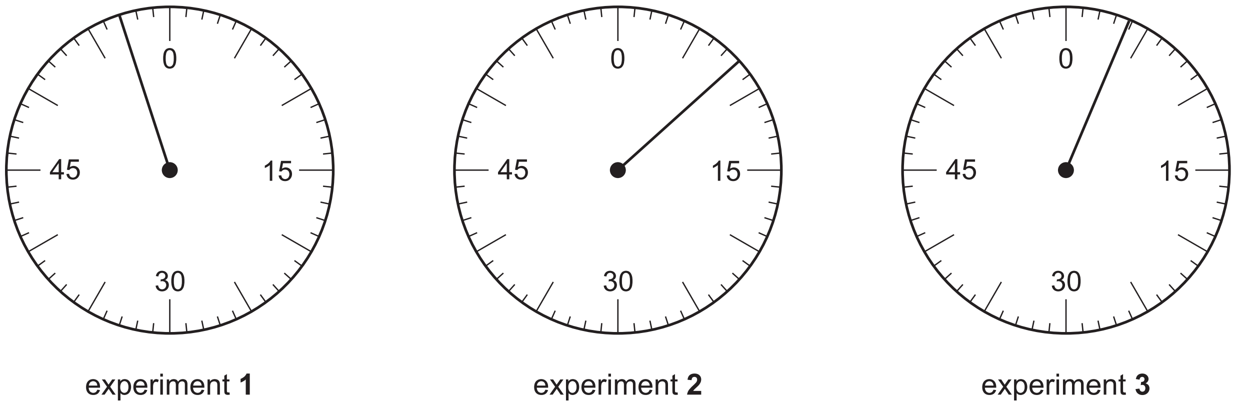


Fig. 2.1

(d) Use the results in Table 2.1 to conclude which ion is the better catalyst, Fe^{3+} or Fe^{2+}. Explain your answer.

....

.... [1]

(e) (i) The student adds ammonia solution to a portion of the solution of $\mathbf{X}^{2+}$ ions. He sees a light blue precipitate which dissolves to form a dark blue solution.

Name metal **X**. .... [1]

(ii) Name the light blue precipitate that the student sees when ammonia is added to the solution of $\mathbf{X}^{2+}$ ions.

.... [1]

(f) The teacher says that the experiments are not a fair comparison. Suggest **one** change to experiment **1** which would make the comparison fair.

....

....

.... [1]

3 A student has been given a plastic cup, shown in Fig. 3.1. He finds the volume of the cup in cm^3 using two different methods, **method 1** and **method 2.**

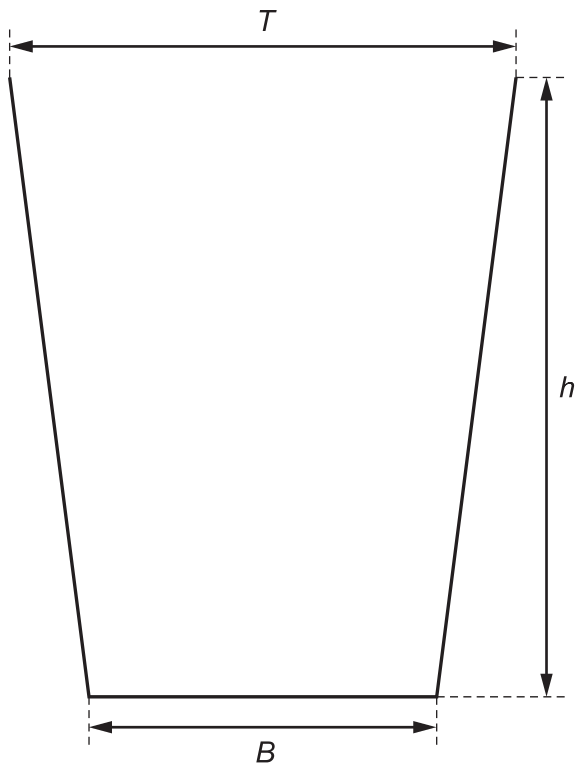


Fig. 3.1

method 1

Fig. 3.1 shows the actual size of the cup. Use a ruler to answer **(a)(i)**, **(ii)** and **(iii)**.

(a) **(i)** Measure *h*, the vertical height of the cup, to the nearest 0.1 cm.

h = ... cm [1]

(ii) Measure *B*, the diameter of the bottom of the cup, to the nearest 0.1 cm.

B = ... cm [1]

(iii) Measure *T*, the diameter of the top of the cup, to the nearest 0.1 cm.

T = ... cm [1]

(iv) Calculate *d*, the average diameter of the cup, using your answers to **(a)(ii)** and **(iii)**.

d = ... cm [1]

(v) Calculate V_1, the volume of the cup, to the nearest cm^3, using the equation

$$V_1 = \pi d^2 \frac{h}{4}$$

V_1 = ... cm^3 [1]

method 2

The student places 250 cm^3 of water into a measuring cylinder. He fills the plastic cup from the measuring cylinder.

Fig. 3.2 shows the amount of water left in the measuring cylinder.

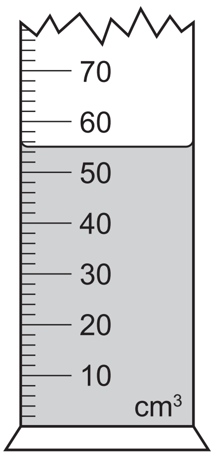


Fig. 3.2

(b) (i) Read the scale to the nearest 1 cm^3 to find the volume of water left in the measuring cylinder.

volume of water = ... cm^3 [1]

(ii) Find V_2, the volume of water that was placed in the plastic cup.

V_2 = ... cm^3 [1]

(c) The student thinks that **method 2** is less accurate than **method 1**.

Suggest **two** sources of inaccuracy in **method 2.**

1 ....

....

2 ....

....

[2]

(d) Another student finds the mass in grams of the empty plastic cup. Then he finds its mass when it is full of water.

Explain how he can use these two masses to find the volume of water in the cup.

....

....

.... [1]

4 A student is given some seeds and asked to investigate the effect of light on the growth of seedlings.

(a) The seeds need to germinate before she can carry out the experiment.

State **two** conditions she needs to provide in order for the seeds to germinate.

1 ....

2 ....

[2]

She places the seeds in three petri dishes **A**, **B** and **C** and germinates them. After two days, she arranges the dishes as shown in Fig. 4.1.

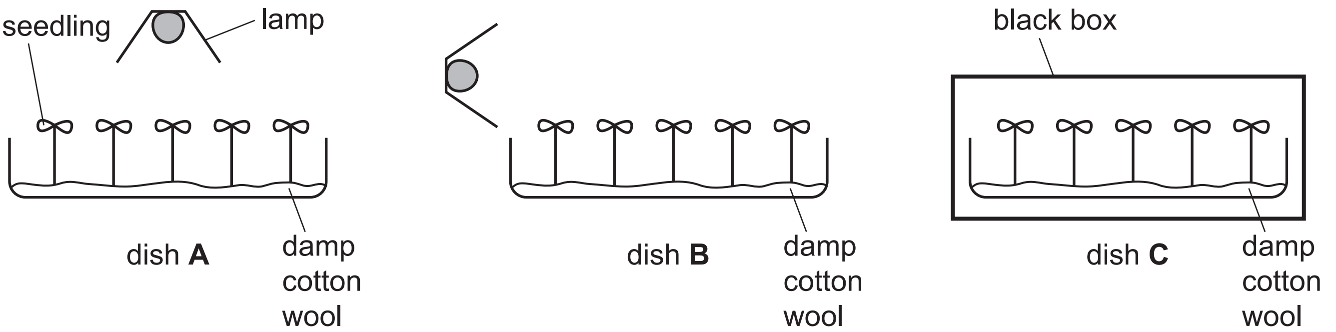


Fig. 4.1

She places dish **A** directly below a lamp, dish **B** to the right of a lamp and dish **C** in the dark.

She leaves the dishes for a further two days and then records the appearance of the seedlings in each dish.

(b) Predict the appearance of the seedlings by completing the diagrams for each dish on Fig. 4.2.

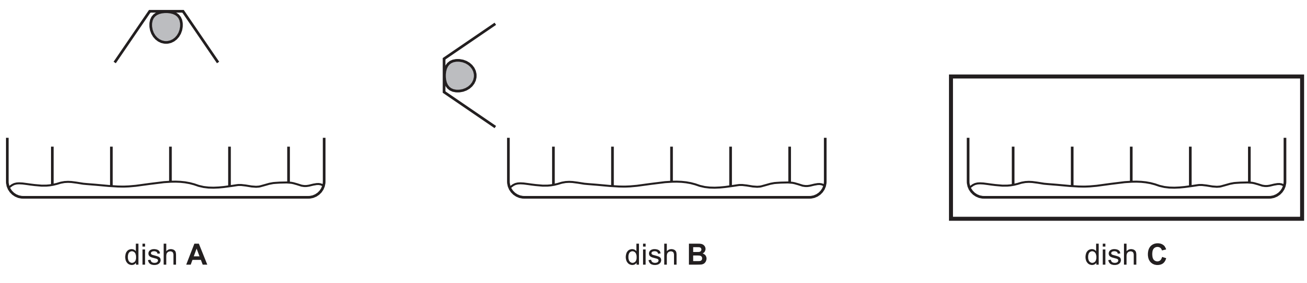


Fig. 4.2

[3]

(c) Name the type of response demonstrated by the seedlings.

.... [1]

(d) Describe how the student could test the seedlings for the presence of reducing sugar. State the observation for a positive result.

....

....

.... [2]

(e) Suggest **two** reasons why the student used more than one seed in each petri dish.

1 ....

....

2 ....

.... [2]

5 A student carries out an investigation on carbon dioxide.

He dissolves carbon dioxide in water. Then he finds the concentration of the carbon dioxide solution by reacting it with limewater.

Fig. 5.1 shows the apparatus for making the carbon dioxide using marble chips and dilute hydrochloric acid.

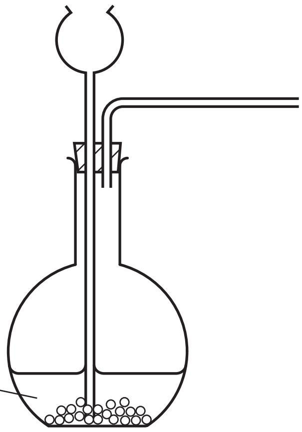


Fig. 5.1

(a) Complete Fig. 5.1 to show how the carbon dioxide is dissolved in water. [1]

(b) The student slowly adds limewater to 25 cm^3 of the carbon dioxide solution.

When enough limewater has been added, a precipitate forms in the mixture. He records the volume of limewater used at the point where the precipitate has just formed. He repeats the experiment another two times.

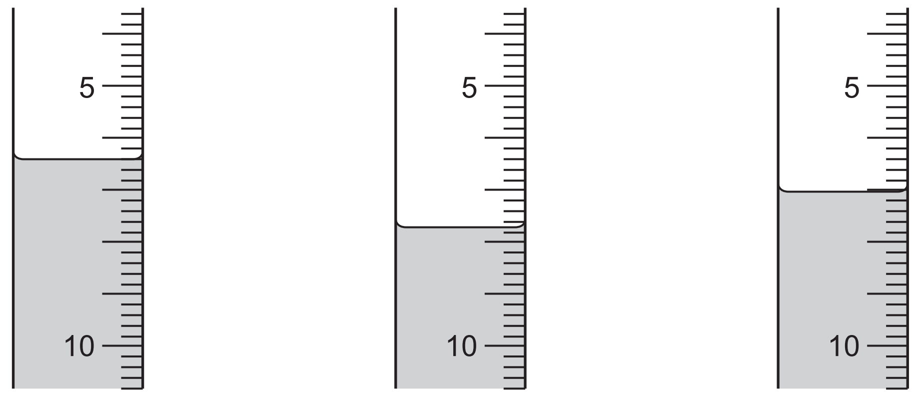
(i) Suggest the best way for the student to detect the precipitate as soon as it begins to form.

....

.... [1]

(ii) Fig. 5.2 shows the measuring instruments used to add limewater to the carbon dioxide solution in each of the three experiments. Each instrument is shown after the limewater has been added.

The measuring instruments are filled with limewater to the zero point of the scale and the limewater slowly released from a tap at the bottom of the instrument. The level of limewater in each tube shows how much has been used.



experiment 1 experiment 2 experiment 3

Fig. 5.2

Read the scales and record in Table 5.1 the volume of limewater used to the nearest 0.1 cm^3.

Table 5.1

experiment	1	2	3
volume of limewater used / cm^3			

[3]

(iii) Find the average volume of limewater used.

average volume = ... cm^3 [1]

(c) Calculate the concentration of the carbon dioxide solution. Use the formula shown below.

$$\text{concentration of carbon dioxide solution} = \frac{\text{average volume of limewater} \times 0.015\,\text{mol/dm}^3}{\text{volume of carbon dioxide solution}}$$

concentration of carbon dioxide solution = ... mol / dm^3 [2]

(d) A solution of carbon dioxide in water is slightly acidic.

Limewater is alkaline.

An indicator may be used in this experiment instead of looking for the precipitate.

Suggest a suitable indicator to add to the carbon dioxide solution. State the colour change when enough limewater has been added to react with all of the carbon dioxide solution.

indicator ....

colour change .... to .... [2]

6 Two students investigate the speed of a trolley running down a smooth slope. The trolley has a mass of 1 kg. The angle of the smooth slope can be adjusted by raising one end. The arrangement of apparatus is shown in Fig. 6.1.

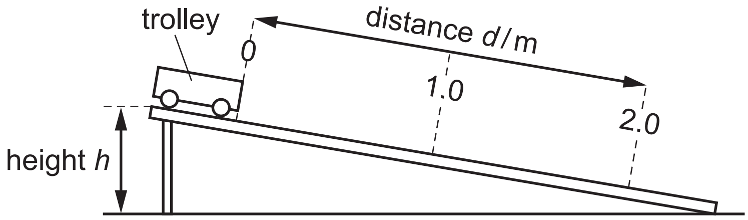


Fig. 6.1

method

- the height h is initially set at 2 cm.
- The trolley is placed at the top end of the slope as shown in Fig. 6.1.
- The trolley is released and a timer is started.
- When the trolley passes the 1 m mark, the time t_1 is noted and recorded in Table 6.1.
- When the trolley reaches the 2 m mark, the time t_2 is noted and recorded in Table 6.1.
- The experiment is repeated using different heights of 4 cm and 5 cm.

(a) Explain the best way for the students to work together to obtain the data recorded in Table 6.1 for each experiment.

....

.... [1]

(b) The timer displays for the missing values of t_1 and t_2 are shown in Fig. 6.2. Read the displays and record the times in the correct places in Table 6.1.

You will have to decide which reading goes in which column. [1]

Fig. 6.2

Table 6.1

height h / cm	time t_1 / s for 1 m	time t_2 / s for 2 m
2	3.5	4.9
4		
5	2.0	3.1

(c) (i) Use data for h = 2 cm from Table 6.1, to show that the trolley accelerates as it runs down the slope. Show your working.

[2]

(ii) Use data from Table 6.1 to show that the trolley reaches a greater speed over 2 m when the height of the slope is greater. Show your working.

[2]

(d) The students repeat the experiments using a trolley of mass 2 kg. Predict how the results of this set of experiments will compare with the results in Table 6.1. Justify your answer.

....

....

.... [2]

(e) One of the students suggests that the height h is increased to 30 cm. Suggest why the results may be inaccurate for this experiment.

....

.... [1]

(f) State the energy transformation that occurs as the trolley runs down the slope.

....

.... [1]

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