

2024 Paper 3 Answers

S/N	Possible solutions				Marks	Cambridge Comments																								
1																														
ai	<table><tr><th>percentage concentration of sodium chloride solution</th><th>Volume of stock solution, S / cm³</th><th>Volume of deionised water / cm³</th><th>Total volume of solution / cm³</th></tr><tr><td>0.0</td><td>0.0</td><td>30.0</td><td>30.0</td></tr><tr><td>2.5</td><td>7.5</td><td>22.5</td><td>30.0</td></tr><tr><td>5.0</td><td>15.0</td><td>15.0</td><td>30.0</td></tr><tr><td>7.5</td><td>22.5</td><td>7.5</td><td>30.0</td></tr><tr><td>10.0</td><td>30.0</td><td>0.0</td><td>30.0</td></tr></table>				percentage concentration of sodium chloride solution	Volume of stock solution, S / cm ³	Volume of deionised water / cm ³	Total volume of solution / cm ³	0.0	0.0	30.0	30.0	2.5	7.5	22.5	30.0	5.0	15.0	15.0	30.0	7.5	22.5	7.5	30.0	10.0	30.0	0.0	30.0	1 1 1	The majority of candidates completed the table with the correct volumes
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a ii	1. Used the 1 cm³ syringe to measure volumes that are in 1 decimal place ; 2. Ensured that the syringe is fully immersed in deionised water and stock solution when extracting respective volumes to prevent presence of air bubbles ; 3. Turn the syringe upside down and flick it or tap it to remove any air bubbles present ; 4. Volume readings were read at eye level to prevent parallax error ; AVP Any two valid points to get the 2 marks				2	Most candidates correctly stated the precautions for ensuring accurate dilutions. Some candidates mistakenly referred to reading the meniscus when using syringes.																								
	Step 14: 5 to 15 °				1																									

b	<table border="1" data-bbox="289 240 1377 784"> <tr> <th data-bbox="289 240 562 370" rowspan="2">Concentration of sodium chloride solution / %</th><th colspan="3" data-bbox="562 240 1377 305">Angle of bending of potato strips / °</th></tr> <tr> <th data-bbox="562 305 835 370">Strip 1</th><th data-bbox="835 305 1108 370">Strip 2</th><th data-bbox="1108 305 1377 370">Mean</th></tr> <tr><td data-bbox="289 370 562 435">0.0</td><td data-bbox="562 370 835 435"></td><td data-bbox="835 370 1108 435"></td><td data-bbox="1108 370 1377 435"></td></tr> <tr><td data-bbox="289 435 562 500">2.5</td><td data-bbox="562 435 835 500"></td><td data-bbox="835 435 1108 500"></td><td data-bbox="1108 435 1377 500"></td></tr> <tr><td data-bbox="289 500 562 565">5.0</td><td data-bbox="562 500 835 565"></td><td data-bbox="835 500 1108 565"></td><td data-bbox="1108 500 1377 565"></td></tr> <tr><td data-bbox="289 565 562 630">7.5</td><td data-bbox="562 565 835 630"></td><td data-bbox="835 565 1108 630"></td><td data-bbox="1108 565 1377 630"></td></tr> <tr><td data-bbox="289 630 562 695">10.0</td><td data-bbox="562 630 835 695"></td><td data-bbox="835 630 1108 695"></td><td data-bbox="1108 630 1377 695"></td></tr> <tr><td data-bbox="289 695 562 784">Unknown solution U</td><td data-bbox="562 695 835 784"></td><td data-bbox="835 695 1108 784"></td><td data-bbox="1108 695 1377 784"></td></tr> </table> Correct headers with units ; Total of two readings taken ; Correct number of decimal places (1 dp in independent variable. Whole number for strips 1 and 2 and 1 dp for mean) ; Correct trend (as concentration increases, angle of bending increases) Value unknown solution U ;	Concentration of sodium chloride solution / %	Angle of bending of potato strips / °			Strip 1	Strip 2	Mean	0.0				2.5				5.0				7.5				10.0				Unknown solution U				1 1 1 1 1	All candidates drew a table to record their results. Stronger responses included detailed headings with appropriate units. The majority of candidates adhered to the instructions, recording two results for each concentration of sodium chloride solution and the results for solution U of unknown concentration. Most candidates accurately calculated the mean angle of bending for the two potato strips in each sodium chloride solution.
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c	Scale - Ensure that the graph takes up more than 50 % of space provided ; Line - best fit curve ; Axes - labelled fully with the correct units and 1 dp for both axes ; Plots - plots plotted accurately ;	1 1 1 1	The majority of candidates demonstrated a strong ability to transpose data from a table into graphical form. Most responses had correctly labelled axes with appropriate interval																															

			markings. Stronger responses exhibited appropriate scales, precise plotting and a clear line. Most candidates were able to draw a line or curve of best fit, accurately following the expected trend without extrapolation. Some candidates showed a lack of understanding of the aim of the investigation, leading to errors such as plotting the unknown value U on the graph or drawing a bar chart instead of a line graph.
di	Dependent on student values for U and step 14 respectively ;	2	Most candidates were able to use their graphs to obtain the required concentrations.
dii	Dotted lines on graph for both values ;	1	Most candidates showed clearly how they derived the required concentrations on the graph.
e	1. There are greater impact of anomalies on the average value ;	2	Some candidates

	2. Reduce reliability of data obtained as two data points is not enough to identify a trend ; 3. With only two data, it is difficult to determine the precision of the attempts per concentration ; 4. Small sample size that is not representative of the concentration of the entire potato ; Any two valid points		confused this question with sources of error. Stronger responses typically referenced anomalies and associated reliability to the mean angle of bending.										
f	<table><tr><td>Source of error</td><td>How you would minimise the source of error</td></tr><tr><td>Using of knife to cut the potato strips</td><td>Use a precision cutter or use a template to cut the potatoes accurately</td></tr><tr><td>Solutions may evaporate while the strips were immersed in the solution</td><td>Cover the petri dishes</td></tr><tr><td>Using of ruler to measure the dimensions of the potato strips</td><td>Use digital calipers instead</td></tr><tr><td colspan="2">Any two valid points - 2m Correct method to minimise both sources of error - 2m</td></tr></table>	Source of error	How you would minimise the source of error	Using of knife to cut the potato strips	Use a precision cutter or use a template to cut the potatoes accurately	Solutions may evaporate while the strips were immersed in the solution	Cover the petri dishes	Using of ruler to measure the dimensions of the potato strips	Use digital calipers instead	Any two valid points - 2m Correct method to minimise both sources of error - 2m		4	A broad range of errors were identified by candidates. The majority were able to recognise at least one source of error and suggest a reasonable approach to minimise it. These candidates demonstrated a sound understanding of the equipment that could have been used or the procedures that could help reduce errors. Some responses included sources of error or suggested improvements that were either vague or not directly relevant to the investigation, for example, 'potato strips of different sizes can affect the investigation'. Weaker responses on how to minimise the source of error lacked accurate
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			references to the procedure or did not propose meaningful changes to the data collection process, for example, 'ensure that potato strips are totally immersed in the solutions'.
g	Dependent on data obtained for both 0.0 % and 10.0 %. If angle of bend is more than value seen in step 14, Water potential in sodium chloride is lower than that of the cells in the potato strips ; Therefore, <u>more water molecules</u> exited the cells through the partially permeable membrane via <u>osmosis</u>. This makes the potato strips cells be more flaccid therefore bending more. ; If angle of bend is less than value seen in step 14, Water potential in sodium chloride is higher than that of cells in potato strips ; Therefore, <u>more water molecules</u> entered the cells through the partially permeable membrane via <u>osmosis</u> This increased turgidity of the potato strip cells, making it bend less ; If angle of bend is the same value as seen in step 14, Water potential of sodium chloride solution is the same as that of the cells in the potato strips ; There is <u>no net movement of water molecules</u> into or out of the cells through the partially permeable membrane via <u>osmosis</u> ;	1 m for water potential 1m for movement of water from where to where via osmosis 1m for either flaccid / turgid	Stronger responses exhibited a strong understanding of the concepts of water potential and osmosis, with appropriate application of theoretical knowledge to the experimental results. Most candidates used appropriate biological terminology, such as 'increase in turgidity of cells in 0.0% solution'. Weaker responses did not make reference to the 0.0% and 10.0% sodium chloride solutions.
2			

a	1. Xylem has a thicker cell wall 2. Xylem has a larger lumen than the other cells AVP				2	Most candidates were able to state the visible features of xylem vessels shown in Fig. 2.1. Weaker responses gave features that were not visible. These responses simply listed what was taught in theory, for example, 'presence of lignin'. Some responses included inaccurate features, such as referring to the xylem vessel as having a 'thick cell wall'.																
bi	<table><tr><th>Xylem vessel</th><th>Measurement of width / mm</th><th>Actual width / mm</th><th>Actual width / μm</th></tr><tr><td>1</td><td>13</td><td>0.464</td><td>464</td></tr><tr><td>2</td><td>8</td><td>0.286</td><td>286</td></tr><tr><td>3</td><td>9</td><td>0.321</td><td>321</td></tr></table>				Xylem vessel	Measurement of width / mm	Actual width / mm	Actual width / μm	1	13	0.464	464	2	8	0.286	286	3	9	0.321	321	3 1m per row	Candidates who performed well met the requirements of the question by accurately identifying and labelling the three largest xylem vessels, measuring the widths of the identified xylem vessels accurately, correctly transferring measurements to the table, and adhering to the specified number of significant figures when calculating the actual
Xylem vessel	Measurement of width / mm	Actual width / mm	Actual width / μm																			
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			widths.
bii	Mean width = $(464 + 286 + 321) / 3$ = 357 μm	1	Almost all candidates carried out the necessary calculations to obtain the actual mean width of the labelled xylem vessels. A few candidates incorrectly gave their responses in mm instead of μm as required.
ci	Light intensity ;	1	The majority of candidates correctly identified the independent variable.
cii	Temperature of surroundings ; Volume of water provided ; Number of leaves plant has ; Any two valid points	2	This question was well answered.
ciii	Higher temperature would mean higher rate of evaporation of water from the thin layer of moisture around of spongy mesophyll cells. This will result in higher rate of transpiration and eventually higher rate of water uptake ; The higher volume of water provided may result in plants to increase water absorption from the roots. Therefore leading to higher rate of water uptake. ; More leaves will result in higher rate of transpiration. Therefore, increasing the rate of water uptake ;	1	The majority of candidates exhibited a clear understanding of the importance of keeping identified variables constant in relation to the dependent variable in the investigation. Weaker responses tended to be vague, such as referencing the need for a 'fair test' or achieving

			'accurate results' without adequately addressing the specific role of constant variables.
civ	Independent variable: air speeds Dependent variable: rate of movement of bubble of air / mm per hour Constants (at least 3): volume of water, number of leaves of plant, light intensity Safety precaution (at least 2): Do not touch the bulb of the lamp as it may be hot Be careful when using a knife to cut off the roots of the plant Interpretation of results: If the air speed increases and the rate of movement of bubble of air increases, it shows that the higher air speed would increase the rate of water uptake by the plant. But if the air speed increases and the rate of movement of bubble of air decreases, it shows that the higher air speed decreases the rate of water uptake by the plant. Procedure: 1. Prepare the setup as seen in Fig. 2.2, with 300 cm³ of water. 2. Place a lamp at 10 cm away from the setup 3. Place a fan at about 10 cm away from the setup 4. Ensure the fan is at the lowest air speed of 1. 5. Measure the rate of movement of bubble air by reading the movement of air bubble up the capillary tube after an hour. 6. Repeat step 5 for a total of 3 hours. 7. Repeat steps 1 to 6 two more times to get an average reading. 8. Repeat steps 1 to 7 for different fan air speeds (2, 3, 4, 5 and 6) 9. Record your values in a suitable table.	1 1 1 2	Candidates generally did not perform well on this question. Stronger responses were concise and focused on a modified procedure using the apparatus shown in Fig. 2.2, often providing additional detail on how variables should be controlled. Weaker responses tended to list variables without integrating them into the experimental procedure. Some candidates focused on predicting or concluding the investigation, rather than describing the design of the investigation and data collection methods necessary to address the aim of the investigation.

