

Answer ALL questions.

- 1** A student read about the benefits of an increased intake of vitamin C in the diet. However, she disliked eating fruit and did not want to take vitamin tablets. Therefore she wanted to obtain most of her daily intake of vitamin C from vegetables. She also read that vitamin C in vegetables is destroyed when they are cooked.

She decided to do a project on the effect of temperature on vitamin C content.

She heated orange juice samples in boiling tubes at five different temperatures, in a water bath. In each case, the tubes were left in the water bath for fifteen minutes and then cooled in a beaker of ice for five minutes.

She determined the vitamin C content of each sample by titrating it with a 0.1% DCPIP solution (2,6-dichlorophenolindophenol). The vitamin C in the orange juice decolourises the DCPIP solution.

She repeated this procedure five times for each temperature.

- (a) (i) State **two** variables that were controlled in this investigation.

(2)

- (ii) Name **one other** variable, in her method, which should have been controlled. Describe how it could have been controlled.

(2)

Variable

How it could be controlled

.....

.....

.....

.....

(b) The results of her investigation are shown in the table below.

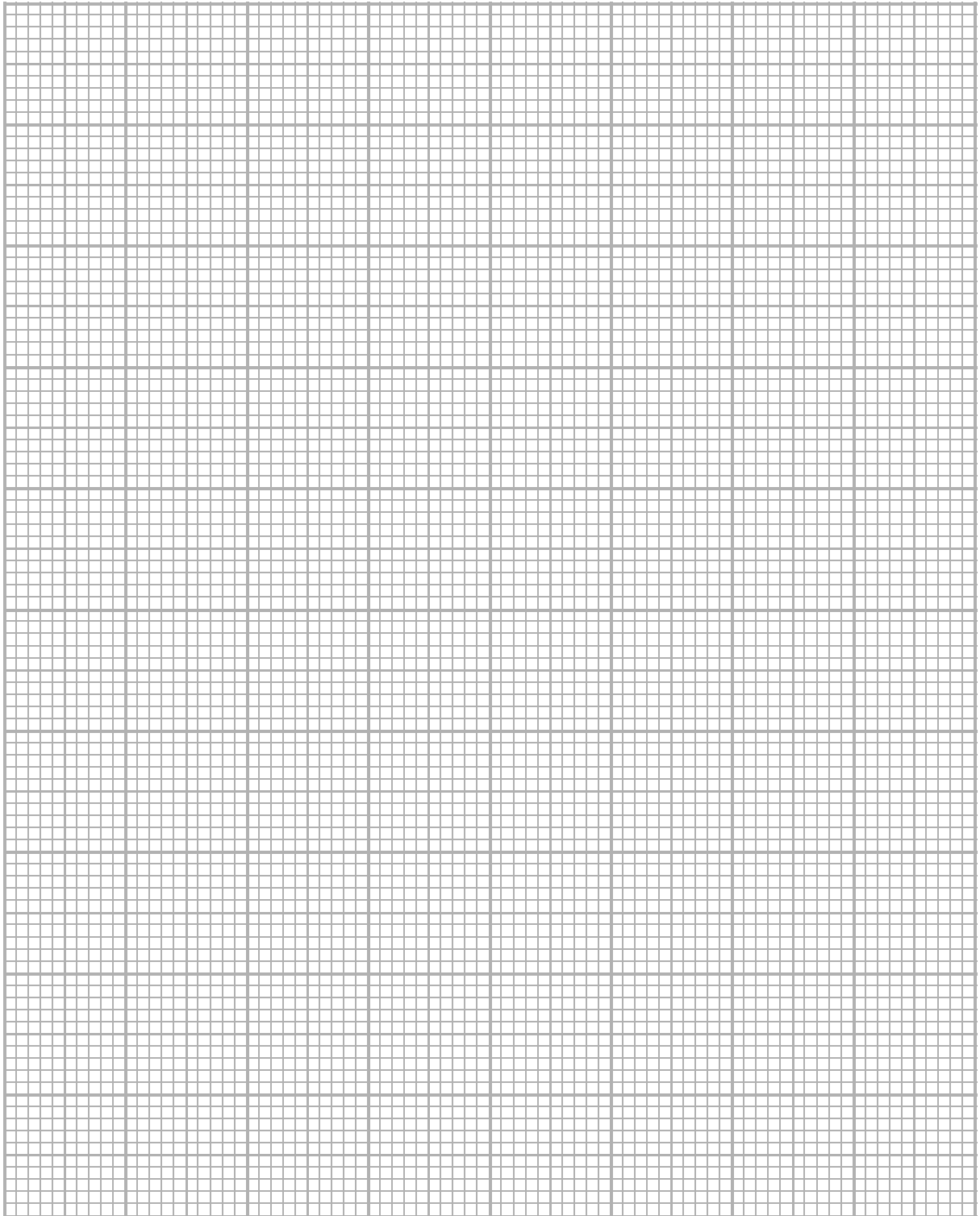
Temperature / °C	Volume of juice needed to decolourise DCPIP / cm ³						Standard Deviation (SD)
	1	2	3	4	5	Mean	
20	4.1	4.2	4.2	4.2	4.0	4.1	0.09
23	3.9	3.8	4.0	3.8	3.8	3.9	0.09
30	6.6	6.6	6.1	6.5	6.6	6.5	0.22
40	7.4	7.1	7.1	7.1	7.0	0.15
50	8.5	8.5	8.4	8.5	8.3	8.4	0.09

- (i) Complete the table by calculating the mean volume of juice, kept at 40 °C, needed to decolourise DCPIP. Show your working.

(2)

- (ii) Plot a suitable graph to show the effect of temperature on the mean volume of juice needed to decolourise DCPIP. On your graph, include the standard deviations.

(5)



(iii) Use the results of this investigation to describe the effect of temperature on the vitamin C content of orange juice.

(2)

(iv) Using the information in the table, comment on the reliability of these data.

(2)

- (c) To check the validity of her results, she found some data about the effects of cooking on fresh vegetables.

The data are shown in the table below.

Vegetable	Percentage loss of vitamin C due to cooking (%)
Soko (<i>Celosia argentea</i>)	38
Tete (<i>Amaranthus hybridus</i>)	35
Cassava (<i>Manihot esculenta</i>)	30
Okra (<i>Hibiscus esculentus</i>)	36

- (i) Compare these data with those that the student obtained in her study and comment on the validity of her results.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Suggest what further information she would need in order to make a valid comparison of her results with these published data.

(2)

.....

.....

.....

.....

(Total for Question 1 = 20 marks)

- (d) Some of the statements in the passage have no supporting evidence.
For example, paragraph 12 states that:

“Many religious groups do not agree with the use of stem cells in medicine.”

To find some evidence to support this statement, the student carried out an Internet search and found information from source A and source B.

Source A

A survey asked the following question:

“Regardless of whether or not you think it should be legal, for each issue, please tell me whether you personally believe that in general it is morally acceptable or morally wrong.”

Issues	Morally acceptable (%)	Morally wrong (%)
Medical research using stem cells obtained from human embryos	62	30
The death penalty	62	30
Gambling	63	32
Abortion	40	48

Source B

Issues	Catholics (%)	Non-Catholics (%)
Medical research using stem cells obtained from human embryos	63	62
The death penalty	61	68
Gambling	72	59
Abortion	40	41

- (i) Discuss the usefulness of these sources of evidence as support for the statement in paragraph 12.

(4)

- (ii) The student presented some of these data in a visual form.

Describe how the relevant data in source A and source B could be presented in a suitable visual form.

(3)

1 A student used the procedure outlined below to find the water potential of a plant storage tissue that has coloured cell sap.

- pieces of plant tissue are placed into different sucrose solutions of known concentrations to allow osmosis to occur
- damaged cells release pigment that colours the sucrose solutions that bathe the tissue
- the water potential of the sucrose solutions may change as a result of osmosis
- sucrose solutions become less dense if they **gain** water from the tissue
- a pipette is filled with the coloured sucrose solution that has bathed the plant tissue
- a drop of the coloured bathing sucrose solution is released half way down a tube of sucrose solution of the same concentration as the original bathing solution as shown in Fig. 1.1
- the direction and rate of movement of the drop of coloured solution is determined by its density

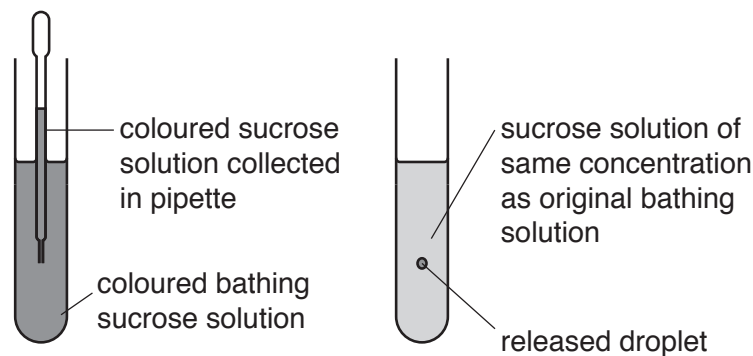


Fig. 1.1

Fig. 1.2 shows the results that the student plotted from the investigation.

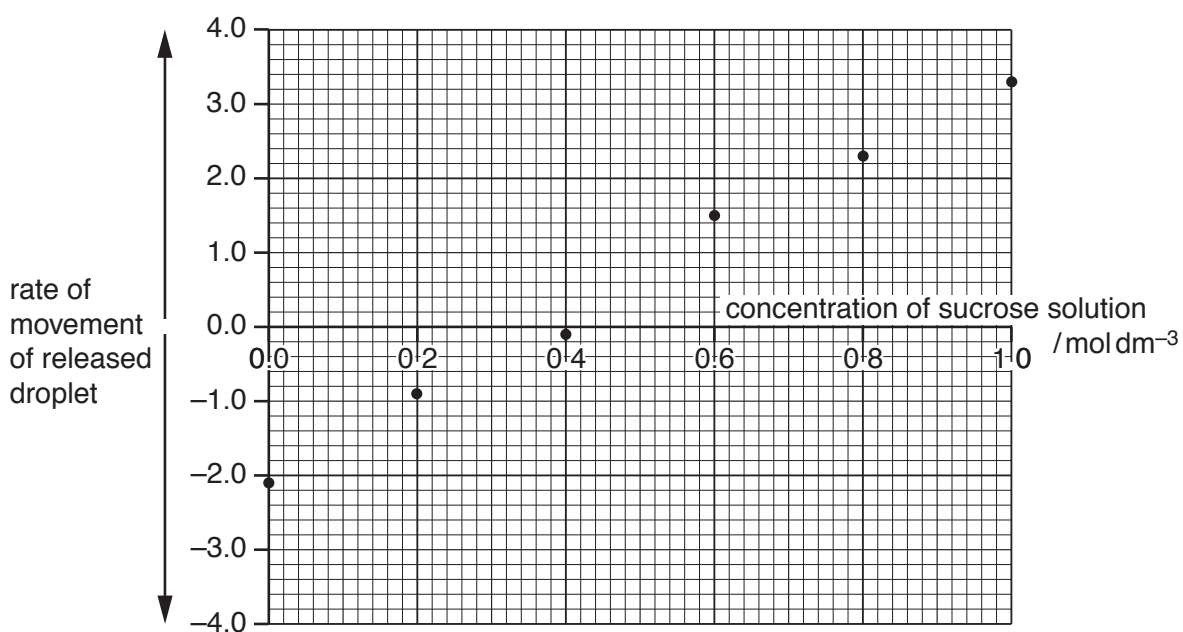


Fig. 1.2

(a) Describe how the student could use this procedure to find the water potential of the plant storage tissue that has coloured cell sap.

[8]

(b) (i) Suggest suitable units for the rate of movement of the drop.

..... [1]

(ii) State how the student would estimate the water potential of the plant tissue.

.....

.....

..... [2]

(c) (i) Identify the independent and dependent variables in this investigation.

independent

.....

dependent

..... [2]

(ii) Identify **two** variables which the student may not have adequately controlled during the investigation.

1.

2. [2]

(iii) State how **one** of the variables you have identified in (c)(ii) may have influenced the results.

.....

.....

..... [1]

(d) The student made direct observations of the cells of the tissues that had been immersed in 0.2 mol dm^{-3} and 0.8 mol dm^{-3} sucrose solutions.

(i) Predict the appearance of the cells under the microscope when immersed in

0.2 mol dm^{-3} sucrose solution

.....

0.8 mol dm^{-3} sucrose solution

..... [1]

Use the space below for any diagrams you include in your answer to (i).

(ii) Explain your answers to (d)(i).

.....

.....

..... [2]

[Total: 19]