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COMBINED SCIENCE**0653/63**

Paper 6 Alternative to Practical

October/November 2020**1 hour**

You must answer on the question paper.

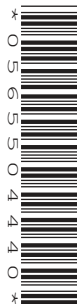
No additional materials are needed.

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.

- 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.

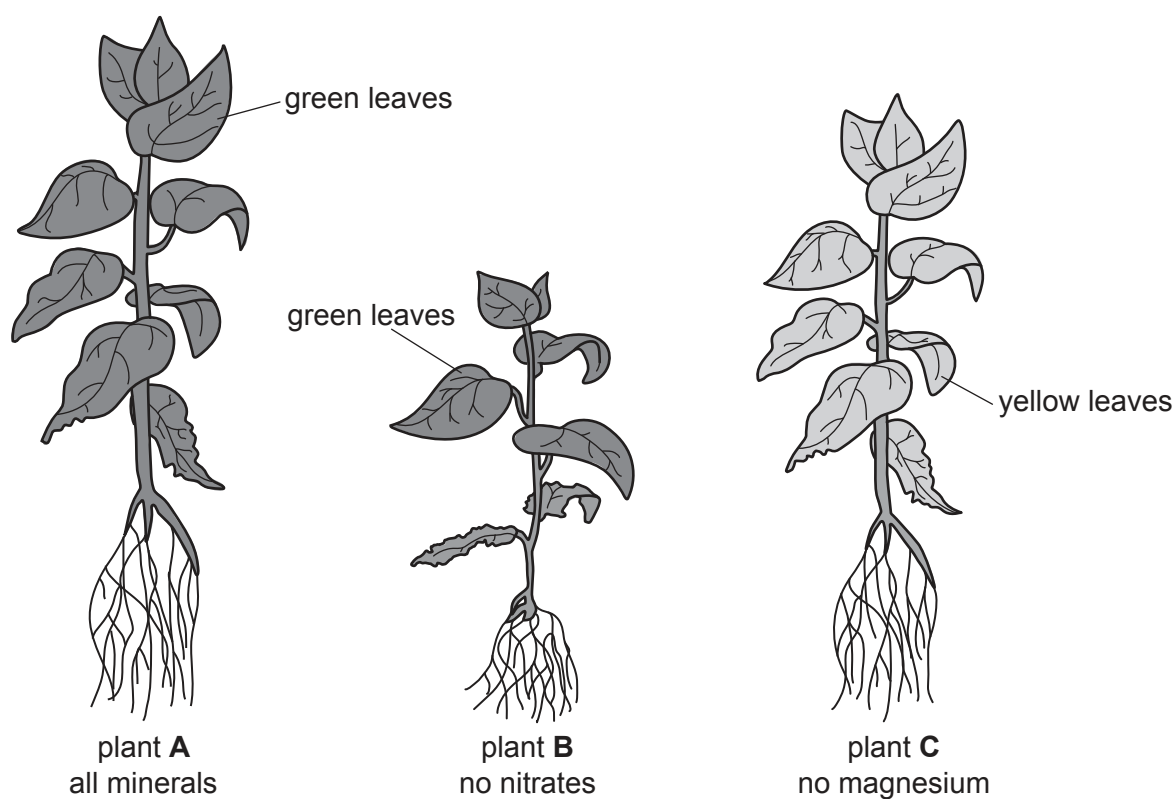


Fig. 1.1

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

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

3

- (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.

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

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]

4

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.

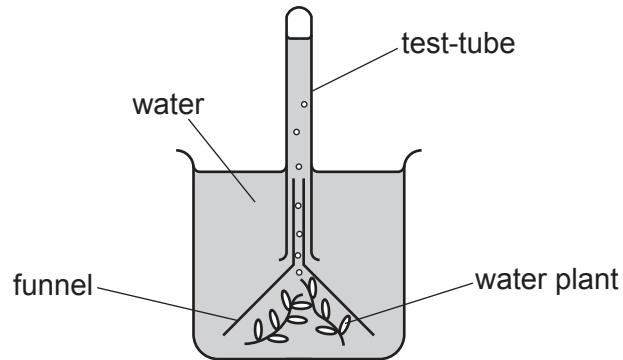


Fig. 2.1

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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5

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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.

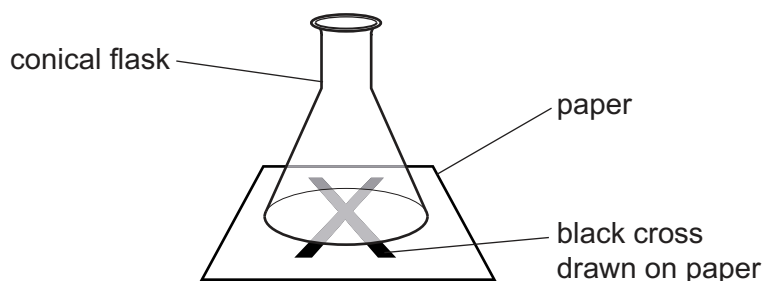


Fig. 3.1

(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.

8

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.

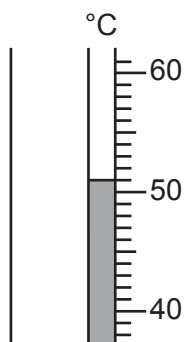


Fig. 3.2

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]

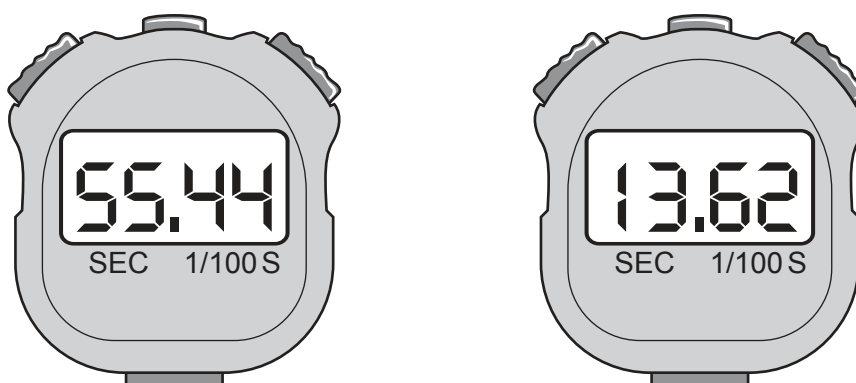
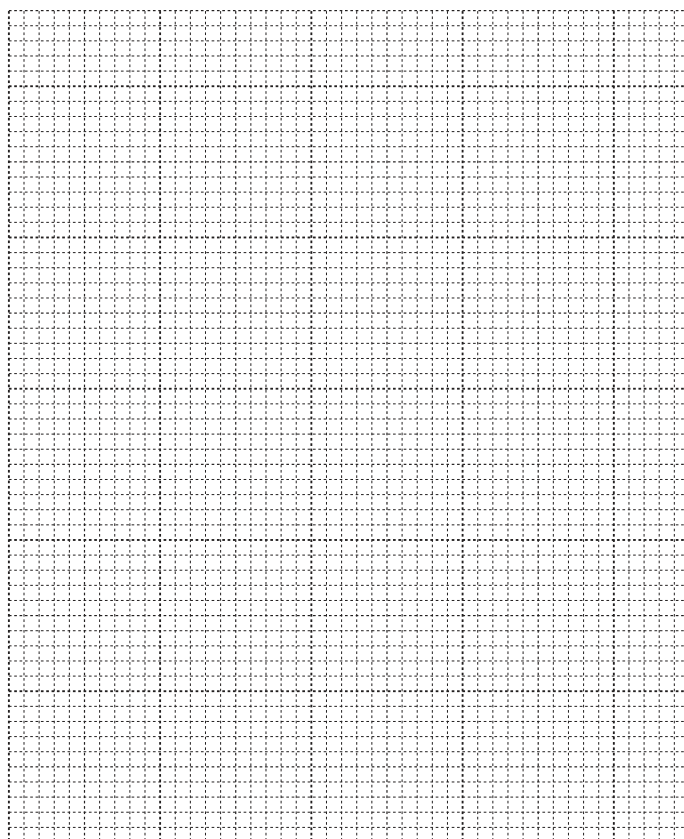


Fig. 3.3

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- (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]

10

(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.

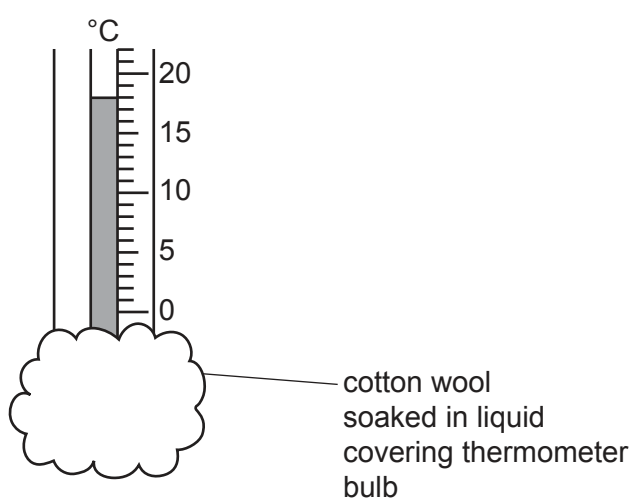


Fig. 4.1

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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]

13

- (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.

$$\begin{array}{ccccc} \text{energy } E & = & \text{mass} & \times & \text{thermal energy for 1.0 kg} \\ \text{in kJ} & & \text{in kg} & & \text{in kJ} \end{array}$$

energy E = kJ [2]

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

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

$$\text{mass of empty beaker} = 43.77 \text{ g}$$

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**.

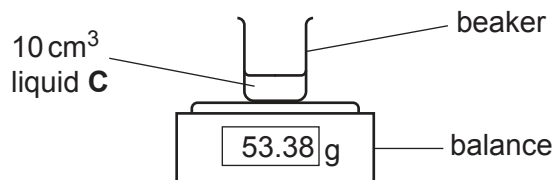


Fig. 4.2

Record the total mass.

$$\text{total mass of beaker and liquid C} = \dots\dots\dots \text{ g [1]}$$

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

$$\text{mass of liquid C} = \dots\dots\dots \text{ g [1]}$$

- (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.

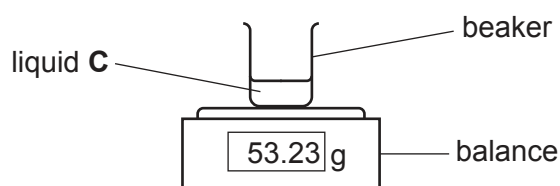


Fig. 4.3

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

$$\text{mass} = \dots\dots\dots \text{ g [1]}$$

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- (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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