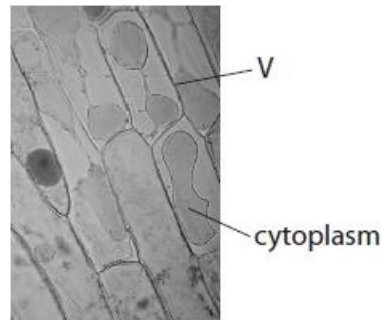


Questions

Q1.

Answer the question with a cross in the box you think is correct. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

Figure 3 shows some onion cells that have been soaked in a concentrated salt solution.



(Source: © Rattiya Thongdumhyu/Shutterstock)

**Figure 3**

(i) The cells in Figure 3 have been stained.

Give one reason why the cells have been stained.

..... (1)

(ii) Which is the name of the structure labelled V?

- A chloroplast
- B vacuole
- C nucleus
- D cell wall

(1)

(iii) The salt solution outside the cell has a higher concentration than the solution inside the cell.

Explain why the cytoplasm shrinks away from the sides of the cell when the cells are in salt solution.

(2)

.....  
.....  
.....  
.....

(Total for question = 4 marks)

Q2.

A student investigated the percentage change in mass of potato cylinders placed in sucrose solutions of different concentrations.

Figure 5 shows the results of the student's investigation.

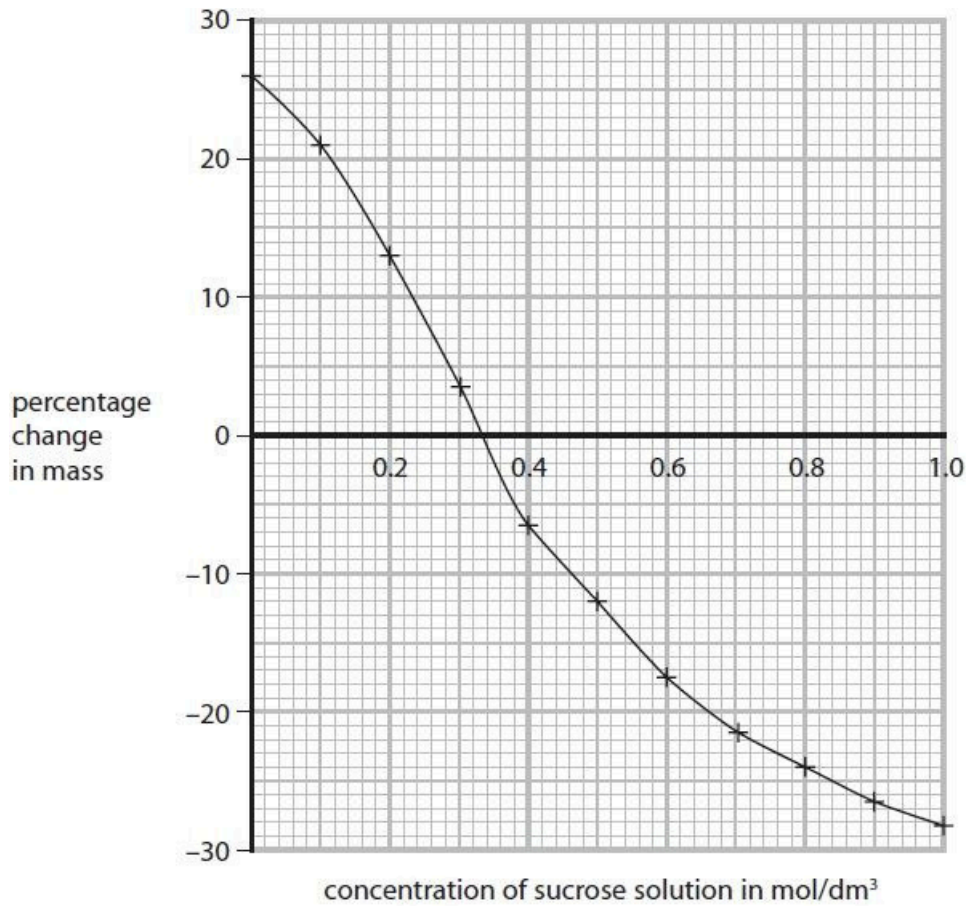


Figure 5

State two conclusions that can be made from these results.

(2)

1 .....

.....

2 .....

.....

(Total for question = 2 marks)

Q3.

Alcohol is broken down by liver cells.

Which process moves alcohol from the blood into the liver cells?

(1)

- A diffusion
- B respiration
- C osmosis
- D transpiration

(Total for question = 1 mark)

Q4.

A student placed three different sized cubes of agar jelly into separate beakers containing the same concentration of hydrochloric acid.

The cubes contained a pink indicator.

This indicator becomes clear when in contact with an acid.

Figure 7 shows the results of the investigation after the cubes had been in the acid for 120 seconds.

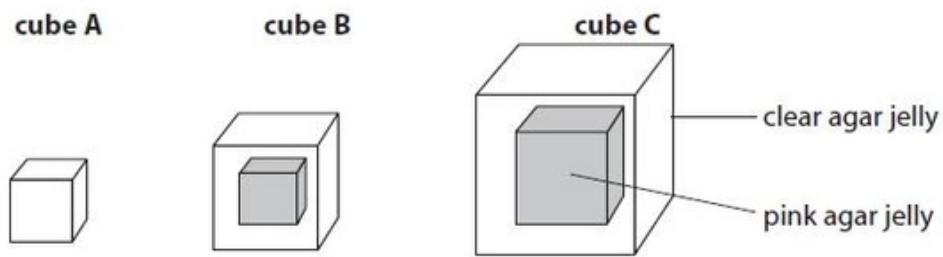


Figure 7

(i) The distance from the outside of cube B to the pink area was 3 mm.

Calculate the distance diffused by hydrochloric acid in one second.

(2)

..... mm

(ii) The student wanted to confirm their results.

Give one improvement the student should make to this investigation to confirm their results.

(1)

.....  
.....  
.....

(Total for question = 3 marks)

Q5.

A student wanted to investigate the movement of water into and out of cells in potatoes. The student had the equipment shown in Figure 8.



Figure 8

The test tubes in the rack contain different concentrations of sodium chloride solution. The solutions were 0.1 M, 0.2 M, 0.3 M, 0.4 M and 0.5 M sodium chloride solution. The test tube in the beaker contains distilled water. There are three potato chips in each of the six test tubes.

(i) State why the test tube in the beaker only contains distilled water and three potato chips.

(1)

.....  
.....

(ii) State two variables that need to be controlled in this investigation.

(2)

1 .....

.....

2 .....

.....

(iii) Explain why the chips in the 0.5 M sodium chloride solution lost mass.

(3)

.....  
.....  
.....  
.....  
.....  
.....

(Total for question = 6 marks)

Q6.

Figure 11 shows two potato chips.

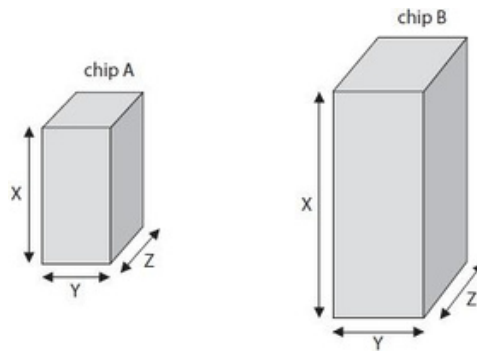


Figure 11

Figure 12 shows some information about each potato chip.

| potato chip | length of X in cm | length of Y in cm | length of Z in cm | total surface area of four sides in cm <sup>2</sup> | total surface area of top and bottom in cm <sup>2</sup> | total surface area of chip in cm <sup>2</sup> |
|-------------|-------------------|-------------------|-------------------|---|---|---|
| A           | 3.0               | 1.5               | 1.5               | 18.0  | 4.5   | 22.5  |
| B           | 5.0               | 2.0               | 2.0               | ?   | ?   | ?   |

Figure 12

(i) Calculate the total surface area of potato chip B using the formula,

$$\text{Total surface area} = 2XY + 2XZ + 2YZ$$

(2)

total surface area = ..... cm<sup>2</sup>

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 13 shows the increase in mass of each potato chip.

| potato chip | increase in mass in grams |
|-------------|---------------------------|
| A           | 0.1                       |
| B           | 0.3                       |

Figure 13

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

.....

.....

.....

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.  
Explain what will happen to the cells in potato chip A.

(3)

.....

.....

.....

.....

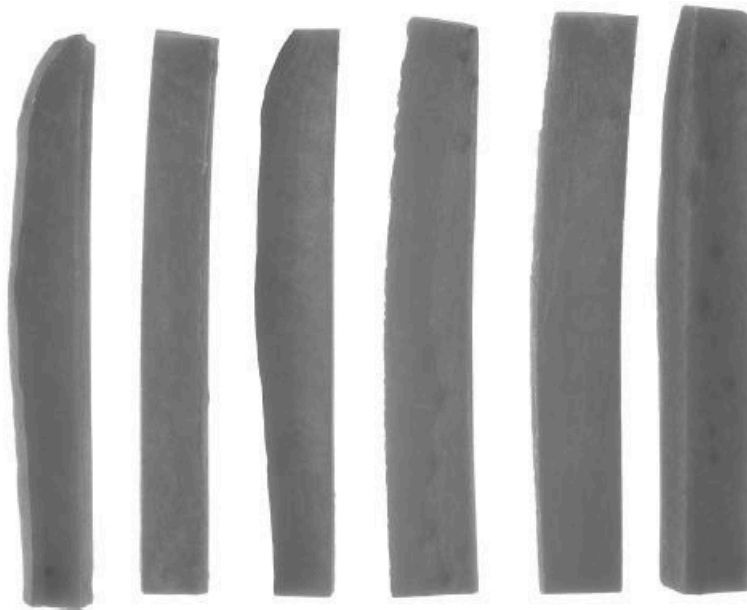
.....

.....

(Total for question = 7 marks)

Q7.

Figure 10 shows some carrot sticks.



(Source: © rukxstockphoto/Shutterstock)

**Figure 10**

A student chose three carrot sticks and weighed each one.

The carrot sticks were placed in 50 cm<sup>3</sup> of distilled water.

After two hours the student weighed each carrot stick again.

Figure 11 shows the results for these carrot sticks P, Q and R.

| carrot stick | mass at the start in grams | mass after two hours in grams | change in mass in grams |
|--------------|----------------------------|-------------------------------|-------------------------|
| P            | 4.0                        | 4.9                           | 0.9                     |
| Q            | 4.2                        | 5.0                           | 0.8                     |
| R            | 4.1                        | 5.0                           | 0.9                     |

**Figure 11**

(i) Give one reason why the student used three carrot sticks instead of just one carrot stick.

(1)

.....  
.....



(ii) Give two ways that this method could be improved.

(2)

1 .....

.....

2 .....

.....

(iii) Calculate the percentage change in mass of carrot stick Q.

(3)

Use the equation

$$\text{percentage change} = \frac{\text{change in mass}}{\text{mass at the start}} \times 100$$

Give your answer to 2 significant figures.

percentage change = ..... %

(iv) Explain the change in mass of the carrot sticks.

(2)

.....  
.....  
.....  
.....

(Total for question = 8 marks)

Q8.

Devise a method, using cubes of agar jelly, to investigate how temperature affects the rate of diffusion.

(3)

.....

.....

.....

.....

.....

.....

.....

(Total for question = 3 marks)

Q9.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .

Substances move into and out of cells.

How does oxygen move into and out of cells?

- A transpiration
- B active transport
- C diffusion
- D osmosis

(Total for question = 1 mark)

Q10.

Answer the question with a cross in the box you think is correct. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

Some substances move into and out of cells by active transport.

Which is the correct description of the movement of a substance by active transport?

- A against a concentration gradient using energy
- B down a concentration gradient using energy
- C against a concentration gradient without using energy
- D down a concentration gradient without using energy

(Total for question = 1 mark)

Q11.

The mineral ions are absorbed from the soil into the roots of plants.

Describe how these mineral ions are transported from the roots to the leaves of the plants.

(2)

.....

.....

.....

.....

.....

(Total for question = 2 marks)

Q12.

\* A student investigated the movement of water.

Hens' eggs were placed in vinegar for two days to dissolve the shell.

This makes the eggs permeable to water.

The eggs were then weighed and placed in different solutions.

After 24 hours the eggs were weighed again.

Figure 11 shows the results.

| solution  | mass of the egg at the start in grams | mass of the egg after 24 hours in grams |
|-----------|---------------------------------------|---|
| tap water | 77                                    | 84                                      |
| 5% salt   | 77                                    | 77                                      |
| 10% salt  | 77                                    | 75                                      |

Figure 11

Evaluate the results of this investigation.

You should include calculations using the data in Figure 11.

(6)

(Total for question = 6 marks)

Q13.

Osmosis is one method that single-celled organisms, such as bacteria, use to obtain molecules from their environment.

Which of the following is a correct description of a process involving the transport of molecules?

(1)

- A Diffusion is used to transport molecules against the concentration gradient
- B Active transport is used to obtain molecules in a low concentration environment
- C Active transport moves substances along the concentration gradient
- D Diffusion uses energy to transport molecules into cells

(Total for question = 1 mark)

Q14.

Answer the question with a cross in the box you think is correct. If you change your mind about an answer, put a line through the box and then mark your new answer with a cross.

(i) Which of the following describes osmosis?

(1)

- A does not use energy to move water into cells
- B does not use energy to move glucose into cells
- C uses energy to move water into cells
- D uses energy to move glucose into cells

(ii) Animal cells will swell and burst when placed in a hypotonic solution.

Explain what happens to plant cells when they are placed in a hypotonic solution.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Mark Scheme

Q1.

| Question Number | Answer  | Mark         |
|-----------------|---|--------------|
| (i)             | To make the { cell / nucleus } more visible   | (1)<br>AO2 2 |
| Question Number | Answer  | Mark         |
| (ii)            | <p>D cell wall</p> <p><b>The only correct answer is D</b></p> <p><i>A is not correct because V is not a chloroplast</i></p> <p><i>B is not correct because V is not a vacuole</i></p> <p><i>C is not correct because V is not a nucleus</i></p> | (1)<br>AO1 2 |
| Question Number | Answer  | Mark         |
| (iii)           | <p>An explanation including two from:</p> <ul style="list-style-type: none"> <li>• water moved out of cell / cytoplasm (1)</li> <li>• by osmosis / definition of osmosis (1)</li> </ul>   | (2)<br>AO2 2 |

Q2.

| Question Number | Answer  | Additional Guidance                                   | Mark             |
|-----------------|---|---|------------------|
|                 | <p>Any two from the following:</p> <ul style="list-style-type: none"> <li>at any point between 0 to 0.33 {mass / water} is gained (1)</li> <li>from 0 to 0.33 the change in mass decreases (1)</li> <li>0.33 is where the concentration inside and outside (of the cell) is the same (1)</li> <li>above 0.33 {mass / water} is lost (1)</li> <li>from 0.33 to 1.0 the change in mass increases (1)</li> </ul> | accept 0.33 mol/dm <sup>3</sup> is the isotonic point | (2)<br>AO3 2a 2b |

Q3.

| Question number | Answer   | Mark         |
|-----------------|--|--------------|
|                 | <p>A diffusion</p> <p><b>The only correct answer is A</b></p> <p><i>B is incorrect because respiration is the release of energy from glucose.</i></p> <p><i>C is incorrect because osmosis is the movement of water, not alcohol.</i></p> <p><i>D is incorrect because protein synthesis is how proteins are made.</i></p> | (1)<br>AO1 1 |

Q4.

| Question number | Answer  | Additional guidance                                | Mark             |
|-----------------|---|--|------------------|
| (i)             | Substitution<br>3 ÷ 120 (1)<br><br>0.025 (mm) | award two marks for correct answer with no working | (2)<br><br>AO2 1 |

| Question number | Answer                     | Additional guidance                           | Mark          |
|-----------------|----------------------------|---|---------------|
| (ii)            | Repeat (the investigation) | accept compare with results from other groups | (1)<br>AO3 3b |

Q5.

| Question number | Answer   | Additional guidance | Mark         |
|-----------------|--|---------------------|--------------|
| (i)             | <ul style="list-style-type: none"> <li>Used as a control / to compare with the results of the other tubes</li> </ul> |                     | (1)<br>AO1.2 |

| Question number | Answer  | Mark         |
|-----------------|---|--------------|
| (ii)            | Any two variables from: <ul style="list-style-type: none"> <li>temperature (1)</li> <li>age / variety of potato (1)</li> <li>{size / volume / length / width / shape / mass / surface area} of chip (before investigation) (1)</li> <li>volume of solution (1)</li> <li>time left in solutions (1)</li> </ul> | (2)<br>AO1.2 |



| Question number | Answer   | Mark         |
|-----------------|--|--------------|
| (iii)           | <p>An explanation including:</p> <ul style="list-style-type: none"> <li>• There is a higher concentration of sodium chloride outside (the cell) than inside / higher concentration of water molecules inside (the cell) than outside (1)</li> <li>• water moves out of {cells / chips} / into (sodium chloride) solution (1)</li> <li>• by <u>osmosis</u> (1)</li> </ul> | (3)<br>AO1.2 |

Q6.

| Question Number | Answer   | Additional guidance  | Mark          |
|-----------------|--|--|---------------|
| (i)             | $(2 \times 5.0 \times 2.0) + (2 \times 5.0 \times 2.0) + (2 \times 2.0 \times 2.0)$ or $20 + 20 + 8$ (1)<br><br>48.0 | Allow full marks for correct final answer<br><br>accept 48 | (2)<br>AO 1 1 |

| Question Number | Answer   | Additional guidance                      | Mark                      |
|-----------------|--|--|---------------------------|
| (ii)            | <ul style="list-style-type: none"> <li>• chip B has greater surface area (1)</li> <li>• therefore <b>more</b> water {absorbed / moved into the potato chip} (1)</li> </ul> | accept chip B is bigger / has more cells | (2)<br>AO 3 2a<br>AO 3 2b |

| Question Number | Answer   | Additional guidance  | Mark                     |
|-----------------|--|--|--------------------------|
| (iii)           | <p>An explanation that links the following:</p> <ul style="list-style-type: none"> <li>(cells) lose water / become plasmolysed (1)</li> </ul> <p>followed by</p> <ul style="list-style-type: none"> <li>(water moves out) by <u>osmosis</u> (1)</li> <li>from a high concentration of water molecules (in the potato) to a low concentration of water molecules (in the solution) / through the partially permeable membrane (to the salt solution) (1)</li> </ul> | <p>accept get smaller/shrink/lose mass</p> <p>accept from low solute concentration to a high solute concentration</p> <p>accept from high to low water potential</p> | <p>(3)</p> <p>AO 1 1</p> |

Q7.

| Question Number | Answer  | Additional guidance  | Mark                    |
|-----------------|---|--|-------------------------|
| (i)             | <p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>a single result could be anomalous (1)</li> <li>to calculate a mean (1)</li> </ul> | <p>accept to see if the results are the same / similar</p> <p>ignore references to increasing accuracy</p> | <p>(1)</p> <p>AO1 2</p> |

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| Question Number | Answer  | Additional guidance   | Mark                                   |
|-----------------|---|---|--|
| (ii)            | <p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• measure the length / width of the carrot sticks (1)</li> <li>• cut sticks from the same carrot / same part of carrot (1)</li> <li>• use the same variety of carrot (1)</li> <li>• (surface) dry the carrot sticks before weighing (1)</li> </ul> | <p>accept other valid ways of improving this method, e.g. using more than three carrot sticks (1)</p> | <p><b>(2)</b></p> <p><b>AO3 3b</b></p> |

| Question Number | Answer  | Additional guidance   | Mark                                  |
|-----------------|---|---|---------------------------------------|
| (iii)           | <p>substitution<br/>(0.8 ÷ 4.2) x 100 (1)</p> <p>evaluation<br/>19.048 (1)</p> <p>2 significant figures</p> <p>19 (%)</p> | <p>full marks for correct answer without any working</p> <p>accept 19.0476 / 19.05 (2)</p> <p>award one mark for rounding an incorrectly calculated answer to 2 significant figures</p> | <p><b>(3)</b></p> <p><b>AO2 1</b></p> |

| Question Number | Answer  | Mark                               |
|-----------------|---|------------------------------------|
| (iv)            | <p>An explanation linking any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>the carrot sticks gained mass (1)</li> <li>because water moved into the carrot (cells) (1)</li> <li>by <b>osmosis</b> / description of osmosis (1)</li> </ul> | <p>(2)</p> <p><b>A03 2a 2b</b></p> |

Q8.

| Question number | Answer   | Additional guidance  | Mark                     |
|-----------------|--|--|--------------------------|
|                 | <p>A logical plan including three from the following:</p> <ul style="list-style-type: none"> <li>heat (hydrochloric) acid to different temperatures (1)</li> <li>use same size agar jelly cubes (1)</li> <li>use same volume/ concentration of acid (1)</li> <li>for same amount of time (1)</li> <li>measure clear distance (from outside of cube) at each temperature (1)</li> </ul> | <p>accept heat agar jelly cubes to different temperatures</p> <p>ignore amount of acid</p> <p>accept for 2 marks<br/>time how long for agar jelly to go clear<br/>(mp 4 and 5)</p> | <p>(3)</p> <p>A03 3a</p> |

Q9.

| Question number | Answer  | Mark                           |
|-----------------|---|--------------------------------|
|                 | <p>C diffusion</p> <p><b>The only correct answer is C</b></p> <p><i>A is not correct because oxygen does not move into and out of cells by transpiration</i></p> <p><i>B is not correct because oxygen does not move into and out of cells by active transport</i></p> <p><i>D is not correct because oxygen does not move into and out of cells by osmosis</i></p> | <p><b>(1)</b></p> <p>AO1 1</p> |

Q10.

| Question number | Answer   | Mark                                  |
|-----------------|--|---------------------------------------|
|                 | <p>A against a concentration gradient using energy</p> <p><b>The only correct answer is A</b></p> <p><i>B is not correct because active transport is not down a concentration gradient using energy</i></p> <p><i>C is not correct because active transport is not against a concentration gradient without using energy</i></p> <p><i>D is not correct because active transport is not down a concentration gradient without using energy</i></p> | <p><b>(1)</b></p> <p><b>AO1 1</b></p> |

Q11.

| Question Number | Answer  | Additional guidance  | Mark                    |
|-----------------|---|--|-------------------------|
|                 | <p>A description including <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• (dissolved) in water (1)</li> <li>• diffusion through the root (1)</li> <li>• (so water moves) through the xylem (1)</li> <li>• by transpiration (stream) (1)</li> <li>• into leaves by diffusion (1)</li> </ul> | <p>accept active transport through the plant</p> <p>reject phloem</p> <p>accept evaporated from the leaves</p> | <p>(2)</p> <p>AO2 1</p> |

Q12.

| Question Number | Indicative content   | Mark |
|-----------------|--|------|
| *               | <p style="text-align: center;"><b>AO2 3 marks/AO3 3 marks</b></p> <p><b>Analysis of data</b></p> <ul style="list-style-type: none"> <li>• the egg in the water has gained mass / water</li> <li>• the egg in the 5% salt has no mass change</li> <li>• the egg in the 10% salt has lost mass / water</li> <li>• mass increase is 7 g for the egg in water</li> <li>• mass increase is 0 g for 5% salt</li> <li>• the mass decrease is 2g for 10% salt</li> <li>• % mass change +9% / 0% / -3%</li> </ul> <p><b>Water movement</b></p> <ul style="list-style-type: none"> <li>• osmosis is the movement of water</li> <li>• across a partially permeable membrane</li> <li>• from a high concentration of water molecules to a low concentration of water molecules</li> <li>• 5% salt is an isotonic solution</li> </ul> | (6)  |

| Level   | Mark | Descriptor  |
|---------|------|---|
|         | 0    | No rewardable material.   |
| Level 1 | 1-2  | <ul style="list-style-type: none"> <li>• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail.</li> <li>• Presents an explanation with some structure and coherence.</li> </ul>   |
| Level 2 | 3-4  | <ul style="list-style-type: none"> <li>• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed.</li> <li>• Presents an explanation that has a structure which is mostly clear, coherent and logical.</li> </ul> |
| Level 3 | 5-6  | <ul style="list-style-type: none"> <li>• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed.</li> <li>• Presents an explanation that has a well-developed structure which is clear, coherent and logical.</li> </ul>                       |

## Additional Guidance

|         |     |   |
|---------|-----|---|
| Level 1 | 1-2 | <ul style="list-style-type: none"> <li>• a brief analysis of the experimental data.</li> <li>• with reference to the movement of water.</li> </ul>  |
| Level 2 | 3-4 | <ul style="list-style-type: none"> <li>• an evaluation of the data including a calculation of mass gain or loss.</li> <li>• with reference to the direction of movement of the water for tap water or 10% salt.</li> </ul>          |
| Level 3 | 5-6 | <ul style="list-style-type: none"> <li>• a detailed evaluation of the data including a % mass change calculation.</li> <li>• with reference to the direction of movement of water by osmosis for tap water and 10% salt.</li> </ul> |

Q13.

| Question number | Answer | Mark |
|-----------------|--------|------|
|                 | B      | (1)  |

Q14.

| Question number | Answer   | Mark |
|-----------------|--|------|
| (i)             | A does not use energy to move water into cells | (1)  |

| Question number | Answer  | Mark |
|-----------------|---|------|
| (ii)            | <p>An explanation that combines identification – amplification of knowledge (2 mark) and reasoning / justification – application of understanding (1 mark):</p> <ul style="list-style-type: none"> <li>• water moves into the plant cell (1)</li> <li>• by osmosis / (water moves) into the vacuole (1)</li> <li>• causing the cell to become turgid / the cell wall prevents the cell from bursting (1)</li> </ul> | (3)  |