Do not write outside the box

0 4 A student investigated the effect of different concentrations of sugar solution on pieces of carrot.

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm^3 of water or one of the sugar solutions as shown in **Figure 6**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 6 shows how the investigation was set up.

Figure 6

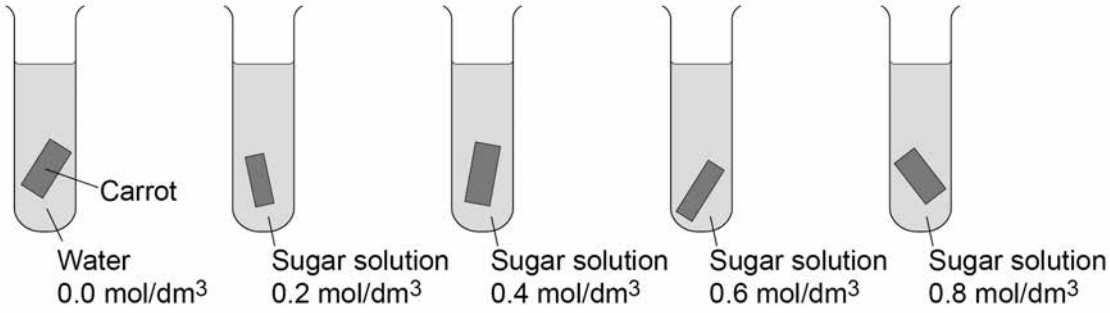

Table 2 shows the results.

Table 2

Concentration of sugar solution in mol/dm^3	Percentage (%) change in mass
0.0	+24
0.2	+12
0.4	+1
0.6	–8
0.8	–15

0 4 . 1 Suggest why the student calculated the percentage (%) change in mass of each piece of carrot.

[1 mark]

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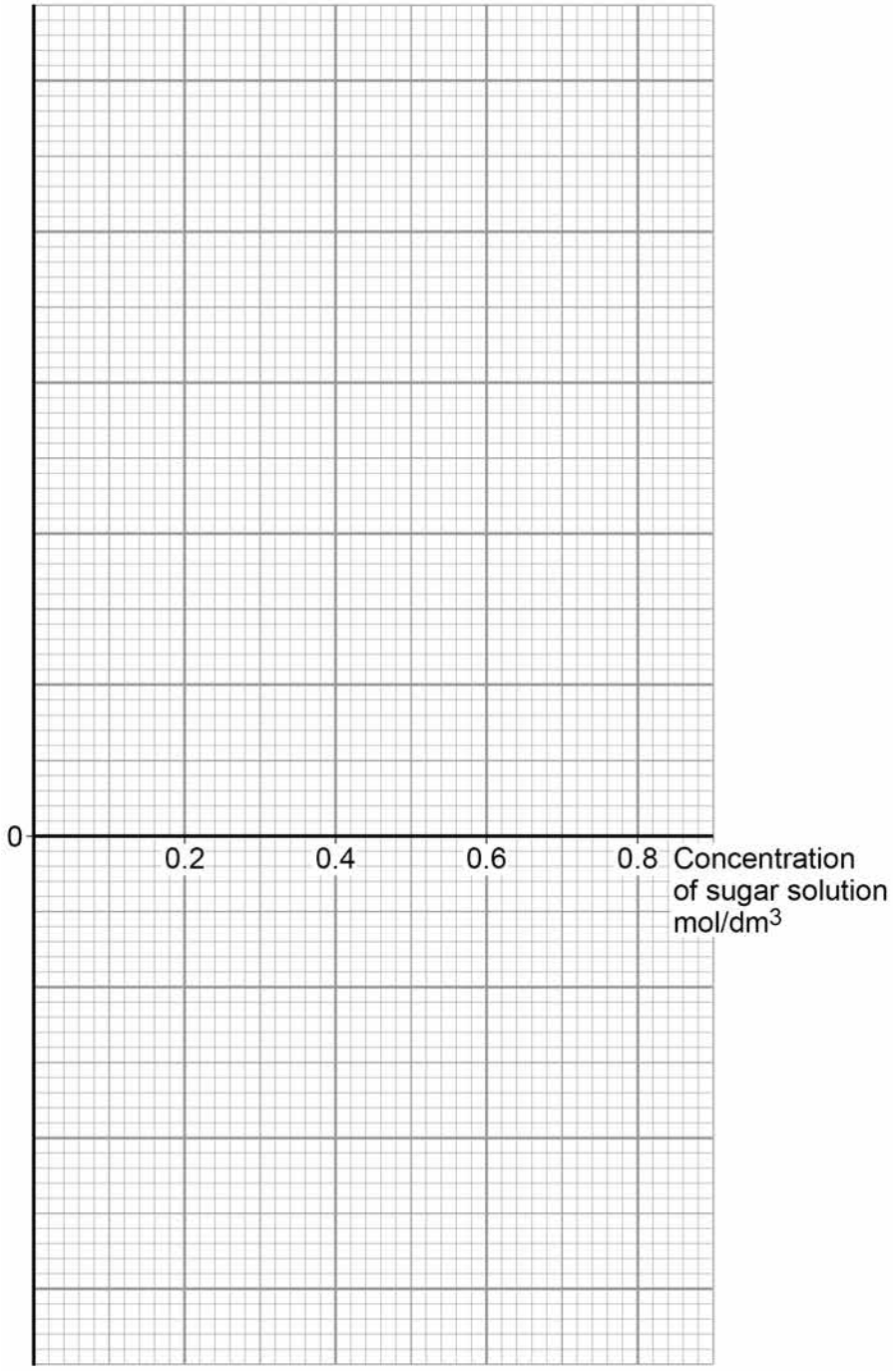
0 4 . 2 Complete **Figure 7** using the results in **Table 2**

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

[4 marks]

Figure 7



Question 4 continues on the next page

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0 4 . 3 Estimate the concentration of sugar solution inside the carrot cells.

Use your completed graph on **Figure 7**

[1 mark]

Concentration = _____ mol/dm^3

0 4 . 4 Explain why the mass of the carrot in the 0.6 mol/dm^3 sugar solution changed.

[4 marks]

0 4 . 5 The student repeated the investigation using boiled pieces of carrot.

The pieces of carrot did **not** change in mass.

Suggest why.

[1 mark]

11

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>04.1</td><td>to control for the starting mass (of the pieces of carrot)</td><td>allow because the pieces of carrot were not all the same mass at the start

do not accept were not all the same size
do not accept as a control variable</td><td>1</td><td>AO3
4.1.3.2</td></tr>
<tr><td>04.2</td><td>suitable scale and label for y-axis

all points plotted correctly

line of best fit</td><td>allow 5 or 6 per 2 cm

do not accept 5 per 1 cm

allow ± ½ a square
allow 1 mark for 4 correct points

<table><tr><th>conc. …</th><th>percentage (%) change…</th></tr><tr><td>0.0</td><td>+ 24</td></tr><tr><td>0.2</td><td>+ 12</td></tr><tr><td>0.4</td><td>+ 1</td></tr><tr><td>0.6</td><td>- 8</td></tr><tr><td>0.8</td><td>- 15</td></tr></table></td><td>1

2

1</td><td>AO2
4.1.3.2</td></tr>
<tr><td>04.3</td><td>value from student’s line of best fit</td><td>allow ± ½ a square</td><td>1</td><td>AO3
4.1.3.2</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	mass decreased		1	AO2 4.1.3.2
	(due to) **loss of water** by **osmosis**	ignore diffusion	1	AO1 4.1.3.2
	through a partially / selectively / semi permeable membrane		1	AO1 4.1.3.2
		a clear reference to concentration of water or concentration of sugar is required for the fourth mark		
	(as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot **or** (as) the concentration of water is less outside the cells / carrot than the concentration inside the cells / carrot	allow (as) concentration of sugar solution inside cells / carrot is lower than the concentration of sugar solution (in the tube or around the carrot) allow answers in terms of dilute and concentrated solutions	1	AO2 4.1.3.2
04.5	the (partially permeable / cell) membrane was damaged	allow idea that cell membrane is no longer intact **or** is **more** permeable / leaky allow the membrane is denatured ignore cells are dead	1	AO3 4.1.3.2
Total			**11**	