1 *Beta vulgaris vulgaris*, as shown in Fig. 1.1, is a food crop with a swollen, edible root known as beetroot.

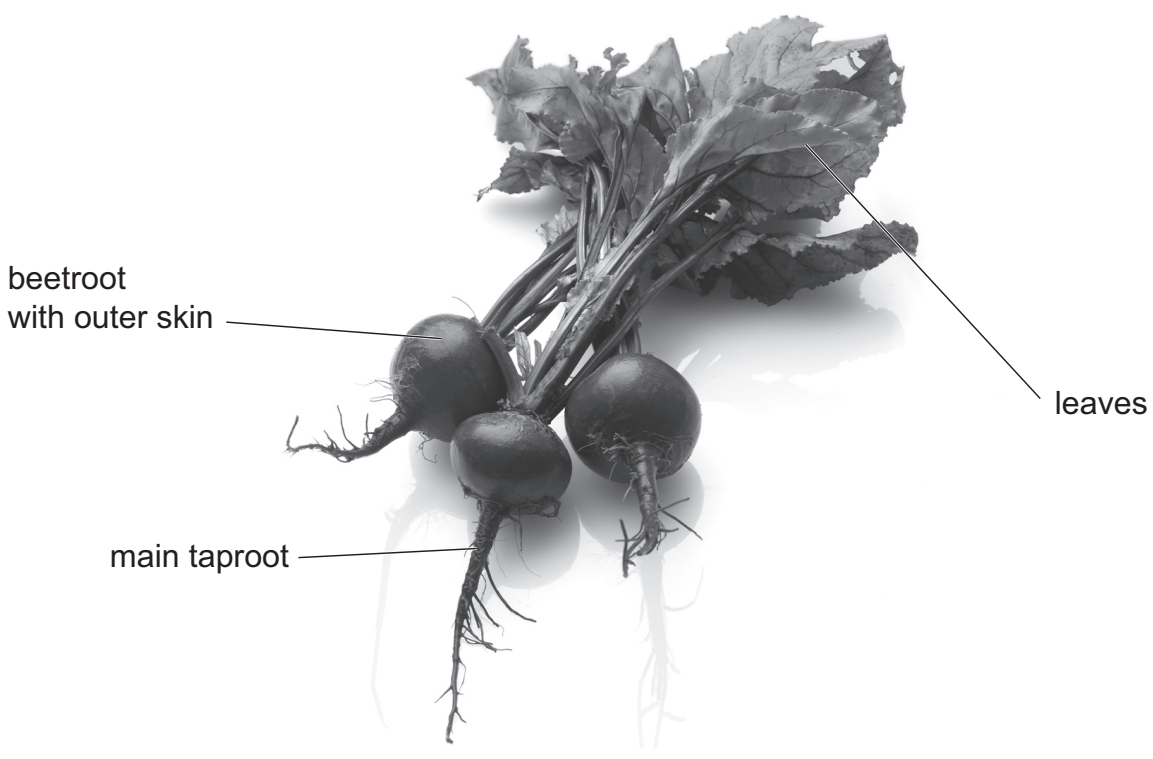

Fig. 1.1

A student determined the concentration of a sucrose solution that has the same water potential as the cells of the beetroot.

The student used distilled water and a stock solution of 2.0 mol dm^{-3} sucrose to prepare a range of sucrose solutions.

Each sucrose solution was prepared using proportional dilution and had a final volume of 30 cm^3.

(a) Complete Table 1.1 to show how the concentrations were made.

Table 1.1

final concentration of sucrose solution / mol dm^{-3}	volume of distilled water / cm^3	volume of 2.0 mol dm^{-3} stock sucrose solution / cm^3
2.0	0.0	30.0
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
0.0	30.0	0.0

[2]

(b) Describe a method the student could use to collect the data needed to determine the concentration of a sucrose solution that has the same water potential as the cells of the beetroot.

The student was supplied with the sucrose solutions prepared in **1(a)** and standard laboratory equipment.

Do **not** include details of how the student:

- prepared the sucrose solutions in **1(a)**
- would use the data collected to determine the concentration of a sucrose solution that has the same water potential as the cells of the beetroot.

Your method should be set out in a logical order and be detailed enough to allow another person to follow it.

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..... [7]

(c) The student calculated the mean percentage change in mass of the beetroot for each concentration of sucrose solution.

(i) The student plotted these calculated values to obtain a line graph.

Complete Fig. 1.2 by:

- labelling the axes
- sketching the line that the student obtained.

Fig. 1.2

[2]

(ii) Explain how the student used the completed line graph in Fig. 1.2 to estimate the concentration of sucrose solution that has the same water potential as the cells of the beetroot.

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..... [1]

(iii) The cells of the beetroot contain a red pigment which can leak out into the solution when the tissue is cut. The student noticed that each sucrose solution was coloured red at the end of the investigation.

Suggest **one** improvement the student could make to the method to reduce the amount of red pigment in each sucrose solution.

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..... [1]

[Total: 13]

Question 2 starts on page 6.