Cambridge Assessment International Education

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CANDIDATE NAME

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0565504440

COMBINED SCIENCE **0653/63**

Paper 6 Alternative to Practical **October/November 2020**

1 hour

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 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

[Turn over

1 A student investigates the effect of minerals on the growth of plants.

Procedure

The student:

- chooses three plants of the same species and same size
- grows the plants in three separate pots
- waters the plants with water containing different minerals:

  – Plant **A** is given water containing all of the minerals it needs.
  – Plant **B** is given water containing all of the minerals it needs apart from nitrates.
  – Plant **C** is given water containing all of the minerals it needs apart from magnesium.

Fig. 1.1 shows the three plants after two weeks of growth.

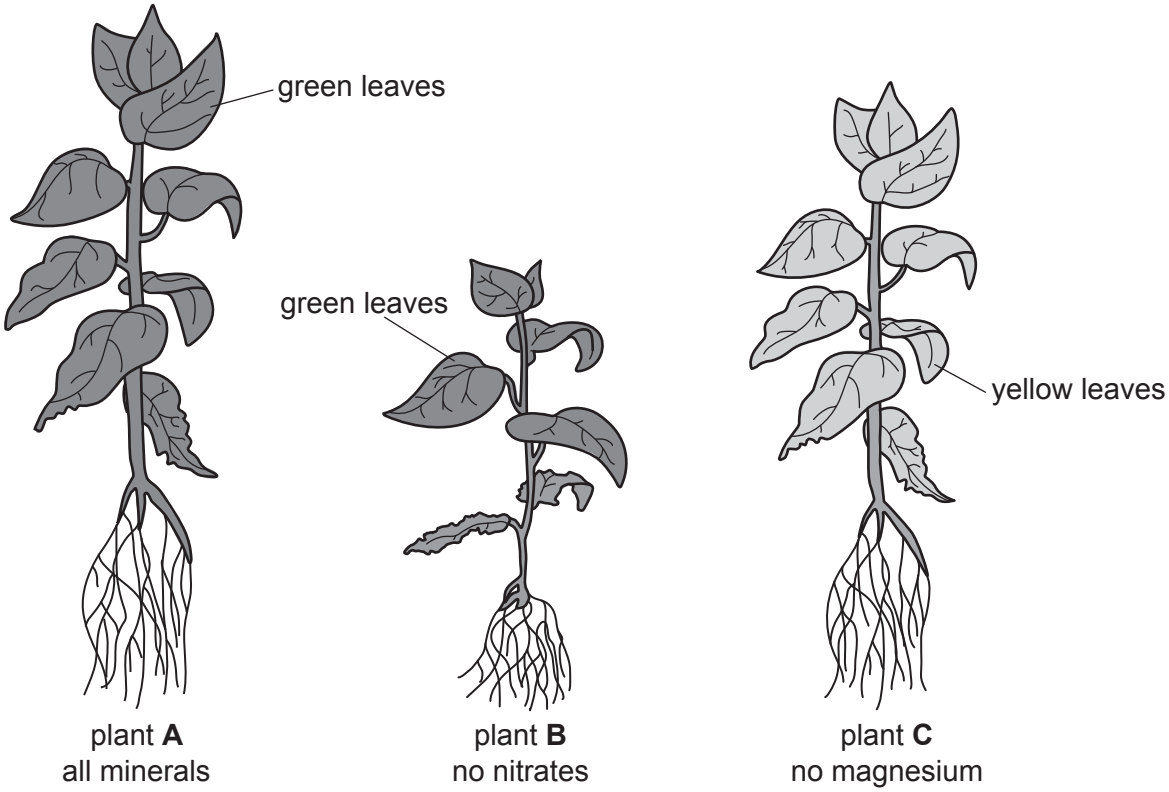

Fig. 1.1

(a) (i) Explain why the student uses plants that are the same species.

.....

..... [1]

(ii) Measure the height (from the top of the leaves to the bottom of the roots) of plant **C** in Fig. 1.1.

Record this value in Table 1.1. Include the units in the table heading.

Table 1.1

plant	height / .....
A	93
B	60
C	

[2]

(iii) Calculate the percentage difference in height between plant **A** and plant **B**.

Use the equation shown.

$$\text{percentage difference} = \frac{\text{height of plant } \mathbf{A} - \text{height of plant } \mathbf{B}}{\text{height of plant } \mathbf{B}} \times 100\%$$

percentage difference = ... % [1]

(b) State two **visible** differences, other than height, between plant **B** and plant **C**.

1 .....

.....

2 .....

.....

[2]

(c) Chlorophyll is a green pigment.

Suggest a reason for the appearance of plant **C**.

.....

..... [1]

[Total: 7]

[Turn over

2 A student states:

'If I double the intensity of light, the rate of photosynthesis will also double.'

The student places a water plant in the apparatus shown in Fig. 2.1.

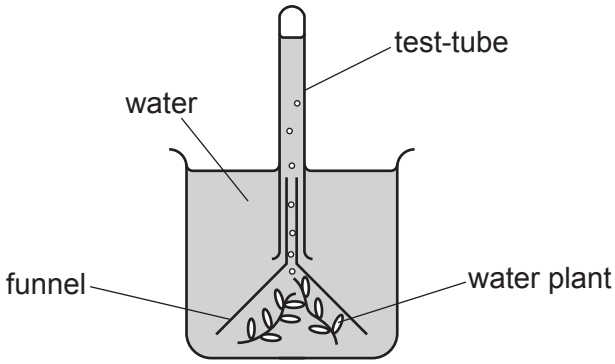

Fig. 2.1

Plan an investigation to test if the student's statement is correct.

In your answer, include:

- any **additional** apparatus and chemicals you will need, including a labelled diagram if you wish
- a brief description of the method and the measurements you will make
- the variables you will control
- how you will use your results to check if the student's statement is correct.

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..... [7]

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3 A student investigates the effect of temperature on the rate of a reaction.

Aqueous sodium thiosulfate and dilute hydrochloric acid are both colourless liquids.

When aqueous sodium thiosulfate reacts with dilute hydrochloric acid, a yellow precipitate is made. As the precipitate forms, the mixture becomes opaque (you cannot see through it).

The apparatus is shown in Fig. 3.1.

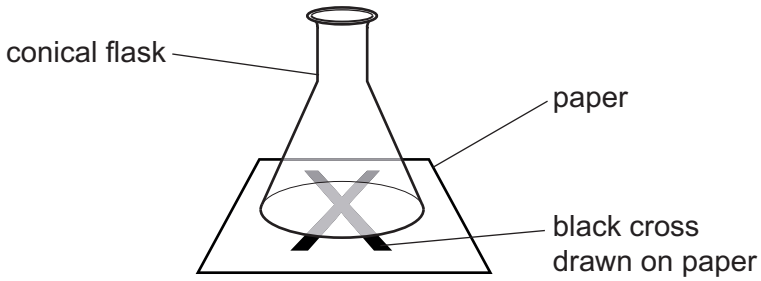


Fig. 3.1

(a) Procedure

The student:

- measures 50 cm^3 of aqueous sodium thiosulfate in a measuring cylinder and pours it into a conical flask
- heats the aqueous sodium thiosulfate to approximately 20 °C
- places the conical flask onto a black cross drawn on a piece of paper
- measures the actual temperature of the aqueous sodium thiosulfate and records it in Table 3.1
- adds 5 cm^3 dilute hydrochloric acid and starts a stop-watch
- looks at the cross through the mixture in the conical flask
- stops the stop-watch when the mixture becomes opaque and the cross cannot be seen (note that it is quite difficult to decide the exact time when the cross cannot be seen)
- records this time in Table 3.1.

[Turn over

The student repeats this procedure, heating the aqueous sodium thiosulfate to approximately 30 °C, 40 °C, 50 °C, 60 °C, 70 °C and 80 °C.

(i) The temperature for the fourth experiment is shown on the thermometer in Fig. 3.2.

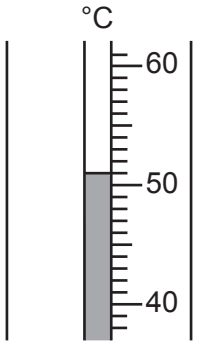


Fig. 3.2

Record this temperature to the nearest 0.5 °C in Table 3.1. [1]

Table 3.1

temperature / °C	time for mixture to become opaque / s
20.0	96
31.0	
42.5	35
	42
59.5	
72.0	6
80.0	2

(ii) The times for the temperatures 31.0 °C and 59.5 °C are shown on the stop-watches in Fig. 3.3.

Record these times to the nearest second in Table 3.1. [2]

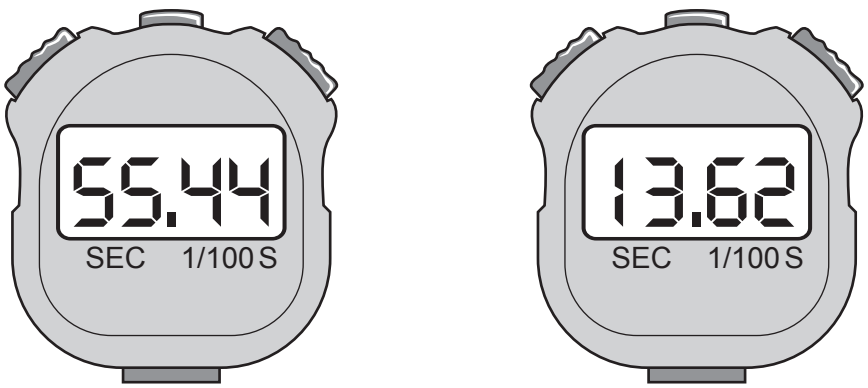
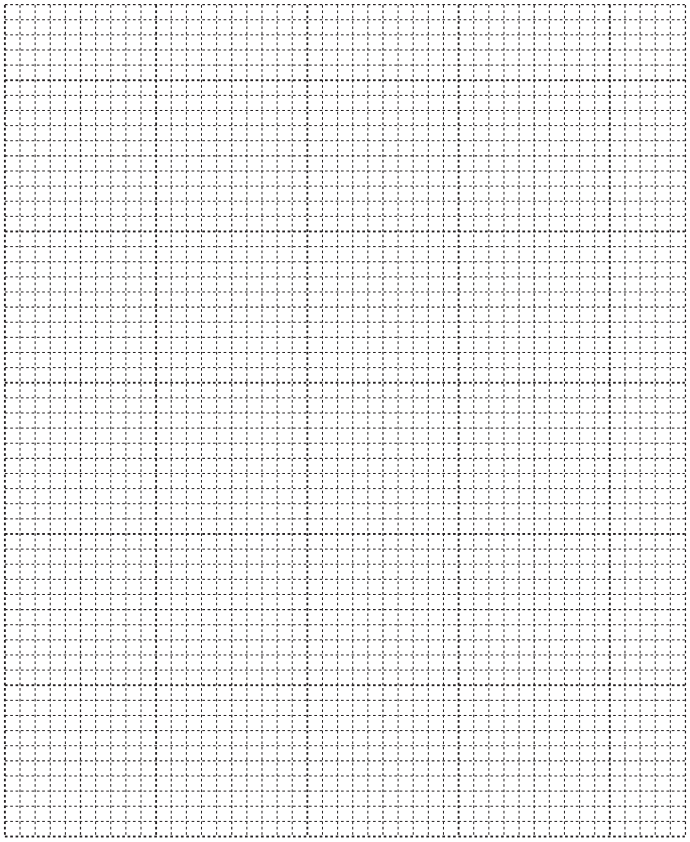


Fig. 3.3

(b) (i) On the grid, plot a graph of time for mixture to become opaque (vertical axis) against temperature.



[3]

(ii) Draw a circle around the point of the anomalous result. [1]

(iii) State if the anomalous result is too high or too low.

Suggest what happened to cause this anomalous result.

anomalous result is too .....

suggestion .....

..... [1]

(iv) Draw the best-fit curve. [1]

(v) Describe in detail the relationship between temperature and **rate** of reaction.

.....

.....

.....

..... [2]

(vi) Suggest a reason why this experiment is not repeated at 90 °C.

Do **not** include safety in your answer.

.....

..... [1]

(c) Suggest **one** change to the procedure that would improve accuracy.

.....

..... [1]

[Total: 13]

4 A student compares the temperature changes that occur when three different liquids **A**, **B** and **C** evaporate.

(a) Procedure

The student:

- covers the bulb of a thermometer with cotton wool
- reads the initial temperature of the thermometer and records this value in Table 4.1
- dips the bulb and cotton wool into liquid **A** and shakes off any excess liquid so that the cotton wool is wet but not dripping
- starts a stop-watch and swings the thermometer gently from side to side
- records the final temperature of the thermometer after two minutes.

Fig. 4.1 shows how the apparatus is set up for the experiment.

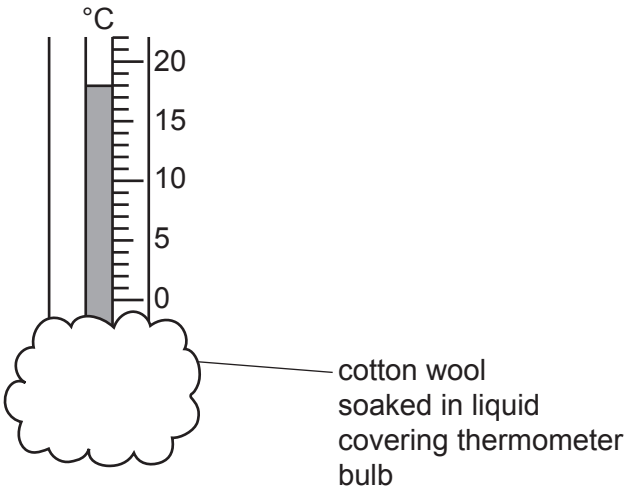


Fig. 4.1

[Turn over

The student repeats the procedure using liquid **B** and then repeats it again with liquid **C**.

Table 4.1

liquid	initial temperature / °C	final temperature / °C	temperature change / °C
A	22.0	18.0	
B	22.0	21.5	
C	22.0	12.5	
no liquid	22.0	22.0	

(i) The student also repeats the procedure with dry cotton wool (no liquid) as a control experiment.

Explain how doing this control experiment helps the student to draw conclusions about temperature changes during the evaporation of liquids.

.....

..... [1]

(ii) Calculate the temperature change for each experiment.

Record your results in Table 4.1.

[2]

(iii) Use the results in Table 4.1 to place liquids **A**, **B** and **C** in order of temperature change.

smallest temperature change .....

.....

largest temperature change .....

[1]

(iv) Suggest **two** improvements to the procedure that would allow the student to make a more accurate comparison of the differences in temperature change between liquids **A**, **B** and **C**.

improvement 1 .....

improvement 2 .....

[2]

(b) Table 4.2 shows the amounts of thermal energy needed for liquids **A**, **B** and **C** to evaporate.

Table 4.2

liquid	thermal energy for 1.0 kg of liquid to evaporate / kJ
A	779
B	2257
C	518

(i) Describe the relationship between the temperature change and the amount of thermal energy needed for a liquid to evaporate. Use the information in Table 4.2 and your answer to **(a)(iii)**.

.....

.....

..... [1]

(ii) Calculate the energy *E* required to evaporate 3.0 kg of liquid **B**. Use the equation shown.

Give your answer to 2 significant figures.

$$\text{energy } E \text{ in kJ} = \text{mass in kg} \times \text{thermal energy for 1.0 kg in kJ}$$

energy *E* = ... kJ [2]

(c) The student investigates the rate of evaporation of liquid **C**.

The student measures the mass of an empty beaker using a balance.

mass of empty beaker = 43.77 g

The student pours 10 cm^3 of liquid **C** into the beaker.

(i) Fig. 4.2 shows the total mass of the beaker and liquid **C**.

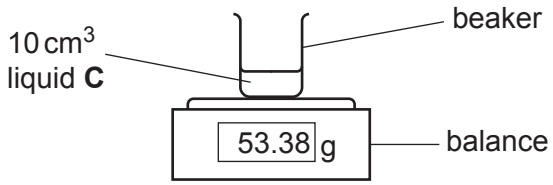


Fig. 4.2

Record the total mass.

total mass of beaker and liquid **C** = ... g [1]

(ii) Calculate the mass of liquid **C** in the beaker.

mass of liquid **C** = ... g [1]

(iii) The student leaves the beaker on a table in the laboratory for one hour.

Fig. 4.3 shows the total mass of the beaker and liquid **C** after one hour.

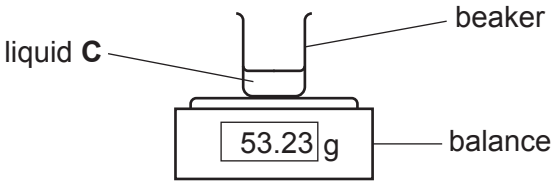


Fig. 4.3

Use Fig. 4.3 to calculate the mass of liquid **C** that has evaporated.

mass = ... g [1]

(iv) Suggest **one** change that the student can make to the experiment to increase the rate of evaporation of liquid **C**.

.....

..... [1]

[Total: 13]

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