Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

6542443093

COMBINED SCIENCE **0653/63**

Paper 6 Alternative to Practical **October/November 2018**

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.

This document consists of **20** printed pages.

DC (NF/CGW) 172997

CAMBRIDGE International Examinations

[Turn over

1 A student investigates a flower.

Fig. 1.1 shows part of the student's flower.

Fig. 1.1

(a) **(i)** In the box provided, make a large detailed pencil drawing of the flower in Fig. 1.1.

This should show all the flower parts.

[4]

(ii) On your drawing, label a petal, the stigma and an anther. [3]

(b) (i) A student crushes some olives, producing olive juice.

Describe a test that can be used to confirm that a sample of the olive juice contains fat.

Include the observation for a positive result.

test ....

....

observation ....
[2]

(ii) Suggest why this method would be unsuitable to test for the presence of fat in milk.

....

....[1]

2 Solid **J** is a mixture of two compounds. Only one of the compounds is soluble in water.

A student separates the compounds and identifies some of the ions in each compound.

(a)
- She places solid **J** in a beaker, adds distilled water and stirs well.
- She filters the mixture into a test-tube.
- She keeps the filtrate and the residue for further testing.
- She records her observations.

the filtrate is colourless

the residue is black

(i) Draw **and** label the apparatus she uses to filter the mixture.

Label the positions of the filtrate and the residue.

[3]

(ii) Suggest why the water she uses is distilled water.

....

....[1]

(b) • The student scrapes the solid from the filtration in **(a)** into a beaker.

• She adds dilute sulfuric acid and heats the mixture until the solid disappears.

• She tests for the cation in the resulting liquid by adding sodium hydroxide solution.

• She records her observations.

blue precipitate (ppt.)

Identify the cation.

....[1]

(c) The student places some of the liquid from the filtration in **(a)** in a test-tube and tests for the cation by adding sodium hydroxide solution.

She heats the mixture and tests for any gases near the mouth of the test-tube using damp blue and damp red litmus papers.

From her observations, she concludes that the cation is the ammonium ion.

(i) State her observations for each stage of the method in **(c)**.

observations for:

addition of sodium hydroxide solution ....

....

damp blue litmus paper ....

damp red litmus paper ....
[2]

(ii) Explain why she uses sodium hydroxide solution rather than ammonia solution to test for the ammonium ion.

....

....[1]

(iii)
- The student places another sample of the liquid from the filtration in **(a)** into a test-tube.
- She adds dilute nitric acid.
- She then adds a few drops of barium nitrate solution.
- She records her observations.

observations for:

addition of nitric acid … *no reaction and no bubbles*

addition of barium nitrate solution … *white ppt.*

State what the student can conclude about the anions present.

nitric acid test ....

barium nitrate test ....

[2]

3 A student investigates how the temperature of the surroundings affects the rate of cooling of water in a test-tube.

(a) • She sets up the test-tube in a stand, as shown in Fig. 3.1.

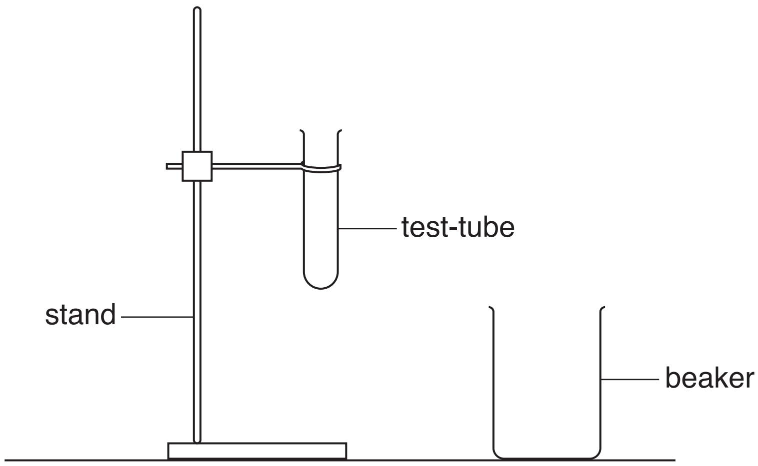

Fig. 3.1

- She pours 200 cm^3 of cold water into the beaker.
- She pours hot water into the test-tube until it is about half full.
- She places the test-tube into a beaker of cold water, as shown in Fig. 3.2.

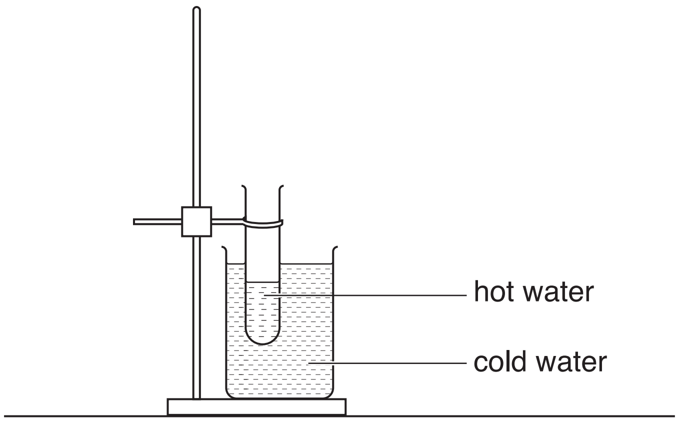

Fig. 3.2

- She places a thermometer into the test-tube.
- She waits for one minute.
- She measures the temperature θ of the hot water in the test-tube and records this in Table 3.1 at time $t = 0$. She starts the stopclock.
- She measures the temperature θ of the water every 30 seconds for a total time of 3 minutes.
- She records the temperatures and times in Table 3.1.

Table 3.1

	test-tube cooling in beaker of cold water	test-tube cooling in beaker of warm water
time *t* /	temperature of water in test-tube *θ* /	temperature of water in test-tube *θ* / ....
0	83.5	84.0
30	68.5	73.5
60		69.5
90	56.5	66.0
120	53.5	64.0
150	51.5	62.5
180	50.0	61.5

(i) Fig. 3.3 shows the reading on the thermometer at time *t* = 60 seconds.

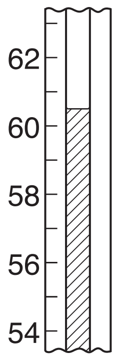

Fig. 3.3

Read the thermometer and record the value in Table 3.1. [1]

(ii) State why it is important to wait for one minute before recording the initial temperature of the hot water.

....

....[1]

(iii) State **two** precautions that the student should take to ensure that the temperatures that she measures are as accurate as possible.

1 ....

....

2 ....

....

[2]

(b) The student repeats the investigation, but this time she replaces the beaker of cold water shown in Fig. 3.2 with a beaker of warm water.

She records her results in Table 3.1.

(i) Write the units in the column headings in Table 3.1. [1]

(ii) Calculate the decrease in the temperature of the water in the test-tube after 3 minutes when cooling in the beaker of cold water and when cooling in the beaker of warm water.

temperature decrease in beaker of cold water = ...

temperature decrease in beaker of warm water = ...
[1]

(c) Use the information in **(b)(ii)** or the results in Table 3.1 to describe how the temperature of the surroundings affects the cooling of the water in the test-tube.

....

....

....

....[2]

(d) Suggest **one** improvement that could be made to the experimental procedure which would allow a fairer comparison between cooling in cold water and cooling in warm water.

Explain how your improvement makes the comparison fair.

improvement ....

....

explanation ....

....

....
[2]

4 A student uses a choice chamber to investigate the responses of woodlice (small invertebrates) to the intensity of light and the amount of water vapour in their surroundings.

The choice chamber is divided into four sections, each of which has different conditions, as shown in Fig. 4.1.

View from above

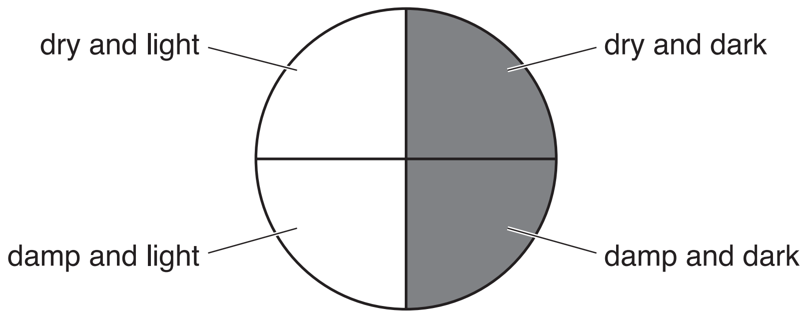

Fig. 4.1

- The student adds 8 woodlice to the choice chamber.
- The woodlice are free to move between any of the four sections.
- The student records the positions of the woodlice after 15 minutes.
- The test is carried out a total of three times.
- The results are shown in Fig. 4.2.

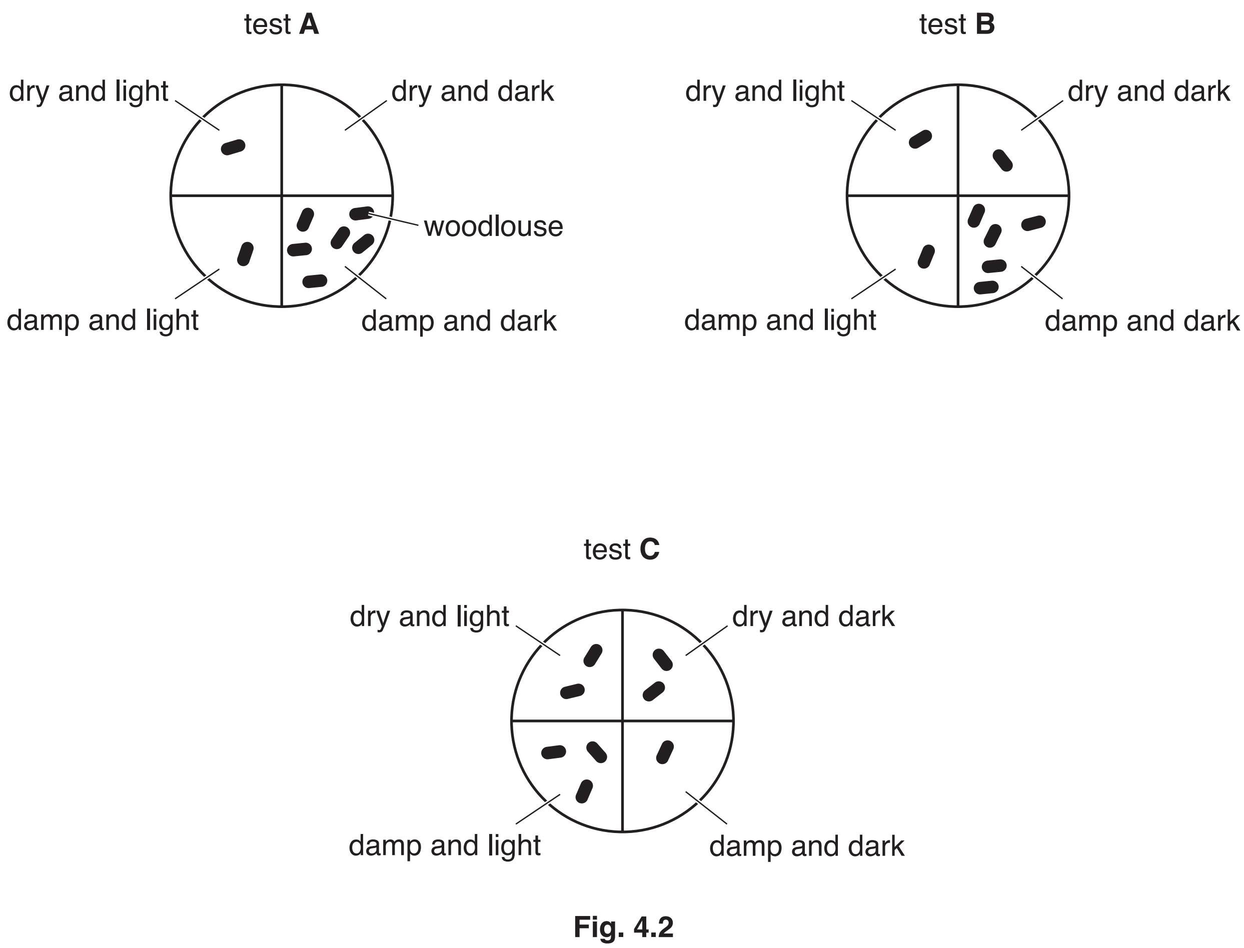

Fig. 4.2

Table 4.1 shows some of these results.

Table 4.1

conditions in each section	number of woodlice counted			average number of woodlice
	test **A**	test **B**	test **C**	
dry and dark	0	1		1
damp and dark	6	5		4
damp and light	1	1		2
dry and light	1	1		

(a) **(i)** Count the number of woodlice in each section of the choice chamber in test **C** and record the numbers in Table 4.1. [1]

(ii) Calculate the average number of woodlice in the dry and light section of the choice chamber.

Record this number in Table 4.1. [1]

(b) Draw a bar chart to show the average number of woodlice (vertical axis) found in each section.

[4]

(c) **(i)** State which section of the choice chamber the woodlice prefer.

....[1]

(ii) Suggest how the woodlice should be placed in the choice chamber at the start of the experiment.

....

....[1]

(iii) Using the same apparatus, suggest **two** improvements to this investigation.

1 ....

2 ....
[2]

Please turn over for Question 5.

5 A student investigates the products of combustion of a hydrocarbon.

A hydrocarbon is burned in the apparatus shown in Fig. 5.1.

The products of this combustion are drawn through the apparatus by a pump for 10 minutes.

At the start, the U-tube is clean and dry and the limewater is colourless.

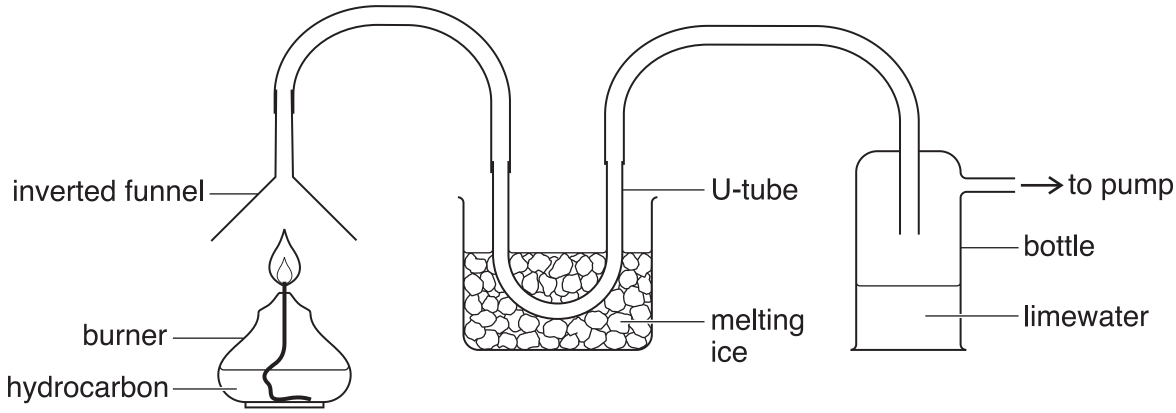

Fig. 5.1

(a) During the 10 minutes, a colourless liquid forms inside the U-tube.

The student thinks that this is water.

(i) Describe a chemical test that can be used to confirm that the colourless liquid in the U-tube contains water.

Include the observation for a positive result.

test ....

....

observation ....

....
[2]

(ii) Explain why the U-tube is immersed in melting ice.

....

....[1]

(b) The teacher tells the student that the apparatus in Fig. 5.1 contains an error in the bottle containing the limewater.

The student makes the necessary change to the apparatus.

The limewater then changes its appearance showing that carbon dioxide is present.

(i) Draw on Fig. 5.1 the change that the student makes to the apparatus. [1]

(ii) State the change in the limewater that shows the presence of carbon dioxide.

....

....[1]

(c) The student tells his class that the experiment proves that the complete combustion of a hydrocarbon in oxygen produces carbon dioxide and water only.

State whether you agree with the student **and** explain your answer in detail.

Use the observations and conclusions in **(a)** and **(b)** and the apparatus shown in Fig. 5.1 to help explain your answer.

statement ....

explanation ....

....

....

....
[2]

(d) Another student says that the bottle containing the limewater should be placed before (to the left of) the U-tube.

Explain why this student is incorrect.

....

....[1]

(e) The teacher tells the student to carry out a second experiment.

He sets up the apparatus in Fig. 5.1 with a dry U-tube and a correctly connected bottle of fresh limewater but without the burner.

He draws air through the apparatus for 10 minutes without burning the hydrocarbon.

Explain why this second experiment is carried out.

....

....[1]

(f) When the student dismantles the apparatus after burning the hydrocarbon, he observes a black solid on the inverted funnel.

Suggest the identity of the black solid.

....[1]

6 A student is using refraction of light to determine the concentration of a solution of sugar.

She sets up the apparatus shown in Fig. 6.1.

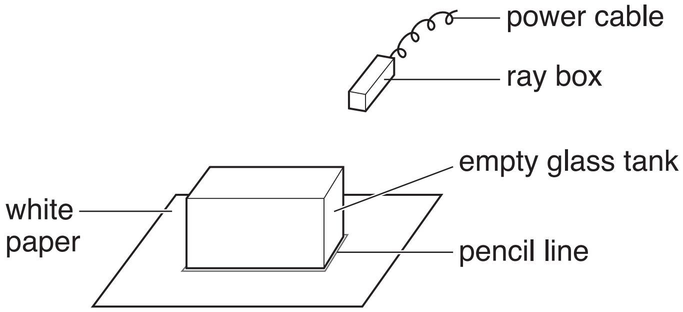

Fig. 6.1

The ray box is used to direct a ray of light towards the glass tank. The student draws around the tank with pencil so that it can be moved and replaced in exactly the same position.

She fills the tank with distilled water and switches on the ray box.

She looks at the apparatus from above so that she can see the ray of light as it enters and leaves the tank, as shown in Fig. 6.2.

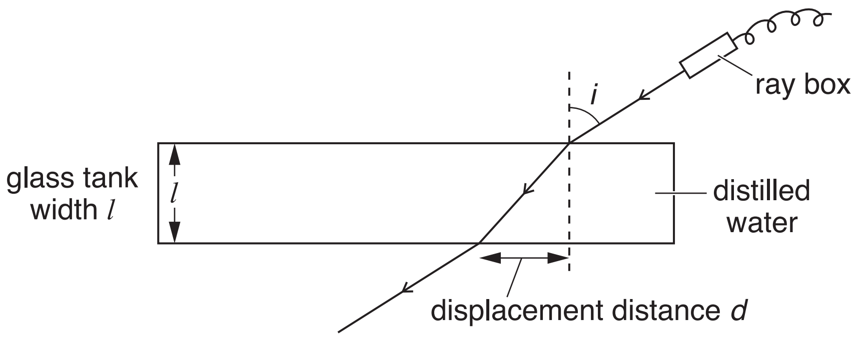

Fig. 6.2

She adjusts the angle of incidence *i* of the light until there is a large displacement distance *d*.

She measures the displacement distance *d* as 8.6 cm and records this value in Table 6.1.

Table 6.1

sugar solution concentration / g per 100 cm^3 water	displacement distance *d* / cm
0	8.6
20	
40	7.9
60	7.5
80	7.0

The angle of incidence *i* needs to be kept constant throughout the experiment.

She draws a line along the path of the ray onto the paper and measures the angle *i*.

(a) Fig. 6.3 shows the angle of incidence *i* of the ray of light.

Measure the angle *i* and record it to the nearest degree.

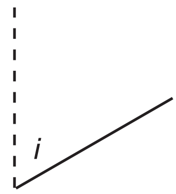

Fig. 6.3

angle = ... ° [1]

(b) The student empties the tank and fills it with a sugar solution of concentration 20 g per 100 cm^3 of water.

She places the tank into exactly the same position on the paper and makes sure that the angle of incidence *i* is the same as in **(a)**.

She measures the displacement distance *d* and records the value in Table 6.1.

She repeats the procedure for solutions of concentration 40, 60 and 80 g per 100 cm^3 of water.

Fig. 6.4 shows the displacement distance *d* when the concentration is 20 g per 100 cm^3 of water.

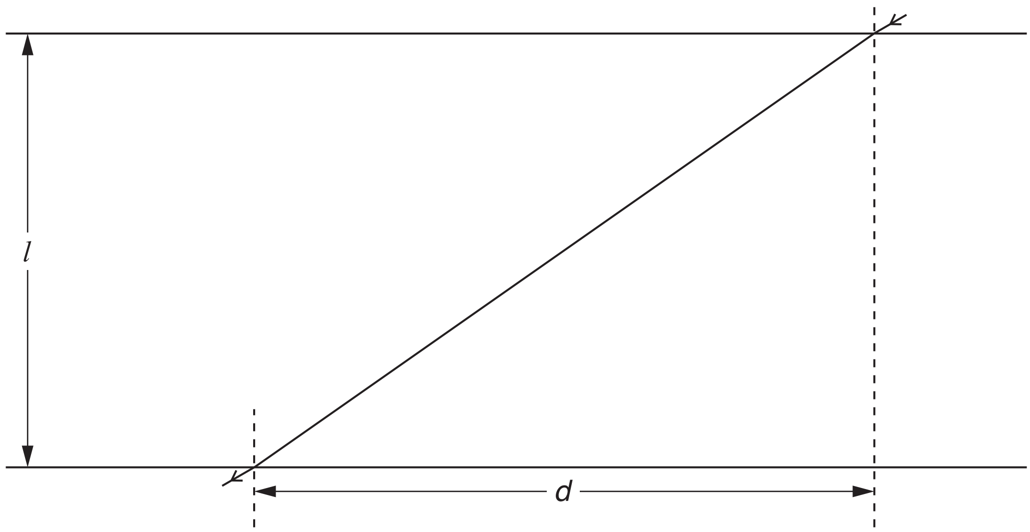

Fig. 6.4

Measure and record the displacement distance *d* in Table 6.1. [1]

(c) (i) On the grid provided, plot a graph of displacement distance *d* (vertical axis) against sugar solution concentration.

You do **not** need to start the *y*-axis at 0.

[3]

(ii) Draw the best-fit straight line. [1]

(d) The student fills the tank with a sugar solution of unknown concentration.

She measures the displacement distance *d* as 7.7 cm.
Use your graph to determine the concentration of this solution.
Show clearly on your graph how you arrived at your answer.

concentration .... g per 100 cm^3 water [1]

(e) The teacher says that if the angle of incidence *i* is increased then the displacement distance *d* will also increase.

(i) Explain why larger values of *d* would increase the accuracy of the experiment.

....

....[1]

(ii) Suggest another change to this experiment which would result in larger values of *d*.

....

....[1]

(f) Suggest **one** disadvantage of replacing the sugar solution concentrations used in this experiment with sugar solution concentrations of 40, 45 and 50 g per 100 cm^3 of water.

....

....[1]