Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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CO-ORDINATED SCIENCES **0654/63**

Paper 6 Alternative to Practical **May/June 2021**

1 hour 30 minutes

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 60.
- The number of marks for each question or part question is shown in brackets [ ].

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

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1 Fig. 1.1 shows a slice of pepper.

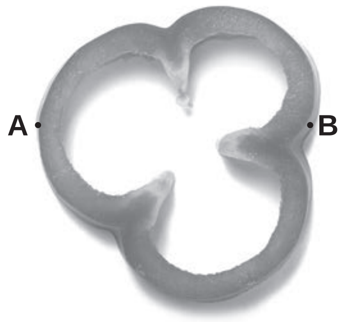


Fig. 1.1

(a) In the box, make an enlarged detailed pencil drawing of the surface of the slice of pepper.

[3]

(b) **(i)** Draw a line to join points **A** and **B** in Fig. 1.1.

Measure and record the length of this line in millimetres to the nearest millimetre.

length of line **A**–**B** in Fig. 1.1 = ... mm [1]

(ii) Draw the line **A**–**B** to show this diameter on your drawing in **(a)**.

Measure and record the length of this line in millimetres to the nearest millimetre.

length of line **A**–**B** on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{length of line } \mathbf{A\text{–}B} \text{ on drawing}}{\text{length of line } \mathbf{A\text{–}B} \text{ in Fig. 1.1}}$$

m = ... [1]

(c) A student tests some egg white and potato for the presence of nutrients.

(i) The egg white contains protein and no starch.

The potato contains starch and no protein.

Complete Table 1.1 with the final colour observed in each test.

Table 1.1

test solution	final colour observed with egg white	final colour observed with potato
iodine		
biuret		

[4]

(ii) Suggest why it is difficult to test a red pepper using biuret solution.

....

.... [1]

(d) A student tests the egg white for the presence of fat.

(i) State two substances needed for the fat test.

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

(ii) Explain why there should be no flames in the laboratory when doing this test.

.... [1]

[Total: 13]

2 A student investigates the concentration of carbon dioxide in some water samples.

Hydrogencarbonate indicator changes colour in different concentrations of dissolved carbon dioxide as shown in Fig. 2.1.

carbon dioxide concentration	colour of hydrogencarbonate indicator
high	yellow
normal	red
low	purple

Fig. 2.1

(a) The student is given three water samples, **A**, **B** and **C**.

The student adds 1 cm^3 of hydrogencarbonate indicator to each water sample.

The student's results are shown in Table 2.1.

Table 2.1

water sample	colour of hydrogencarbonate indicator observed	carbon dioxide concentration
A	purple	
B	yellow	
C	red	

(i) Use the student's observations and the information in Fig. 2.1 to complete Table 2.1. [2]

(ii) Suggest a piece of apparatus suitable for adding 1 cm^3 of hydrogencarbonate indicator to the water samples.

.... [1]

(b) Animals produce carbon dioxide in respiration and plants use up carbon dioxide in photosynthesis.

All three water samples previously contained living organisms.

(i) Suggest which water sample contained just animals.

Explain your answer.

water sample ....

explanation ....

.... [1]

(ii) Suggest which water sample contained just plants.

Explain your answer.

water sample ....

explanation ....

.... [1]

(iii) Suggest what the other water sample contained.

Explain your answer.

....

.... [1]

(c) Name another reagent used to test for the presence of carbon dioxide gas.

.... [1]

[Total: 7]

3 A student investigates the neutralisation of aqueous sodium hydroxide by dilute hydrochloric acid.

Concentration can have the unit M. A solution with a concentration of 0.2 M is two times more concentrated than a 0.1 M solution.

(a) Procedure

The student:

- measures 10 cm^3 of 0.5 M aqueous sodium hydroxide using a measuring cylinder and pours this into a conical flask
- adds 5 drops of methyl orange indicator to the flask, the indicator turns yellow
- slowly adds drops of dilute hydrochloric acid until the indicator just turns orange
- marks the number of drops on a tally chart
- adds up the total number of drops added and records it in a table.

The student repeats the procedure with 1.0 M, 1.5 M and 2.0 M aqueous sodium hydroxide instead of the 0.5 M aqueous sodium hydroxide.

The student uses the same dilute hydrochloric acid.

The tally chart in the student's notebook is shown in Fig. 3.1.

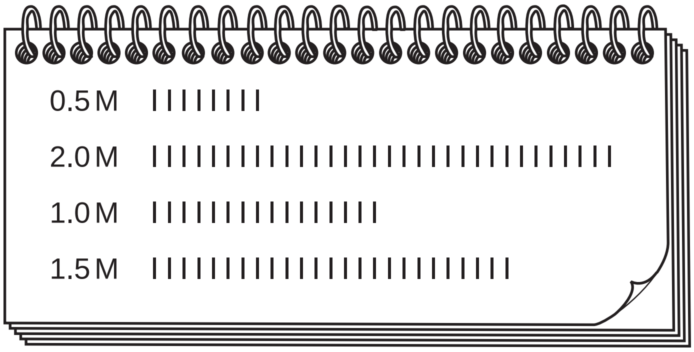


Fig. 3.1

(i) Construct a results table for the student's results.

[1]

(ii) Count the number of drops recorded in the tally chart for each concentration of aqueous sodium hydroxide.

Record the numbers in your table. [2]

(iii) Suggest two improvements to the method to make the results more accurate and reliable.

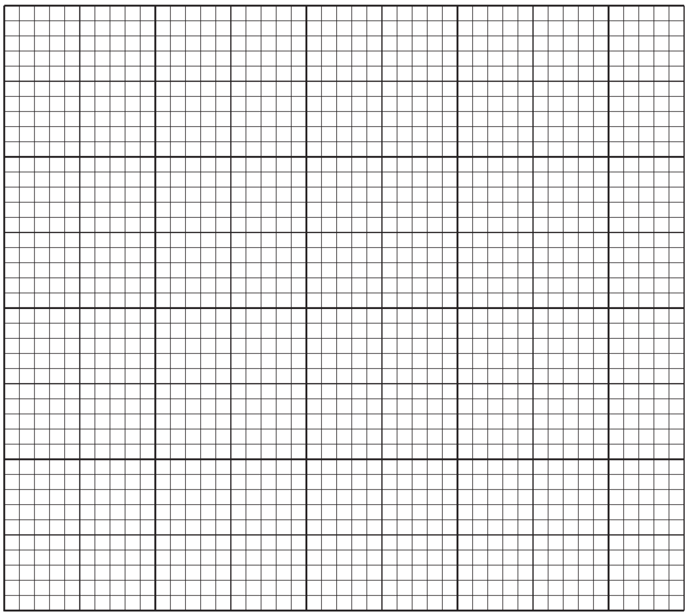
improvement 1 ....

....

improvement 2 ....

.... [2]

(b) **(i)** Plot on the grid provided a graph of number of drops of dilute hydrochloric acid (vertical axis) against concentration of aqueous sodium hydroxide.



[3]

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

(iii) Describe in detail the relationship between concentration of aqueous sodium hydroxide and number of drops of dilute hydrochloric acid added.

....

....

.... [2]

(iv) Use your graph to predict the number of drops of the same dilute hydrochloric acid needed to just change the colour of methyl orange when $10\,cm^3$ of 1.8 M aqueous sodium hydroxide is used.

Show on your graph how you arrived at your answer.

number of drops = ... [2]

(v) The student repeats the four experiments but this time uses hydrochloric acid that is **twice** as concentrated.

Draw a line on the grid to show the results the student should expect to get.

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

(c) The mixture in the conical flask is a solution of the salt called sodium chloride.

Fig. 3.2 shows drawings of apparatus.

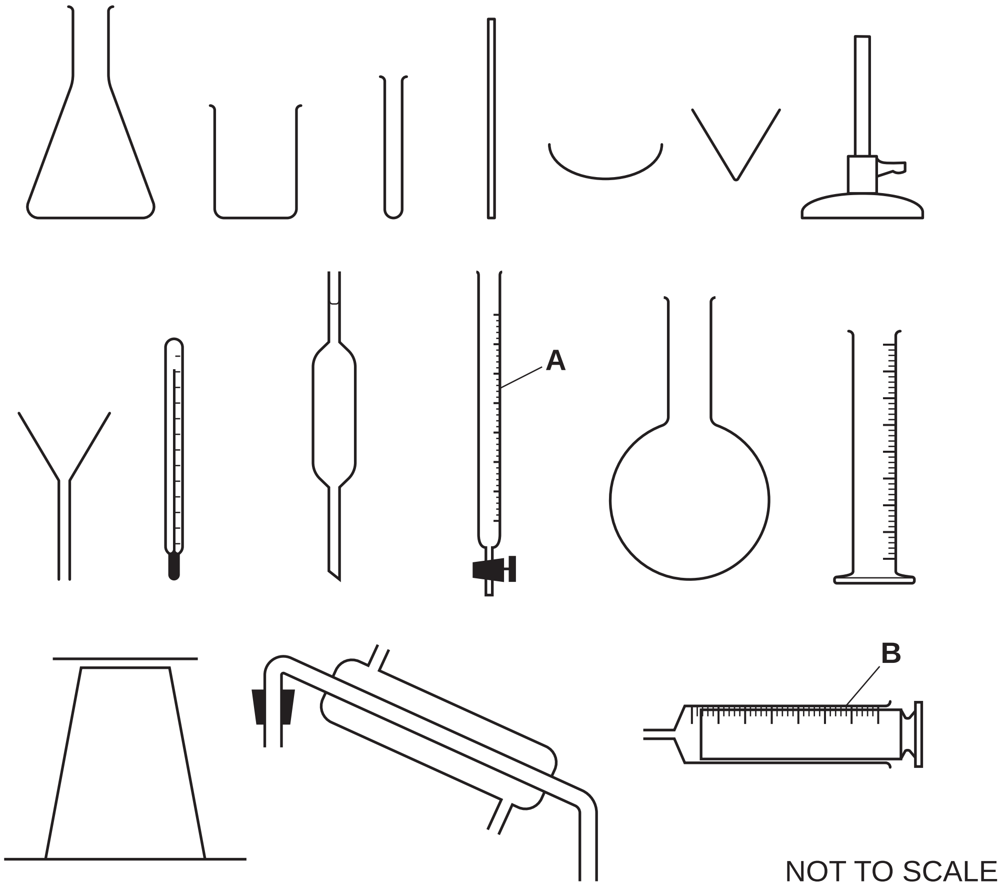


Fig. 3.2

(i) Name the pieces of apparatus shown in Fig. 3.2 labelled **A** and **B**.

A is ....

B is ....
[2]

(ii) A student wants to separate the salt from the aqueous salt solution.

Choose the apparatus from Fig. 3.2 needed to separate quickly the salt from the aqueous salt solution.

Draw a large, clear, labelled diagram of the assembled apparatus used to get the salt.

Use a ruler.

[3]

[Total: 20]

4 A student investigates the cooling rates of different volumes of hot water.

The student sets up the apparatus as shown in Fig. 4.1.

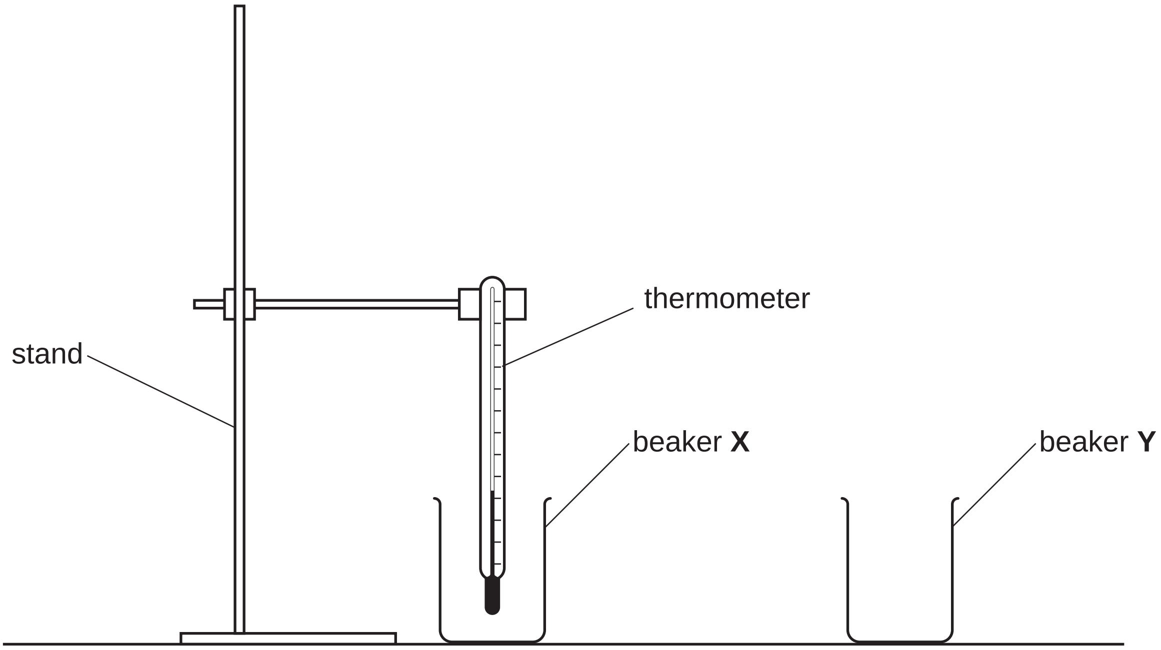


Fig. 4.1

(a) Procedure

The student:

- pours 200 cm^3 of hot water into beaker **X**
- waits for 30 seconds
- stirs the water carefully and reads the temperature of the hot water
- records in Table 4.1 the initial temperature of the hot water at time $t = 0$
- immediately starts a stopwatch
- records the temperature θ of the water every 30 seconds for 180 seconds.

Table 4.1

	beaker **X** (200 cm^3 of water)	beaker **Y** (100 cm^3 of water)
time *t* /	temperature θ /	temperature θ / ....
0	86.0	87.0
	81.5	81.0
	80.0	78.5
	78.5	76.0
	77.5	74.0
	76.5	72.5

(i) Complete the column headings in Table 4.1 by adding the units for time *t* and temperature θ. [1]

(ii) Complete the time column in Table 4.1. [1]

(iii) Suggest why the student waits for 30 seconds before recording the initial temperature of the hot water.

....

.... [1]

(iv) Suggest why the student stirs the hot water before recording its initial temperature.

.... [1]

(b) The student replaces beaker **X** with an identical beaker **Y**.

The student repeats the procedure in **(a)** for beaker **Y**, using 100 cm^3 of hot water in beaker **Y**.

The student's results are shown in Table 4.1.

Fig. 4.2 shows the thermometer readings for beaker **X** and beaker **Y** after 30 seconds.

Record in Table 4.1 the thermometer readings for beaker **X** and beaker **Y**.

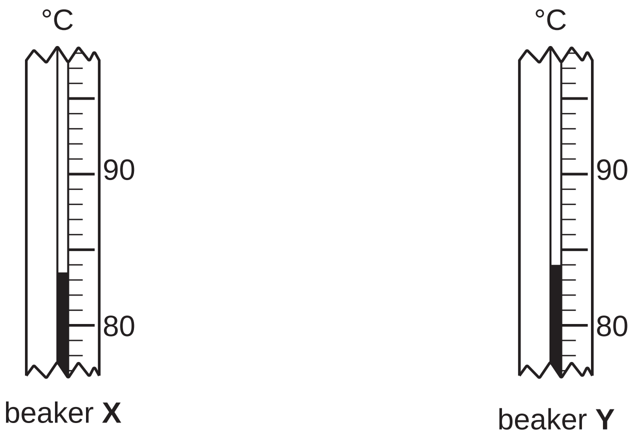


Fig. 4.2

[2]

(c) **(i)** Calculate the decrease in temperature of the water in beaker **X** and the water in beaker **Y** over the 180 seconds.

beaker **X**

decrease in temperature over the 180 seconds = ...

beaker **Y**

decrease in temperature over the 180 seconds = ...

[1]

(ii) Calculate the average rate of cooling in beaker **X** over the 180 seconds cooling period. Use the equation shown.

$$\text{average rate of cooling} = \frac{\text{decrease in temperature over the 180 seconds}}{180}$$

average rate of cooling in beaker **X** = ... °C / s [1]

(iii) Calculate the average rate of cooling in beaker **Y** over the 180 seconds cooling period.

average rate of cooling in beaker **Y** = ... °C / s [1]

(d) The temperature of the water in beaker **X** and in beaker **Y** decreases as it cools.

State **one** other similarity between the way in which the temperature changes in both beakers.

....

.... [1]

(e) The teacher says that the rate of cooling of the smaller volume of water in beaker **Y** should be greater than that of the larger volume of water in beaker **X**.

State if the student's results support the teacher's statement.

Justify your answer with reference to the student's readings.

statement ....

....

justification ....

....
[2]

(f) Another student repeats the investigation to check the results.

State **one** variable that should be kept the same so that a fair comparison is made.

.... [1]

[Total: 13]

5 A student investigates if the time taken for a metal ball rolling along a horizontal bench to come to rest (stopping time) depends on its mass.

The metal ball is placed on a ramp and released from rest.

Plan an experiment to investigate if the stopping time of the metal ball rolling along a horizontal bench depends on its mass.

The apparatus available is listed:

- a wooden plank to act as a ramp
- boss, clamp and stand to support one end of the plank
- metre rule
- selection of metal balls of different sizes and masses.

Fig. 5.1 shows how the plank is supported.

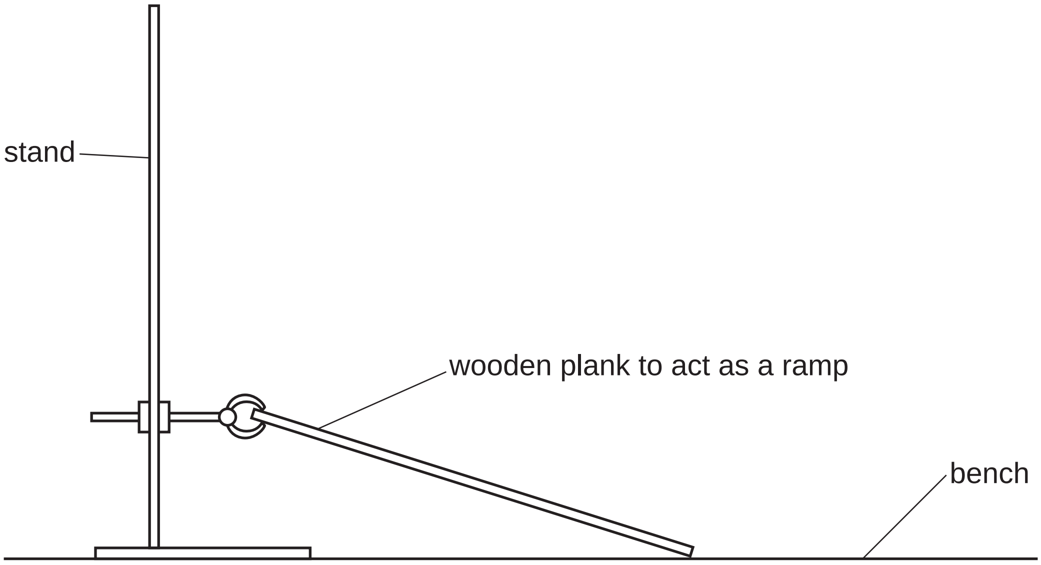


Fig. 5.1

Include in your plan:

- any other apparatus you will use which is **not** included in the list of apparatus
- a brief description of the method
- the measurements you will make, including how to make them as accurate as possible
- the variables you will control
- how you will use your results to draw a conclusion.

You may also include a table that can be used to record results if you wish. You are **not** required to include any results.

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.... [7]

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