Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 1 1 2 8 5 3 6 0 8 4 *

CO-ORDINATED SCIENCES **0654/63**

Paper 6 Alternative to Practical **October/November 2022**

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 **20** pages. Any blank pages are indicated.

1 A student investigates the nutrient content of beans and carrots.

(a) Procedure

The student:

- measures 1 cm^3 of liquidised beans into each of two clean test-tubes
- adds an equal depth of biuret solution to one test-tube
- adds a few drops of iodine solution to the other test-tube
- repeats the procedure with liquidised carrots instead of liquidised beans.

The beans give a positive result with both testing solutions.

The carrots give a negative result with the biuret solution and a positive result with the iodine solution.

(i) Complete Table 1.1 with the final colours the student observes.

Table 1.1

food sample	final colour observed with biuret solution	final colour observed with iodine solution	nutrients present
beans			
carrots			

[3]

(ii) Complete Table 1.1 to state the nutrients present in each food sample. [2]

(b) (i) Describe how a food sample is tested with Benedict's solution. Include the observation for a positive result.

test ....

....

observation ....
[2]

(ii) State the nutrient that gives a positive result with Benedict's solution.

.... [1]

(iii) Suggest why it is difficult to identify a nutrient present in carrot using Benedict's solution.

.... [1]

(c) State the apparatus suitable for measuring a volume of 1 cm^3.

.... [1]

[Total: 10]

BLANK PAGE

2 Fig. 2.1 shows a photomicrograph of some blood cells.

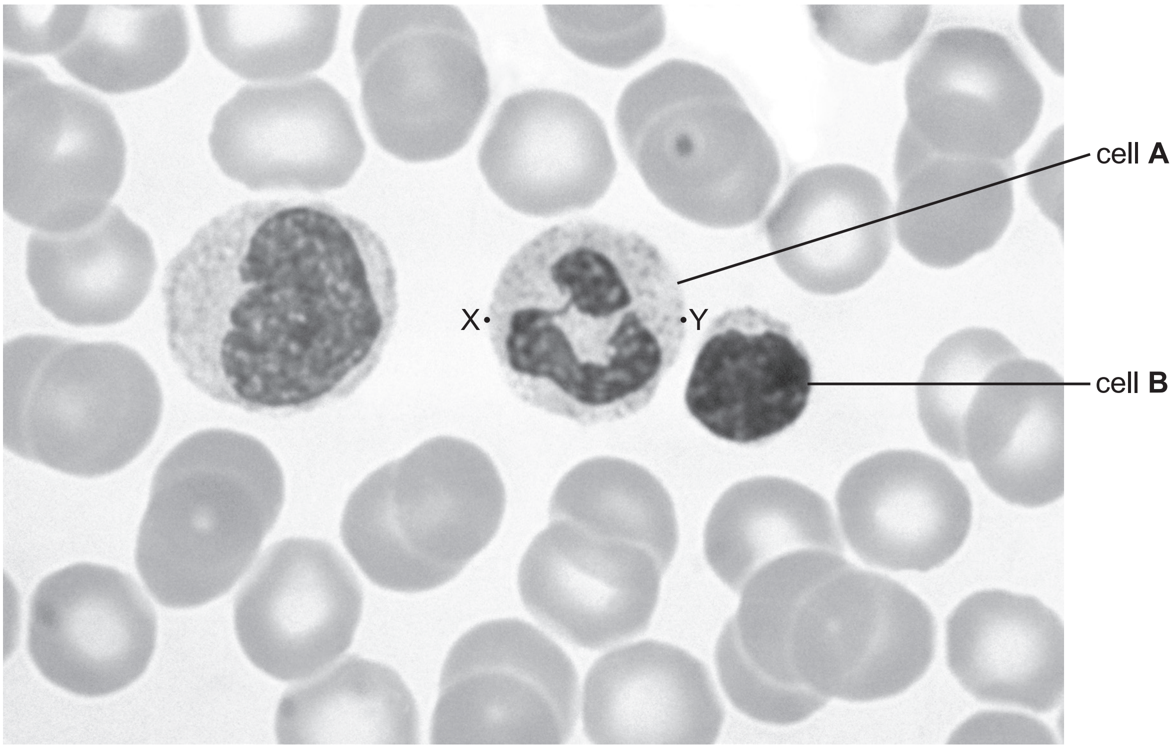


Fig. 2.1

(a) Make a large detailed pencil drawing of blood cell **A** in the box below.

[3]

(b) **(i)** Measure the diameter XY of cell **A** in Fig. 2.1 in millimetres to the nearest millimetre.

diameter of cell **A** in Fig 2.1 = ... mm [1]

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

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

diameter of cell in 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.

$$m = \frac{\text{diameter of cell in drawing}}{\text{diameter of cell in Fig. 2.1}}$$

Record your value to **two** significant figures.

magnification = ... [2]

(c) Describe **one** difference and **one** similarity between cell **A** and cell **B**.

difference ....

similarity ....
[2]

(d) Suggest why a nurse wears surgical gloves when obtaining a sample of blood from a patient.

....

.... [1]

[Total: 10]

BLANK PAGE

3 A student investigates the reaction between dilute hydrochloric acid, HC*l*, and aqueous sodium hydroxide, NaOH.

M is a unit of concentration. The more concentrated a solution the higher the value of M.

A 2 M solution is two times more concentrated than a solution that is 1 M.

The student uses the apparatus shown in Fig. 3.1.

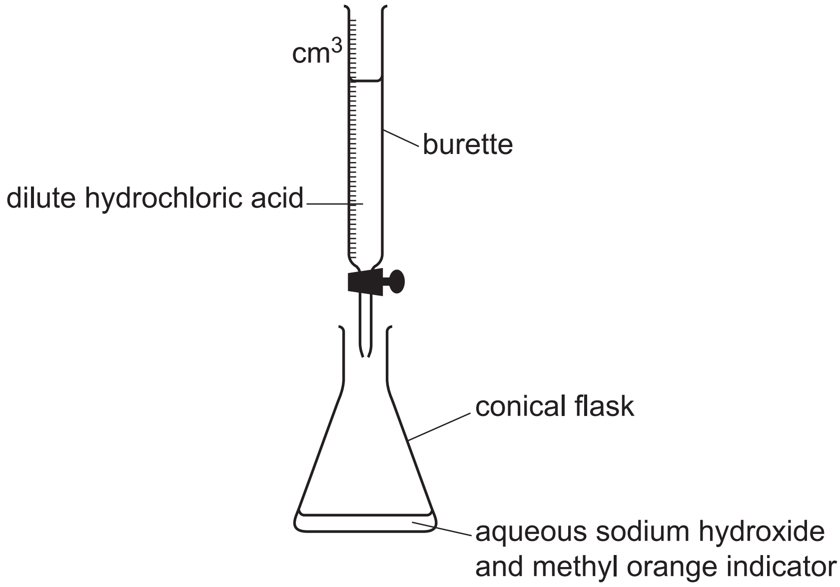


Fig. 3.1

(a) Procedure

The student:

Step **1** measures 25 cm^3 of 0.5 M aqueous sodium hydroxide in a measuring cylinder and pours it into a conical flask

Step **2** adds five drops of methyl orange indicator to the aqueous sodium hydroxide

Step **3** fills the burette with dilute hydrochloric acid

Step **4** records in Table 3.1 the reading on the burette
This is the reading at the start of the experiment and is the **second** row in Table 3.1.

Step **5** slowly adds the dilute hydrochloric acid from the burette into the aqueous sodium hydroxide in the conical flask

Step **6** stops adding dilute hydrochloric acid when the methyl orange turns orange
This is when the aqueous sodium hydroxide has been neutralised.

Step **7** records in Table 3.1 the reading on the burette
This is the reading at the end of the experiment and is the **first** row in Table 3.1.

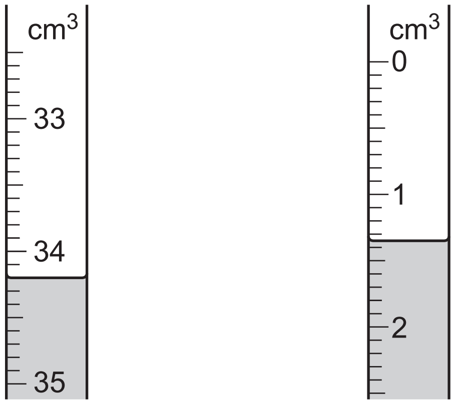
The student repeats the procedure with 0.4 M, 0.3 M, 0.2 M and 0.1 M aqueous sodium hydroxide, using a clean conical flask each time.

Table 3.1

	concentration of aqueous sodium hydroxide				
	0.5 M	0.4 M	0.3 M	0.2 M	0.1 M
reading on burette at the **end** of the experiment / cm^3	42.20		27.75	18.60	13.50
reading on burette at the **start** of the experiment / cm^3	0.00	1.20	2.05		5.40
volume of dilute hydrochloric acid added / cm^3	42.20		25.70		8.10

(i) Fig. 3.2 shows the readings on the burette at the end of the experiment for 0.4 M aqueous sodium hydroxide and at the start of the experiment for 0.2 M aqueous sodium hydroxide.

Record these values in Table 3.1.



burette reading at the **end** for 0.4 M

burette reading at the **start** for 0.2 M

[2]

Fig. 3.2

(ii) Complete Table 3.1 by calculating the missing volumes of dilute hydrochloric acid added.

Use the equation shown.

volume of dilute hydrochloric acid added	=	reading on burette at the **end** of the experiment	–	reading on burette at the **start** of the experiment

[1]

(iii) Suggest what the student can do to have more confidence in their measured results.

....

.... [1]

(iv) Explain why a clean conical flask is used for each experiment.

....

.... [1]

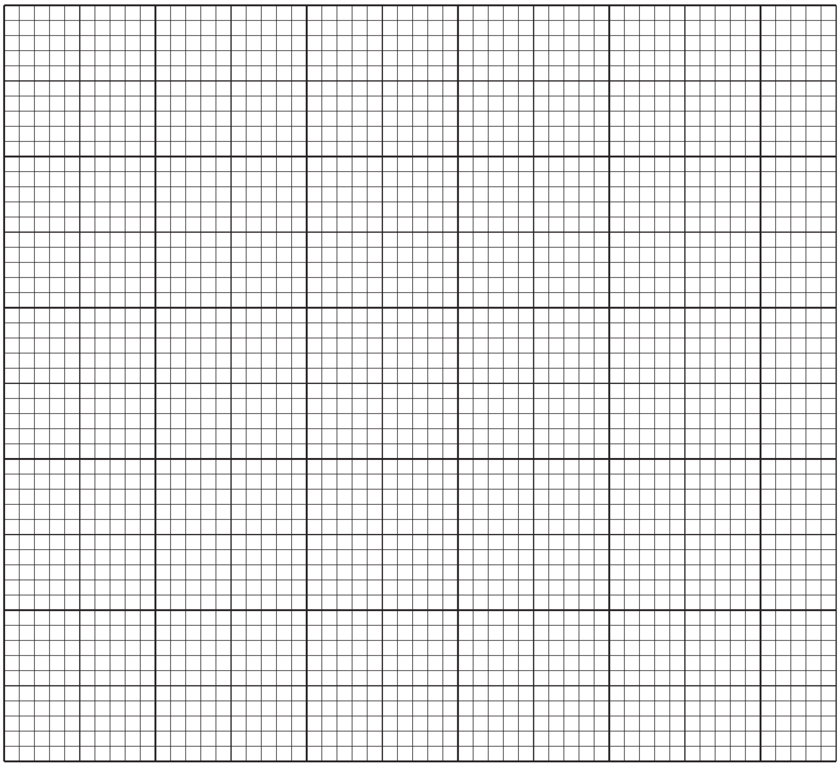
(v) Methyl orange indicator is red in acid, yellow in alkali and orange when neutral.

In Step **6** another student adds too much acid to the mixture.

Suggest the colour of their final mixture in the conical flask.

.... [1]

(b) **(i)** On the grid, plot a graph of volume of dilute hydrochloric acid added (vertical axis) against the concentration of aqueous sodium hydroxide.



[3]

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

(iii) State the relationship between the volume of dilute hydrochloric acid added and the concentration of aqueous sodium hydroxide.
Explain how you used your graph to determine the relationship.

....

....

.... [2]

(c) The student repeats the procedure, and finds that 12.00 cm^3 of dilute hydrochloric acid is needed to exactly neutralise a 25 cm^3 sample of aqueous sodium hydroxide.

Use your graph to estimate the concentration of the aqueous sodium hydroxide.

Show on your graph how you arrived at your answer.

concentration = ... M [2]

[Total: 14]

4 A student identifies four gases **P**, **Q**, **R** and **S**.

(a) Procedure

A student collects four test-tubes of each gas **P**, **Q**, **R** and **S**.

The student tests each gas with a glowing splint, a lighted splint, a piece of damp red litmus paper and limewater.

Some of the results are shown in Table 4.1.

Table 4.1

test used	observations			
	P	**Q**	**R**	**S**
glowing splint	relights	goes out	goes out	goes out
lighted splint	burns brighter	pops	goes out	goes out
limewater	colourless	colourless	milky	colourless
damp red litmus paper				

(i) State the identity of gases **P**, **Q** and **R**.

P is ....

Q is ....

R is ....

[3]

(ii) The student has been told that the only two gases that change the colour of damp litmus paper are chlorine gas and ammonia.
Gas **S** is ammonia.

Complete the table for the results of each gas with damp, red litmus paper. [2]

[Total: 5]

5 A student measures the spring constant k of a spring by two different methods.

The spring constant k of a spring is a measure of how difficult the spring is to stretch.

(a) Method 1

The student:

- measures the unstretched length l_0 of the spring
- attaches the spring to a clamp
- suspends a mass m = 300 g on the spring as shown in Fig. 5.1
- measures the new, stretched length l_1 of the spring.

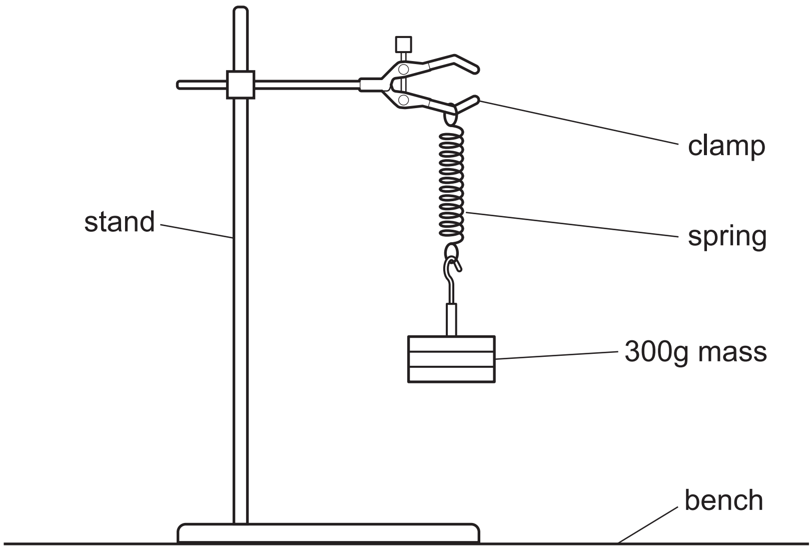


Fig. 5.1

Fig. 5.2 is a full size diagram showing the unstretched spring and the spring when it has been stretched by the 300 g mass.

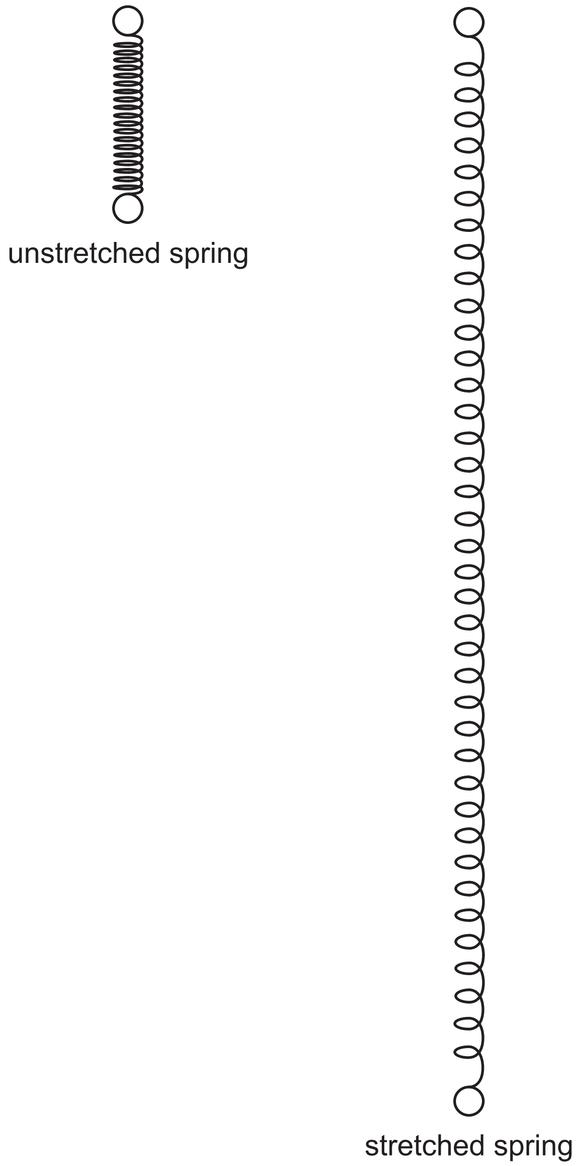


Fig. 5.2

(i) Measure the unstretched length l_0 of the spring in centimetres to the nearest 0.1 cm.

Do **not** include the loops at the end of the spring in your measurement.

l_0 = ... cm [1]

(ii) Measure the new length l_1 of the spring in centimetres to the nearest 0.1 cm.

Do **not** include the loops at the end of the spring in your measurement.

l_1 = ... cm [1]

(iii) Calculate the extension *e* of the spring produced by the mass.

Use the equation shown.

$$e = l_1 - l_0$$

e = ... cm [1]

(b) **(i)** It is important to avoid a line-of-sight (parallax) error when measuring the length of a spring.

Describe **one** way the student avoids this error.

....

.... [1]

(ii) Stretched springs are potentially dangerous because of the elastic energy stored in them.
State **two** safety precautions that the student takes when doing the experiment. Explain how each precaution reduces the risk.

1 ....

....

2 ....

....
[2]

(c) Calculate a value k_1 for the spring constant of the spring.

Use the equation shown.

$$k_1 = \frac{W}{e}$$

where W, the weight of the 300 g mass = 3.0 N.

k_1 = ... N/cm [1]

(d) **Method 2**

The student:

- pulls the mass down a small distance and releases it so that the mass oscillates up and down
- measures the time taken t_1 for 20 oscillations of the mass.

Fig. 5.3 shows the reading on the stop-watch.

Fig. 5.3

Record the time taken t_1 in Table 5.1.

Table 5.1

mass / g	time for 20 oscillations / s			average time for 20 oscillations t_{av} / s	average period T_{av} / s
	t_1	t_2	t_3		
300		14.4	14.1		

[1]

(e) The student repeats **Method 2** two more times and records the times t_2 and t_3 in Table 5.1.

(i) Calculate the average time t_{av} for 20 oscillations of the mass.

Use the equation shown.

$$t_{av} = \frac{(t_1 + t_2 + t_3)}{3}$$

Record your answer in Table 5.1. [1]

(ii) State why repeating the timing and calculating the average time for 20 oscillations is good experimental practice.

....

.... [1]

(f) Calculate the average period T_{av} of the oscillations. The period is the time for one oscillation of the mass.

Record your answer in Table 5.1. [1]

(g) Calculate a value k_2 for the spring constant of the spring.

Use the equation shown.

$$k_2 = \frac{0.12}{(T_{av})^2}$$

k_2 = ... N/cm [1]

(h) **(i)** Use your answers to **(c)** and **(g)** to calculate $(k_1 - k_2)$, the difference between your two measured values of k.

$(k_1 - k_2)$ = ... N/cm [1]

(ii) State whether or not the difference in the values of k_1 and k_2 allows the values to be considered equal within the limits of experimental accuracy.

Explain your answer.

statement ....

explanation ....

....
[1]

[Total: 14]

6 A ball is dropped from rest at a height H above the ground. The ball rebounds and bounces back up to a height h.

Plan an experiment to investigate the relationship between the bounce height h and the height H from which the ball is dropped.

You are provided with a selection of balls of different sizes and different materials.

You may use any other apparatus normally found in a school laboratory.

Include in your answer:

- the apparatus you will use
- a brief description of the method, including how you will ensure your results are accurate
- the variables you will control
- a table with column headings to show how you will present your results (you are not required to enter any readings in the table)
- how you will process your results to reach a conclusion.

You may include a labelled diagram if it helps to explain your plan.

....

....

....

....

....

....

....

[7]

BLANK PAGE

BLANK PAGE