Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9096253894

CO-ORDINATED SCIENCES **0654/62**

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

DC (DH/FC) 206273/3

[Turn over

1 A student investigates the nutrient content of three solutions, **A**, **B** and **C**.

She tests **A**, **B** and **C** separately with Benedict's solution, biuret solution and iodine solution.

(a) Name the test solution which requires use of a hot water-bath.

..... [1]

(b)
- Solution **A** tests positive with iodine solution.
- Solution **B** tests positive with biuret solution.
- Solution **C** tests positive with Benedict's solution.
- Results of all the other tests are negative.

(i) Use this information to record in Table 1.1, the final colours the student observes.

Include the colours for negative results.

Table 1.1

solution	final colour with Benedict's solution	final colour with biuret solution	final colour with iodine solution
A			
B			
C			

[4]

(ii) Use the results to state the nutrient present in each solution.

solution **A** contains .....

solution **B** contains .....

solution **C** contains .....

[3]

(c) Describe a method used to test a liquid for the presence of fats.

Include the observation for a positive result.

method .....

.....

observation ..... [2]

(d) A student investigates the nutrient concentration in two different samples using Benedict's solution. This allows her to compare the concentrations of the nutrient in the two solutions.

(i) Explain how the results will allow the concentrations of the nutrient in the two solutions to be compared.

.....

..... [1]

(ii) State two variables which need to be controlled in this investigation.

variable 1 .....

variable 2 .....
[2]

[Total: 13]

2 Small maggots (insect larvae), as shown in Fig. 2.1, live in damp, warm environments.

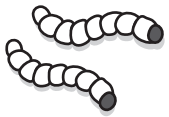

Fig. 2.1

A student wants to find out if maggots are attracted to different colours of light.

Plan an investigation to find out to which colour of light maggots are most attracted.

The student is provided with some maggots which need to be kept alive during the investigation, lamps of different colours and any other common laboratory apparatus.

Include in your plan:

- the apparatus needed
- a brief description of the method, explaining any safety precautions
- 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 include a labelled diagram if you wish.

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]

3 In this investigation a student finds the amount of heat energy released when magnesium reacts with dilute hydrochloric acid.

(a) Procedure

The student:

- adds 15 cm^3 of dilute hydrochloric acid into a test-tube
- measures the initial temperature of the dilute hydrochloric acid and records this temperature in Table 3.1 to the nearest 0.5 °C
- adds 0.1 g of magnesium powder to the dilute hydrochloric acid
- stirs the mixture and measures the highest temperature reached
- records in Table 3.1 this temperature to the nearest 0.5 °C.

The student repeats the procedure using 0.2 g, 0.3 g and 0.4 g of magnesium powder.

Table 3.1

	mass of magnesium			
	0.1 g	0.2 g	0.3 g	0.4 g
initial temperature of dilute hydrochloric acid / °C	21.5	21.5	21.5	22.0
highest temperature of mixture / °C		32.0		43.5
change in temperature ΔT / °C		10.5		21.5

(i) Suggest why the student stirs the mixture.

.....

..... [1]

(ii) Fig. 3.1 shows the thermometer readings for the highest temperature when 0.1 g and 0.3 g of magnesium powder are added.

Record in Table 3.1 these readings to the nearest 0.5 °C.

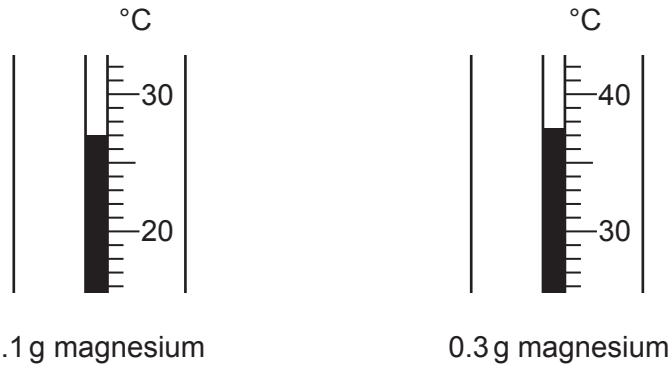

Fig. 3.1

[2]

(iii) Calculate the change in temperature, ΔT, for 0.1 g of magnesium powder added and 0.3 g of magnesium powder added.

Record these values in Table 3.1. [1]

(b) (i) Calculate the heat energy released when **0.2 g** of magnesium powder and when **0.4 g** of magnesium powder are added to dilute hydrochloric acid.

Use the equation shown.

$$\text{heat energy released} = 63 \times \Delta T$$

Give your answers to **two** significant figures.

Heat energy released when **0.2 g** of magnesium powder is added.

heat energy released = ... J

Heat energy released when **0.4 g** of magnesium powder is added.

heat energy released = ... J
[2]

(ii) Two experimental results are considered similar and within experimental error if they are within 10% of each other.

A student suggests that the heat energy released when 0.4 g of magnesium powder is added to dilute hydrochloric acid should be two times the energy released when 0.2 g of magnesium powder is added.

State and explain if the results support the student's suggestion.

Include a calculation in your answer.

.....

.....

..... [2]

(iii) Suggest two changes to the apparatus which would make the measurement of the change of temperature more accurate.

change 1 .....

.....

change 2 .....

.....
[2]

(iv) The student repeats the experiment but finds that the change in temperature for 1 g, 2 g and 3 g of magnesium added all give the same rise in temperature.

Suggest why the changes in temperature are all the same.

.....

..... [1]

[Total: 11]

4 In this investigation, a student identifies three gases.

The student has three test-tubes of gas.

Each test-tube contains a different gas.

One test-tube contains hydrogen collected from the reaction of magnesium and dilute hydrochloric acid.

The other two test-tubes contain two different gases.

(a) Describe a test to identify hydrogen.

Give the observation for a positive result.

test for hydrogen .....

observation .....
[2]

(b) Damp red litmus paper is placed in each of the other two gases.

In one gas, the red litmus paper turns blue and in the other gas, the red litmus paper is bleached white.

Identify the two gases.

the gas which turns red litmus paper blue is .....

the gas which bleaches litmus paper is .....
[2]

[Total: 4]

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5 In this question you will draw the apparatus required for separating a mixture.

A student has a mixture of sand, salt and water.

The student separates the mixture to obtain pure sand, pure salt and pure water.

The student uses the three steps shown.

step 1: stirs the mixture
step 2: filters the mixture
step 3: distils the filtrate

The pieces of apparatus available for this separation are shown in Fig. 5.1.

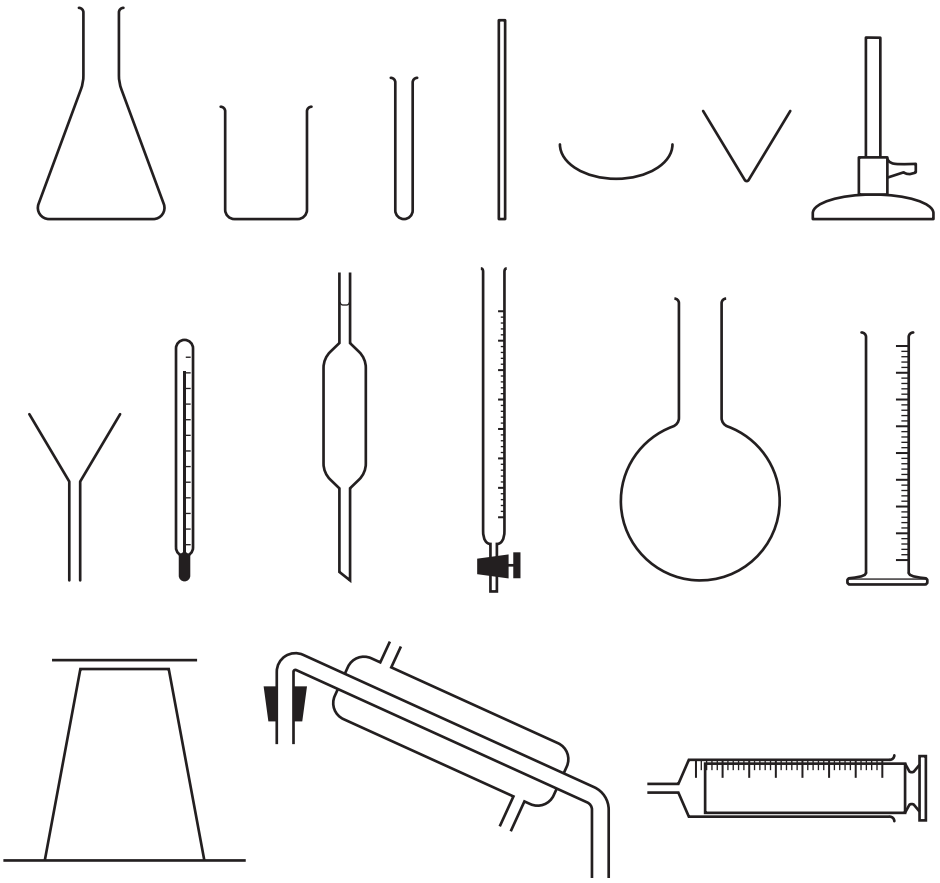

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Fig. 5.1

(a) Choose the apparatus from Fig. 5.1 suitable for doing **step 2**.

Draw a large, clear, labelled diagram of the assembled apparatus for **step 2**.

Use a ruler.

Label the substances separated.

[2]

(b) Choose the apparatus from Fig. 5.1 suitable for doing **step 3**.

Draw a large, clear, labelled diagram of the assembled apparatus for **step 3**.

Use a ruler.

Label the substances separated.

[3]

[Total: 5]

6 A student does an investigation to find an approximate value for the internal diameter *d* of a test-tube.

The internal diameter *d* is estimated by measuring the height *h* and volume *V* of water in the test-tube.

The test-tube is considered to be an approximate cylinder.

Procedure

The student:

- adds 100 cm^3 of water into a measuring cylinder
- pours some water from the measuring cylinder into a test-tube.

Fig. 6.1 shows a full size drawing of this test-tube.

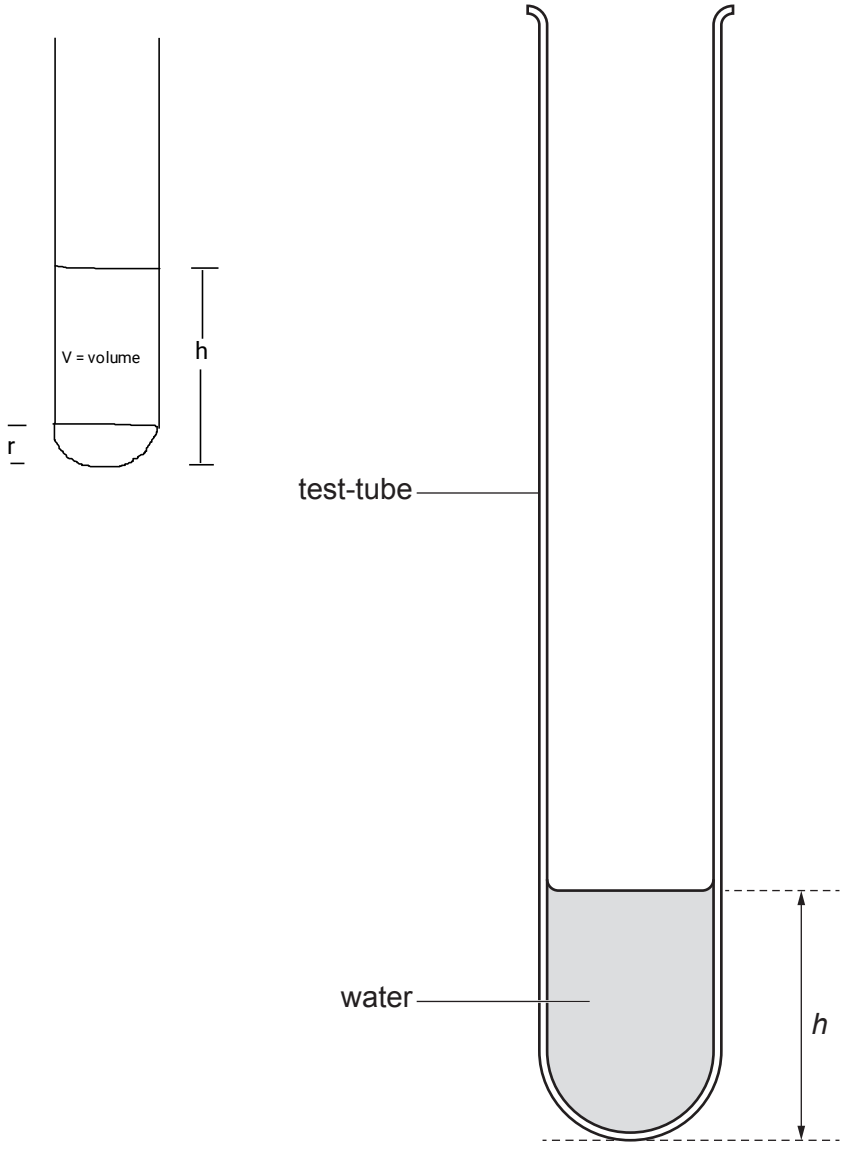


Fig. 6.1

(a) Measure the height *h* of the water in the test-tube in centimetres to the nearest millimetre.

Record *h* in Table 6.1.

Table 6.1

h / cm	R / cm^3	V / cm^3
	91	9
5.8	80	20
8.9	69	31
11.5	58	42
14.3	49	51

[1]

(b) Fig. 6.2 shows the reading *R* of the water remaining in the measuring cylinder.

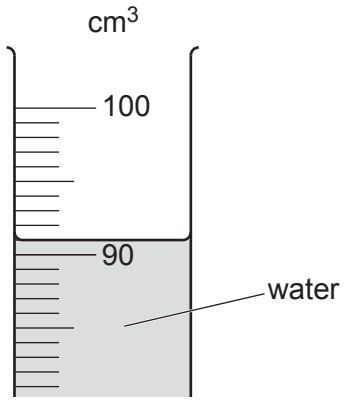


Fig. 6.2

(i) Read the measuring cylinder and record the reading *R* in Table 6.1. [1]

(ii) Calculate the volume *V* of water in the test-tube.

Use the equation shown.

$$V = 100 - R$$

Record your answer in Table 6.1. [1]

(c) Procedure

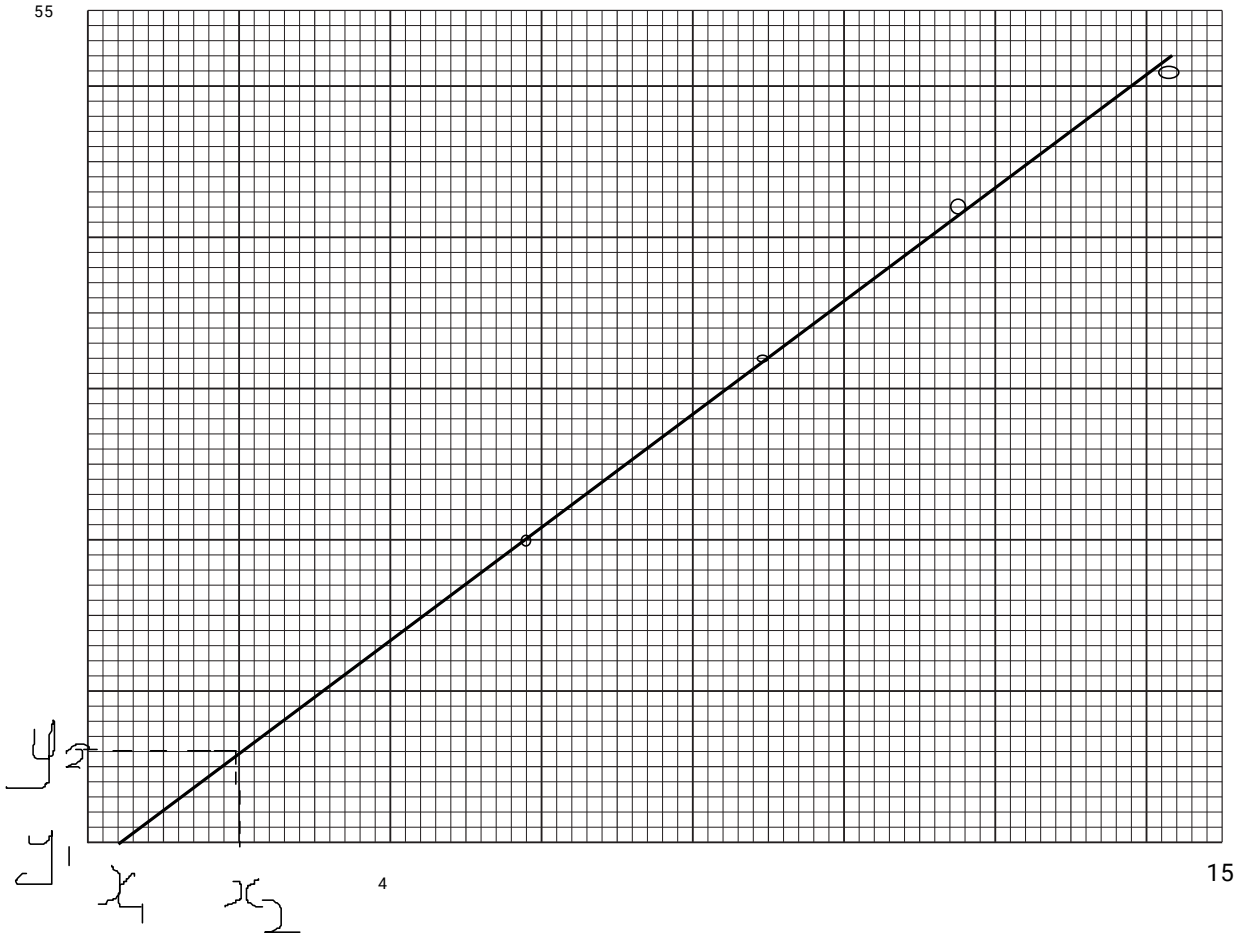
The student:

- adds more water from the measuring cylinder to the test-tube
- measures and records in Table 6.1 the new values of *h* and *R*.

The student repeats the procedure for another three more values of *h* and *R*.

The student's results are shown in Table 6.1.

(i) Plot on the grid provided a graph of *V* (vertical axis) against *h*.



[3]

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

(d) Calculate the gradient *m* of your line.

Show all working and indicate on your graph the values you chose to enable the gradient to be calculated.

m = x2 - x1 / y2 - y1

m = 2 - 0.4 / 6

m = 1.6 / 6 = 2.67

m = 2.67 ..... [2]

(e) Calculate the internal diameter *d* of the test-tube.

Use the equation shown.

$$d = 0.59 \times m$$

d = 0.157 ..... cm [1]

(f) **(i)** State why the student holds the ruler close to the test-tube when measuring the height *h* of the water.

so the student can directly match the height with a point on their ruler
.....

..... [1]

(ii) Suggest one other reason why your calculated value for the internal diameter *d* of the test-tube is only approximate.

we are multiplying by some arbitrary value 0.59
.....

..... [1]

[Total: 12]

7 A student investigates how the resistance of a metal wire depends upon its length.

The student sets up the circuit shown in Fig. 7.1.

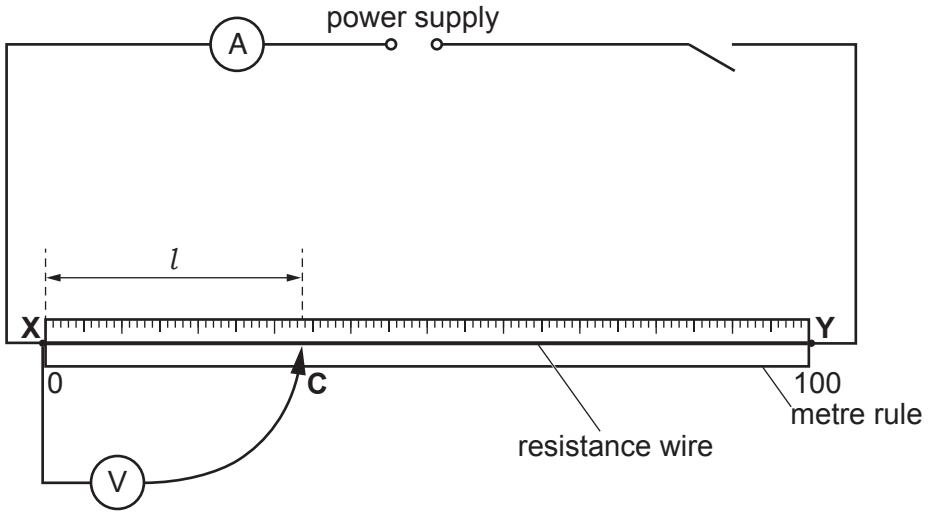


Fig. 7.1

(a) Procedure

The student:

- connects the crocodile clip **C** to the resistance wire **XY** at a length l = 10.0 cm from **X**
- closes the switch
- records in Table 7.1 the current I flowing through the wire and the potential difference V
- opens the switch.

Table 7.1

length l /cm	current I /A	potential difference V /V	resistance R /..... Ω	$\frac{R}{l}$ in Ω/cm
10.0	0.26	0.21	0.80	0.080
20.0	0.25	0.40	1.6	0.080
40.0	0.24	0.82	3.4	0.085

Fig. 7.2 shows the ammeter and voltmeter readings when length l = 10.0 cm.

Record the values of current and potential difference in Table 7.1. [2]

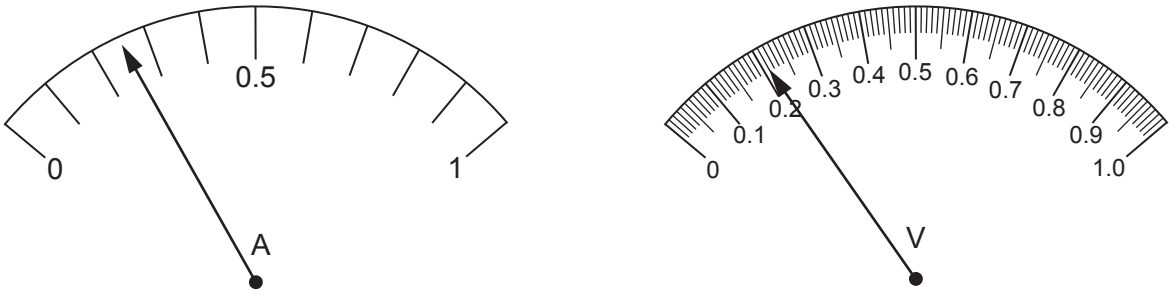


Fig. 7.2

(b) The student repeats the procedure in **(a)** for values of l = 20.0 cm and 40.0 cm.

The results are shown in Table 7.1.

(i) Calculate the resistance R for the length l = 10.0 cm of wire.

Use the equation shown.

$$R = \frac{V}{I}$$

Record the value of R in Table 7.1. [1]

(ii) Insert the missing unit in the heading for resistance in Table 7.1. [1]

(iii) Calculate the ratio $\frac{R}{l}$ for l = 10.0 cm of wire.

Record your answer in Table 7.1. [1]

(c) The teacher states that the resistance of a wire is directly proportional to its length.

State if the student's results agree with this statement within the limits of experimental error.

Use values from Table 7.1 to support your answer.

The student's results agree because the Resistance per cm stays the same

..... [1]

(d) Suggest how the student can extend the investigation to have more confidence in the answer to **(c)**.

try a wire with a different resistance

..... [1]

(e) Suggest why the switch is opened whilst the student changes the length of the wire between taking the readings.

to prevent sparks

..... [1]

[Total: 8]

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