Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

7010781383

CO-ORDINATED SCIENCES **0654/53**

Paper 5 Practical Test **May/June 2021**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
5	
Total	

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

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1 You are provided with a slice of pepper.

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

[3]

(b) **(i)** Measure the diameter of the slice of pepper.

Record this diameter in millimetres to the nearest millimetre.

diameter of slice of pepper = ... mm [1]

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

Record the length of this line in millimetres to the nearest millimetre.

diameter 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.

$$m = \frac{\text{diameter on drawing}}{\text{diameter of slice of pepper}}$$

m = ... [1]

(c) You are going to test some egg white and potato for the presence of nutrients.

(i) **Procedure**

- Half-fill two wells of the spotting tile with egg white.
- Add a few drops of iodine solution to one well containing egg white.
- Add a few drops of biuret solution to the other well containing egg white.
- Record the final colours observed in Table 1.1.

Repeat the procedure using potato puree instead of egg white.

Table 1.1

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

[4]

(ii) State conclusions for your observations.

egg white ....

....

potato puree ....

....
[2]

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

....

.... [1]

[Total: 13]

2 You are going to investigate 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) You are provided with three water samples, **A**, **B** and **C**.

(i)
- Add about 10 drops of hydrogencarbonate indicator to each sample of water.
- Record in Table 2.1 the colour of the hydrogencarbonate indicator in each sample.

Table 2.1

water sample	colour of hydrogencarbonate indicator	carbon dioxide concentration
A		
B		
C		

[2]

(ii) Use your observations and the information in Fig. 2.1 to complete Table 2.1. [2]

(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]

[Total: 7]

3 You are going to investigate 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.

Read through the procedure in **(a)(i)** and answer **(a)(ii)** before you begin the experiment.

(a) (i) Procedure

- Measure 10 cm^3 of 0.1 M aqueous sodium hydroxide using a measuring cylinder and pour this into a conical flask.
- Place the conical flask on a white tile.
- Add 5 drops of methyl orange indicator to the conical flask. The indicator is yellow.
- Slowly add drops of dilute hydrochloric acid from a dropping pipette until the indicator just turns orange or red. Count the drops as you add them.
- Record the total number of drops in a table.

Repeat the procedure with 0.2 M, 0.4 M and 0.6 M aqueous sodium hydroxide instead of the 0.1 M aqueous sodium hydroxide.

Use the same dilute hydrochloric acid. [4]

(ii) Construct a results table for your results.

[1]

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

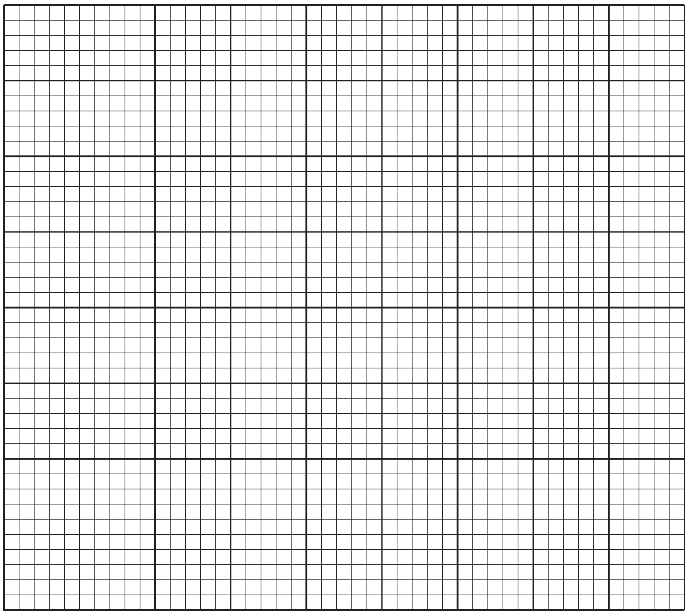
improvement 1 ....

....

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) State the relationship between concentration of aqueous sodium hydroxide and number of drops of dilute hydrochloric acid added.

....

.... [1]

(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 $0.5\,M$ aqueous sodium hydroxide is used.

Show on your graph how you arrived at your answer.

number of drops = ... [2]

(v) A student repeats your four experiments but 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. 3.1 shows drawings of apparatus.

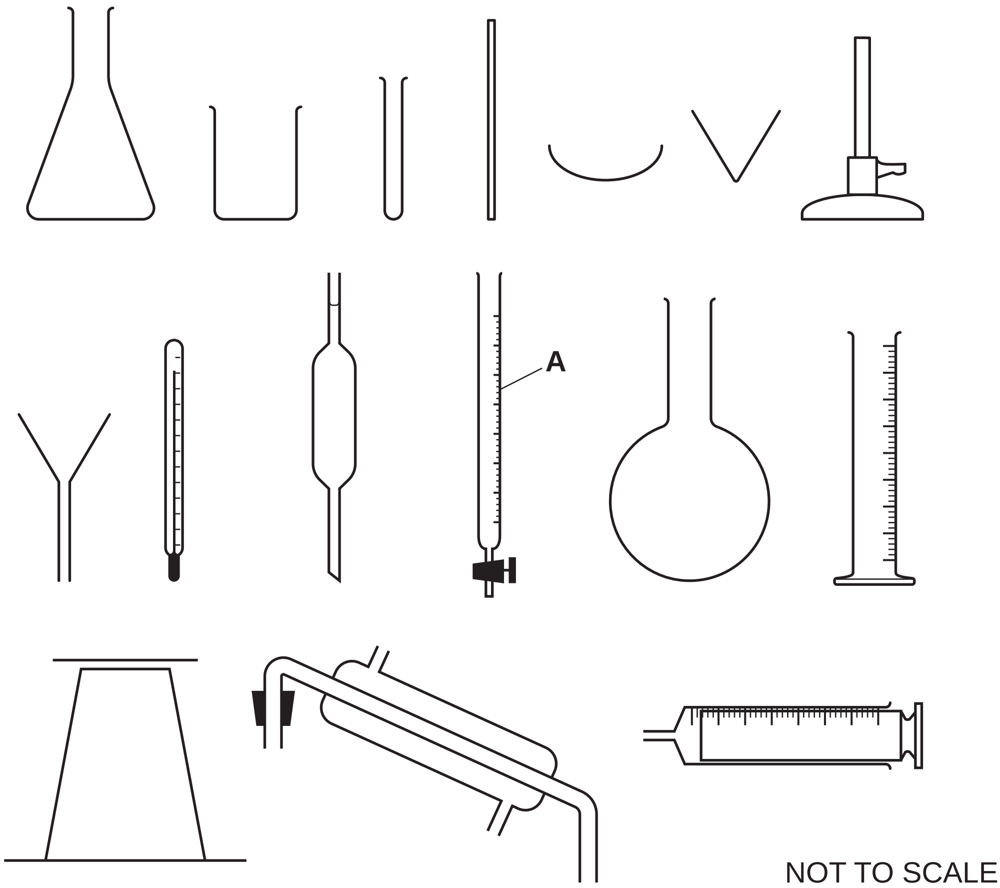


Fig. 3.1

(i) Name the piece of apparatus shown in Fig. 3.1 labelled **A**.

A is .... [1]

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

Choose the apparatus from Fig. 3.1 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 You are going to investigate the cooling rates of different volumes of hot water.

A thermometer has been set up in a stand with a beaker, labelled **X**, underneath as shown in Fig. 4.1.

Do **not** adjust the position of the thermometer in the clamp or the height of the clamp above the bench.

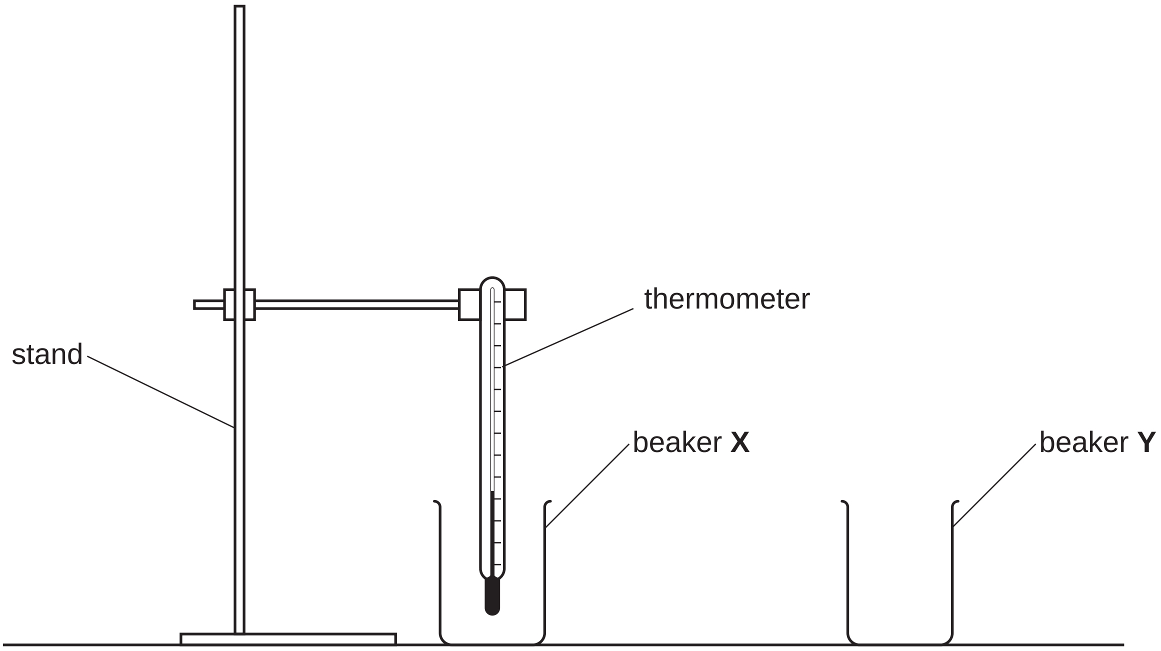


Fig. 4.1

(a) Procedure

- Pour 200 cm^3 of the hot water provided into beaker **X**.
- Wait for 30 seconds.
- Stir the water with the stirrer. Be **very careful** not to touch the thermometer.
- Read the initial temperature of the hot water.
- Record in Table 4.1 the initial temperature of the hot water at time $t = 0$.
- Immediately start the stopwatch and record 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		

(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 you were asked to wait for 30 seconds before recording the initial temperature of the hot water.

....

.... [1]

(iv) Suggest why the hot water is stirred before recording its initial temperature.

.... [1]

(b) Procedure

- Carefully lift the **stand** to take the thermometer out of beaker **X**.
- Place the thermometer into beaker **Y**.

Repeat the procedure in **(a)** for beaker **Y**, using 100 cm^3 of hot water in beaker **Y**. [4]

(c) 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]

(d) 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]

(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 your results support the teacher's statement.

Justify your answer with reference to your readings.

statement ....

....

justification ....

....
[2]

(f) A 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]

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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.

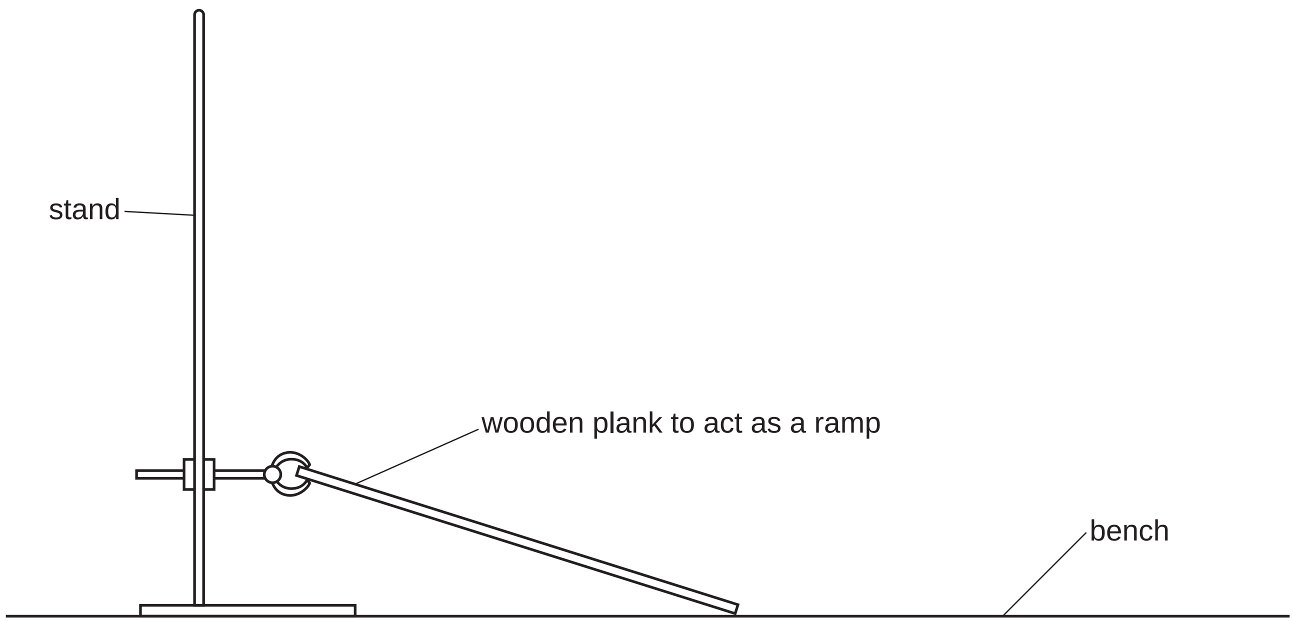

Fig. 5.1

You are **not** required to do this investigation.

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.

[7]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
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.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream 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 nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper (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

Tests for gases

gas	*test and test result*
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

Flame tests for metal ions

metal ion	*flame colour*
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green