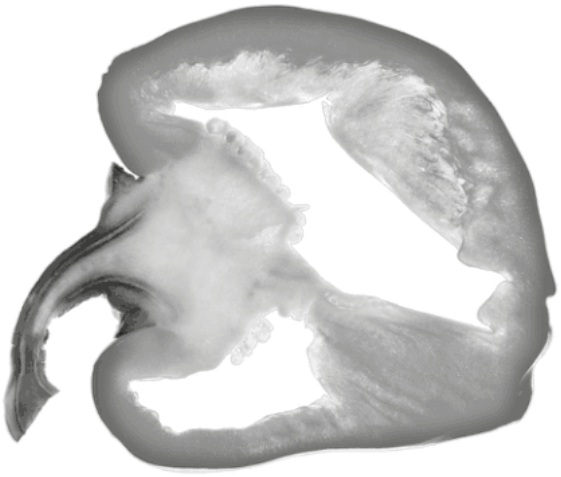
# PAG 8 Transport in and out of Cells: OCR A Level Biology Exam Questio

18 questions · 39 marks · about 47 minutes. Answer in the spaces, then check the mark schemes at the end.

**Question 1 · A level Paper 3 · June 2025 · Q5(a) · 1 mark**

**5** A student investigates water potential in the cells of a bell pepper, *Capsicum annuum*.

A slice of bell pepper is shown in the image.



The student:

- prepares several concentrations of sucrose solution
- cuts pieces of pepper and records the mass of each piece
- places pieces of pepper in each sucrose solution
- removes the pieces after 30 minutes and dries them
- records the mass of each piece.

**(a)** The student makes sucrose solutions of different concentrations by diluting a stock solution.

State a piece of equipment, with a higher resolution than a measuring cylinder, that the student should use to transfer solutions during the dilution procedure.

..... **[1]**


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**Question 2 · A level Paper 1 · June 2022 · Q18(a)(i) · 3 marks**

**18** A student investigated osmosis in plant cells.

They used cylinders of potato cut with a cork borer and measured the change in length of the cylinders after they were placed in sucrose solutions and left overnight.

**(a)** The student was given 100 $cm^3$ of a solution of 1 mol $dm^{-3}$ sucrose and asked to prepare 30 $cm^3$ of each dilution.

**(i)** Complete **Table 18.1** to show how the student should prepare the solutions.

| Final concentration of solution (mol $dm^{-3}$) | Volume of 1 mol $dm^{-3}$ sucrose solution ($cm^3$) | Volume of distilled water ($cm^3$) | Final volume ($cm^3$) |
|---|---|---|---|
| 1.0 | | | 30.0 |
| 0.8 | | | 30.0 |
| 0.6 | | | 30.0 |
| 0.4 | | | 30.0 |
| 0.2 | | | 30.0 |
| 0.0 | | | 30.0 |

**Table 18.1**

**[3]**


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**Question 3 · AS Paper 1 · June 2024 · Q21(c) · 2 marks**

**(c)** The students prepared the sucrose concentrations using a serial dilution technique. The students were provided with 10 $cm^3$ of a 0.8 mol $dm^{-3}$ sucrose concentration.

Describe how the students produced 0.4, 0.2 and 0.1 mol $dm^{-3}$ sucrose concentrations each with a volume of 10 $cm^3$.

.....

.....

.....

.....

..... **[2]**

Turn over


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**Question 4 · A level Paper 1 · June 2022 · Q18(b)(i) · 1 mark**

**(b)** The student's results are shown in **Table 18.2**.

| Concentration of sucrose ($mol\,dm^{-3}$) | Length of potato cylinder (mm) | | | Percentage change in length (%) | Mean percentage change in length (%) |
|---|---|---|---|---|---|
| | initial | final | change | | |
| **1.0** | 49.5 | 48.0 | –1.50 | –3.0% | –3.4% |
| | 50.5 | 49.0 | –1.50 | –3.0% | |
| | 49.0 | 47.0 | –2.00 | –4.1% | |
| **0.8** | 49.0 | 48.0 | –1.00 | –2.0% | –2.6% |
| | 50.5 | 49.5 | –1.00 | –2.0% | |
| | 51.0 | 49.0 | –2.00 | –3.9% | |
| **0.6** | 50.0 | 50.5 | 0.50 | 1.0% | 0.3% |
| | 51.0 | 51.0 | 0.00 | 0.0% | |
| | 50.5 | 50.5 | 0.00 | 0.0% | |
| **0.4** | 50.5 | 51.5 | 1.00 | 2.0% | 0.7% |
| | 49.5 | 51.0 | 1.50 | 3.0% | |
| | 51.0 | 49.5 | –1.50 | –2.9% | |
| **0.2** | 50.0 | 52.0 | 2.00 | 4.0% | 4.3% |
| | 50.5 | 52.5 | 2.00 | 4.0% | |
| | 49.5 | 52.0 | 2.50 | 5.1% | |
| **0.0** | 49.5 | 52.0 | 2.50 | 5.1% | 4.4% |
| | 49.0 | 51.0 | 2.00 | 4.1% | |
| | 50.0 | 52.0 | 2.00 | 4.0% | |

**Table 18.2**

The student was told that one of their results was anomalous.

**(i)** Identify the anomalous result.

..... **[1]**


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**Question 5 · A level Paper 1 · June 2022 · Q18(b)(ii) · 2 marks**

**(ii)** State **one** variable that should be controlled in this experiment and give a reason for your choice.

Control variable .....

Reason .....

.....

.....

**[2]**

Turn over


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**Question 6 · AS Paper 1 · June 2024 · Q21(a) · 2 marks**

**21** A group of students are investigating osmosis in plant cells.

This is the method they use:

- Use a cork borer to cut cylinders of sweet potato to 30 mm in length.
- Dry each cylinder using a paper towel and record its mass.
- Prepare 5 $cm^3$ of sucrose concentrations of 0.0, 0.1, 0.2, 0.4 and 0.8 mol $dm^{-3}$ in test tubes.
- Place one cylinder into each test tube.
- Leave test tubes at room temperature for 48 hours.
- Remove each cylinder, dry using a paper towel and record its mass.
- Repeat the experiment three times at each sucrose concentration.
- Calculate the percentage change in mass for each cylinder.

The table shows the processed results obtained by the students.

| Sucrose concentration / (mol $dm^{-3}$) | Percentage change in mass | | | | Mean percentage change in mass |
|---|---|---|---|---|---|
| | Replicate 1 | Replicate 2 | Replicate 3 | Replicate 4 | |
| 0.0 | +30.3 | +25.5 | +28.8 | +29.2 | +28.5 |
| 0.1 | +23.3 | +25.5 | +10.3 | +22.2 | +20.3 |
| 0.2 | +12.7 | +14.4 | +14.8 | +12.3 | +13.6 |
| 0.4 | +2.7 | +4.3 | +4.4 | +2.9 | +3.6 |
| 0.8 | –13.9 | –10.9 | –12.5 | –12.8 | –12.5 |

**(a)** Explain the difference between the mean results obtained at the 0.0 mol $dm^{-3}$ and 0.8 mol $dm^{-3}$ sucrose concentrations.

.....

.....

.....

.....

..... **[2]**


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**Question 7 · AS Paper 1 · June 2024 · Q21(d) · 2 marks**

**(d)** The students carried out a similar experiment with carrot tissue.

Explain how the students could use their data to estimate whether sweet potato tissue or carrot tissue had a higher sucrose concentration in its cells.

.....

.....

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.....

..... **[2]**


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**(c)** A group of students used the following method to investigate osmosis in plant cells.

- Cut pieces of plant material of equal surface area ensuring no skin is present.
- Rinse to remove cell debris.
- Gently pat the plant pieces dry with a paper towel.
- Weigh each piece and record mass.
- Put the plant piece in a 200 $cm^3$ beaker.
- Cover plant piece with 50 $cm^3$ of sucrose solution.
- Use sucrose solutions of 0, 0.1, 0.3, 0.5, 0.7 mol $dm^{-3}$.
- Leave for 24 h.
- Remove the piece of plant material.
- Dry carefully using a paper towel.
- Weigh the plant piece and record the mass.
- Calculate the percentage change in mass for each piece.
- Repeat twice for each sucrose concentration.

The students investigated material from three different plants: carrot, courgette and potato. Their results are shown in Table 16.

| Plant | Sucrose concentration / mol $dm^{-3}$ | Percentage change in mass | | | |
|---|---|---|---|---|---|
| | | Replicate 1 | Replicate 2 | Replicate 3 | Mean |
| Carrot | 0 | + 6.0 | + 5.8 | + 5.8 | + 5.87 |
| | 0.1 | + 4.2 | + 4.1 | + 4.3 | + 4.20 |
| | 0.3 | +1.5 | +1.5 | +1.3 | + 1.43 |
| | 0.5 | – 2.4 | – 2.3 | – 2.1 | – 2.27 |
| | 0.7 | – 6.3 | – 6.1 | – 6.3 | – 6.23 |
| Courgette | 0 | + 7.9 | + 7.8 | + 7.6 | + 7.77 |
| | 0.1 | + 5.5 | + 5.5 | + 5.5 | + 5.50 |
| | 0.3 | + 1.9 | + 1.8 | + 2.0 | + 1.90 |
| | 0.5 | – 1.2 | – 1.4 | – 1.1 | – 1.23 |
| | 0.7 | – 4.3 | – 4.4 | – 4.1 | – 4.27 |
| Potato | 0 | + 5.7 | + 5.8 | + 5.7 | + 5.77 |
| | 0.1 | + 3.1 | + 2.9 | + 3.0 | + 3.00 |
| | 0.3 | – 0.3 | – 0.4 | – 0.6 | – 0.43 |
| | 0.5 | – 2.4 | – 2.2 | – 2.5 | – 2.37 |
| | 0.7 | – 6.1 | – 5.9 | – 5.1 | – 5.70 |

**Table 16**

**(i)** Explain why it was necessary to calculate **percentage** change in mass.

.....

.....

.....

..... **[2]**


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**Question 9 · A level Paper 2 · June 2019 · Q16(c)(ii) · 2 marks**

**(ii)** The students identified replicate 3 of the potato in 0.7 mol $dm^{-3}$ sucrose as anomalous.

Suggest a practical error by the students that might have caused this result to be anomalous and explain the likely effect of this error.

.....

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.....

.....

..... **[2]**


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## SECTION B

Answer **all** the questions.

**21** A student investigated the effects of different solutions on pieces of potato tissue. Six potato rods were prepared with a cork borer. The student trimmed them to a length of exactly 5 cm.

After treatment, the six rods were placed in test tubes and submerged in either sucrose solution or distilled water.

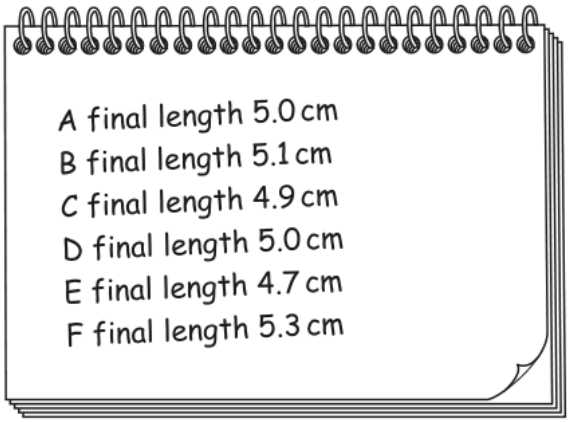
The treatment and liquid added to each potato rod is shown in Table 21 below.

| Potato rod | Treatment | Liquid added |
|---|---|---|
| A | boiled in water for 5 minutes | 1 mol $dm^{-3}$ sucrose solution |
| B | boiled in water for 5 minutes | distilled water |
| C | soaked in ethanol for 5 minutes | 1 mol $dm^{-3}$ sucrose solution |
| D | soaked in ethanol for 5 minutes | distilled water |
| E | untreated | 1 mol $dm^{-3}$ sucrose solution |
| F | untreated | distilled water |

**Table 21**

After 30 minutes, the rods were removed from the tubes and their lengths measured.

The student recorded the results on a piece of scrap paper, shown below.




**15**

**(a)** In the space below, present the student's results in an appropriate format.


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**Question 10 · AS Paper 1 · June 2019 · Q21(b)(i) · 2 marks**

**(b) (i)** Explain how the treatment results in the difference in the final lengths of rod **A** and rod **E**.

.....

.....

.....

.....

..... **[2]**

**Question 11 · AS Paper 1 · June 2019 · Q21(b)(ii) · 2 marks**

**(ii)** Explain how the treatment results in the difference in the final lengths of rod **D** and rod **F**.

.....

.....

.....

.....

..... **[2]**


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**Question 12 · AS Paper 2 · June 2022 · Q1(a) · 4 marks**

**1** The cells in beetroot contain a red pigment called betalain. The plasma membrane of the beetroot cell is impermeable to betalain.

A group of students set out to investigate how temperature affects the structure and permeability of the plasma membrane of beetroot cells. The method they used is shown below.

- Cut some pieces of beetroot.
- Place them in a flask containing 100 $cm^3$ of distilled water.
- Stand this flask in a water bath and increase the temperature at 10 °C intervals.
- Take a sample of water from the flask 5 minutes after each new temperature is reached.
- Measure the absorbance of the water samples taken using a blue filter in the colorimeter.

**(a)** A second group of students made improvements to this method. One of the improvements they made was to carry out two further trials at each temperature.

Suggest **two** further improvements they could have made **and** give a reason for the improvements you have suggested.

Improvement and reason 1

.....

.....

.....

Improvement and reason 2

.....

.....

.....

**[4]**

**Question 13 · AS Paper 2 · June 2024 · Q3(c)(i) · 2 marks**

**(c)** Students used a model cell to investigate the effect of temperature on the rate of diffusion across membranes.

They were provided with:

- a calibrated colorimeter
- a calibration curve
- Benedict's solution and all the apparatus required to carry out a Benedict's test
- glucose solution
- dialysis tubing.

**(i)** Name **two** more pieces of apparatus they would need to make sure this is a controlled investigation.

1 .....

2 .....

**[2]**


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**Question 14 · AS Paper 2 · June 2024 · Q3(c)(ii) · 4 marks**

**(ii)** Outline the method that the students would use to carry out an investigation into the effect of **temperature** on the diffusion rate in their model cells.

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..... **[4]**


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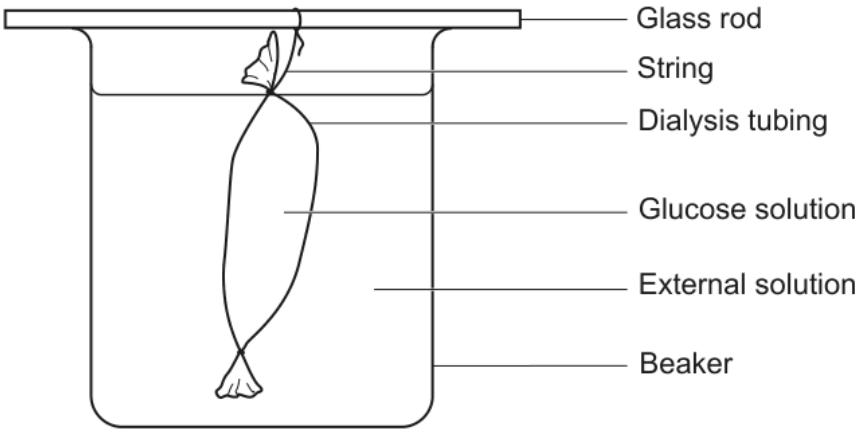
**2**

**(a)** Students use a model cell to investigate the effect of the thickness of the exchange surface membrane on the rate of diffusion across the membrane.

The students are provided with dialysis tubing of different thicknesses, grade 1, grade 3 and grade 5, where grade 5 is the thickest.

They set up the apparatus as shown.

The students remove a sample of the external solution at 30 second intervals and determine the concentration of glucose (mmol $dm^{-3}$) in the sample.




The table shows their results.

| Grade of dialysis tubing | Concentration of glucose found in the samples of external solution taken at 30 s intervals (mmol $dm^{-3}$) | | | | |
|---|---|---|---|---|---|
| | **0 s** | **30 s** | **60 s** | **90 s** | **120 s** |
| 1 | 0.00 | 1.31 | 2.52 | 3.59 | 4.80 |
| 3 | 0.00 | 0.82 | 2.24 | 2.39 | 3.31 |
| 5 | 0.00 | 0.31 | 0.64 | 0.96 | 1.22 |

**5**

**(i)** Identify the independent variable **and** the dependent variable in this experiment.

Independent variable

.....

.....

Dependent variable

.....

**[2]**


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**Question 16 · AS Paper 2 · June 2025 · Q2(a)(ii) · 2 marks**

**(ii)** Suggest **two** improvements to this experiment to increase the accuracy of the results.

Improvement 1 .....

.....

Improvement 2 .....

.....

**[2]**

**Question 17 · AS Paper 2 · June 2025 · Q2(a)(iii) · 2 marks**

**(iii)** Suggest a conclusion that can be drawn from the data in the table.

You should give evidence to support your conclusion.

.....

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.....

.....

..... **[2]**

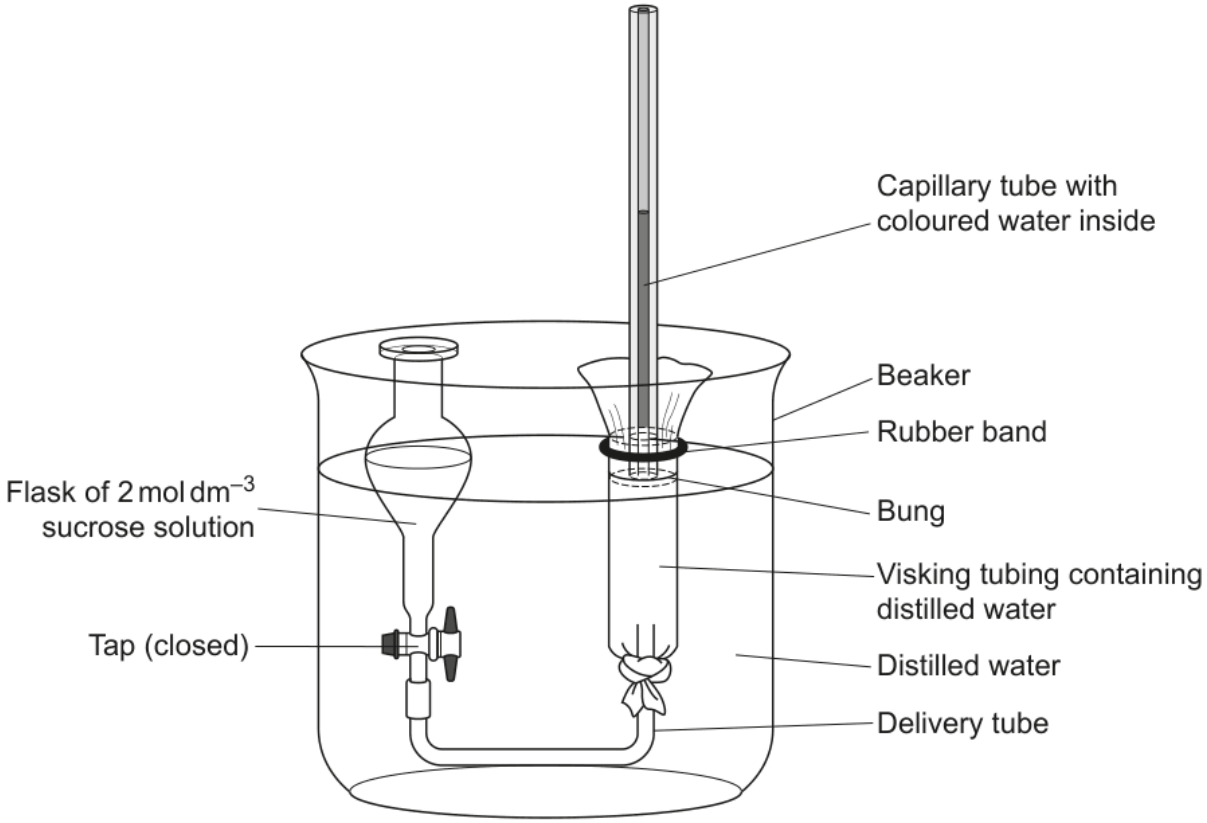

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**Question 18 · information from earlier in the question**

**24** A student is investigating how sucrose is loaded into phloem sieve tubes by companion cells, using a model of phloem tissue.

To create the model, the student added distilled water to a bag made from Visking tubing (an artificial partially permeable membrane). They inserted a capillary tube into one end of the Visking tubing and connected the other end to a flask containing 2 mol $dm^{-3}$ sucrose solution.

They placed the Visking tubing and connected flask into a beaker of distilled water, as shown in the diagram.




The capillary tube, the flask and the beaker of distilled water represent plant tissues involved in the active loading of sucrose. The Visking tubing represents the cell surface membrane of the phloem sieve tube.

The student opens the tap on the flask and the level of the coloured water in the capillary remains the same. After a few minutes, the water level in the capillary tube starts to rise. The tap is then closed after 5 minutes.

**(a) (i)** Describe what happens inside the model, immediately after the tap on the flask is opened.

.....

..... **[1]**


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**Question 18 · AS Paper 1 · June 2022 · Q24(a)(ii) · 2 marks**

**(ii)** Explain why the water level in the capillary tube starts to rise after a few minutes.

.....

.....

.....

.....

..... **[2]**


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## Mark schemes

**Question 1 · A level Paper 3 · June 2025 · Q5(a) · 1 mark**

| | | | | |
|---|---|---|---|---|
| 5 | (a) | micropipette / graduated pipette ✓ | 1 | 3.3 |

**ALLOW** volumetric pipette / syringe / calibrated pipette

**ALLOW** burette / volumetric flask

**IGNORE** 'pipette' unqualified / glass pipette / bulb pipette

**IGNORE** conical flask


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**Question 2 · A level Paper 1 · June 2022 · Q18(a)(i) · 3 marks**

**18 (a) (i)**

| Final concentration of solution (mol $dm^{-3}$) | Volume of 1 mol $dm^{-3}$ sucrose solution ($cm^3$) | Volume of distilled water ($cm^3$) | Final volume ($cm^3$) |
|---|---|---|---|
| 1.0 | 30.0 | 0.0 | 30.0 |
| 0.8 | 24.0 | 6.0 | 30.0 |
| 0.6 | 18.0 | 12.0 | 30.0 |
| 0.4 | 12.0 | 18.0 | 30.0 |
| 0.2 | 6.0 | 24.0 | 30.0 |
| 0.0 | 0.0 | 30.0 | 30.0 |

both columns correct with values given to **one** d.p. ✓ ✓ ✓

| | | |
|---|---|---|
| **3** | 2.4 | **ALL 12 values i.e. both columns must be correct and to 1 decimal place for 3 marks**<br><br>**ALLOW for 2 marks**<br>All 12 values correct but incorrect number of decimal places<br><br>**ALLOW for 1 mark**<br>One column with correct values regardless of d.ps i.e. either volume of sucrose or volume of distilled water |


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**Question 3 · AS Paper 1 · June 2024 · Q21(c) · 2 marks**

| | |
|---|---|
| **(c)** | add 5 $cm^3$ of 0.8 (mol $dm^{-3}$) sucrose (concentration) to 5 $cm^3$ of (distilled) water ✓<br><br>idea of take contents from previous tube and add to next tube with (distilled) water ✓<br><br>*ref to* shake(ing) / mix(ing) contents ✓ |

| | |
|---|---|
| **2 max** | **ALLOW** annotated diagram<br>**ALLOW** ml in place of $cm^3$<br><br>**ALLOW** 'half the 0.8 (mol $dm^{-3}$) and fill to 10$cm^3$ distilled water'<br>**ALLOW** '(10$cm^3$) 0.8 (mol $dm^{-3}$) sucrose (concentration) plus 10$cm^3$ (distilled) water<br><br>**IGNORE** 'repeat these steps' unqualified<br><br>**ALLOW** 'and mix it' / stir(ring) |

**Question 4 · A level Paper 1 · June 2022 · Q18(b)(i) · 1 mark**

| | | | |
|---|---|---|---|
| **18** | **(b)** | **(i)** | -1.5(0) / 3rd replicate / 3rd repeat , at 0.4 (mol $dm^{-3}$ )<br><br>**OR**<br><br>-2.9% ✓ |

| | | |
|---|---|---|
| **1** | 2.8 | **If value not circled in the table, response must include 0.4 (mol $dm^{-3}$)**<br>**ALLOW** anomalous result circled in the table<br>**ALLOW** any value in the 3rd replicate row for 0.4<br>**IGNORE** 0.7% |


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**Question 5 · A level Paper 1 · June 2022 · Q18(b)(ii) · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| 18 | (b) | (ii) | **Any two marks** for **one** variable **and one** explanation | **2** | 3.3 |

**V1** temperature ✓

**E1** (because temperature) affects the rate of , diffusion / osmosis ✓

**OR**

**V2** type / variety / species / age , of potato ✓

**E2** (because potatoes have) different , density / water potential / AW ✓

**OR**

**V3** ensure enough solution to fully immerse potato cylinders / AW ✓

**E3** so osmosis occurs across the whole surface of the cylinder ✓

**variable (V) and explanation (E) must match**
**DO NOT ALLOW** two variables or two explanations
**DO NOT ALLOW** shape as the question stem says 'cylinders'

**E1 ALLOW** temperature affects kinetic energy (of molecules)
**E1 ALLOW** (temperature) changes **or** affects permeability of membranes

**V2 ALLOW** use peeled potato
**V2 ALLOW** same potato


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**Question 6 · AS Paper 1 · June 2024 · Q21(a) · 2 marks**

| | | |
|---|---|---|
| **21** | **(a)** | *mean gain in mass*<br>(solution at) 0.0 (mol $dm^{-3}$) has a higher water potential than inside the (sweet potato) cells ✓<br><br>*mean loss in mass*<br>(solution at) 0.8 (mol $dm^{-3}$) has a lower water potential than inside the (sweet potato) cells ✓<br><br>correct ref to water moving via osmosis ✓ |

| | |
|---|---|
| **2 max** | **ALLOW** symbol for water potential throughout<br>**IGNORE** solute potential<br>**IGNORE** concentration of water<br><br>**DO NOT ALLOW** greater for higher MP1 & MP2<br>**IGNORE** along water potential gradient MP1 & MP2<br>**ALLOW** ORA with correct direction of water movement MP1 & MP2<br>**ALLOW** down water potential gradient MP1 & MP2 |


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**Question 7 · AS Paper 1 · June 2024 · Q21(d) · 2 marks**

| | | | |
|---|---|---|---|
| | **(d)** | | plot a graph of sucrose concentration against (percentage) change in mass **AND** draw a line of best fit (for both plant tissues) ✓<br><br>identify the sucrose concentration via where, the line crosses the x axis / the x intercept is / there is zero percentage change ✓<br><br>higher concentration of x intercept = higher sucrose concentration in cells ✓<br><br>reference to qualitative interpretation of data ✓ |
| | | | **Total** |

| Question | Answer |
|---|---|
| **2 max** | **ALLOW** answer in form of sketched and labelled graph<br><br>**IGNORE** ref to isotonic point unless qualified for MP2 and MP3<br><br>e.g. estimate the sucrose concentration where percentage mass change is zero.<br>e.g. see if higher mass increase was observed indicating more water had entered due to a higher concentration of sucrose being present |
| **9** | |

| Marks | Guidance |
|---|---|

**Question 8 · A level Paper 2 · June 2019 · Q16(c)(i) · 2 marks**

| | | | |
|---|---|---|---|
| **(c)** | **(i)** | different (starting) masses (of plant pieces) ✓<br><br>allows comparison (between plant pieces of different mass) ✓ | **2** |

**ALLOW** different weights
**IGNORE** to remove effect of starting mass


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**Question 9 · A level Paper 2 · June 2019 · Q16(c)(ii) · 2 marks**

| (ii) | 2 max |
|---|---|
| | inadequate drying ✓<br>(so) more mass / heavier (than other pieces) ✓<br><br>piece cut from different (part of) potato ✓<br>(so) cells might have different water potential (at start) ✓ |

**IGNORE** references to measuring errors

**CREDIT only** 1 limitation and corresponding explanation

**Question 10 · AS Paper 1 · June 2019 · Q21(b)(i) · 2 marks**

| (b) (i) | 2 |
|---|---|
| | boiling, damages / AW, plasma / cell surface, membrane ✓<br><br>(therefore) no, osmosis / (net) movement of water, out of A, but water moves out of E<br>**OR**<br>AW ✓ |

Examples of AW: disrupts / destroys / melts / denatures proteins in

Note: needs a comment about both A & E for this mark

**Question 11 · AS Paper 1 · June 2019 · Q21(b)(ii) · 2 marks**

| (b) (ii) | 2 |
|---|---|
| | ethanol dissolves phospholipid (bilayer) ✓<br><br>(therefore) no, osmosis / (net) movement of water into D, but water moves into F<br>**OR**<br>AW✓ |

Note: needs a comment about both D & F for this mark


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**Question 12 · AS Paper 2 · June 2022 · Q1(a) · 4 marks**

| | | |
|---|---|---|
| 1 | (a) | *any two **I** marks and matching **R** marks:*<br>*If an I mark is just missed (e.g. for **I1** answer says weight instead of mass) can still give the matching reason mark **R1***<br><br>**I1** same, number / size / mass / volume (of pieces) ✓<br><br>**R1** to control / same, surface area ✓<br><br>**I2** pieces from same beetroot **OR** pieces from same, part / depth / variety, of beetroot ✓<br>**R2** to control / same, pigment concentration ✓<br><br>**I3** rinse / wash / wipe / dry, pieces ✓<br>**R3** to remove pigment released by, cutting / cell damage ✓<br><br>**I4** use, one / new, flask / tube, per, temperature / repeat ✓<br><br>**R4** to, test effect of / get absorbance for, one / single, temperature ✓ |

| | | |
|---|---|---|
| **4 max** | AO 3.3 | **ALLOW** cubes / discs / cylinders / strips / rectangles / chips / samples / beetroot, for 'pieces' throughout<br>**ALLOW** betalain for 'pigment' throughout<br><br>**I1 ALLOW** cork borer cylinders of same length<br>**I1 IGNORE** weight for 'mass'<br>**R1 ALLOW** same, surface area to volume ratio / SA:V<br>**ALLOW I1** 'same surface area' **+ R1** 'surface area affects rate of pigment loss' for 2 marks<br>**I2 ALLOW** plant for 'beetroot'<br>**I2 ALLOW** species for 'variety'<br>**R2 ALLOW** *idea of* pigment concentration varies / AW<br><br>**R3 ALLOW** to avoid artificially high absorbance reading<br><br>**I4 ALLOW** add pieces when temperature reached<br>**I4 ALLOW** different / new / fresh, pieces for each, temperature / repeat<br>**R4 ALLOW** so pieces experience a single temperature / so pieces not affected by previous temperature **OR** as used / old, pieces damaged by high temperatures / AW |

**Question 13 · AS Paper 2 · June 2024 · Q3(c)(i) · 2 marks**

| | | | | |
|---|---|---|---|---|
| (c) | (i) | stopwatch / timer ✓<br>thermometer / water bath ✓<br>measuring cylinder / pipette / syringe ✓<br>ruler ✓ | **max 2** | **IGNORE** beaker |


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**Question 14 · AS Paper 2 · June 2024 · Q3(c)(ii) · 4 marks**

| | |
|---|---|
| **(ii)** | **1** add glucose (solution) to the, dialysis tubing / model cell ✓<br>**2** knot / secure dialysis tubing, before / after, addition of glucose ✓ |
| | **3** place (tubing) in a water bath and remove sample (around tubing) at, certain / specified / set, time interval(s) ✓<br>**4** add Benedict's (solution) to sample to test for glucose ✓<br>**5** use colorimeter to obtain, absorption / transmission, values ✓<br>**6** use calibration curve to estimate the concentration of glucose ✓<br>**7** repeat at / use, different temperatures ✓ |

| | |
|---|---|
| **max 4** | **ALLOW** Visking tubing for dialysis tubing throughout<br>**1 ALLOW** tubing containing glucose (solution) |
| | **3 ALLOW** glucose solution for 'sample'<br>**3 IGNORE** remove sample from inside the dialysis tubing<br>**3 ALLOW** dialysis tubing added to, test tube/beaker, of water<br>**4 IGNORE** adding Benedict's to the dialysis tubing<br>**4 ALLOW** look at colour with Benedicts to see how much glucose is present |


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**Question 15 · AS Paper 2 · June 2025 · Q2(a)(i) · 2 marks**

| | | | | | |
|---|---|---|---|---|---|
| 2 | (a) | (i) | *Independent variable*<br>grade / thickness, of (dialysis) tubing ✓<br><br>*Dependent variable*<br>concentration of glucose (found in the external bathing solution samples taken at 30s intervals) ✓ | 2 | 2.7 |

**IGNORE** 'membrane' in place of (dialysis) tubing

**IGNORE** 'conc.' in place of concentration

**Question 16 · AS Paper 2 · June 2025 · Q2(a)(ii) · 2 marks**

| | |
|---|---|
| (ii) | repeated investigation, with wider range of grade(s) of dialysis tubing<br>**OR**<br>repeat investigation, with larger number of grade(s) of tubing within the range ✓<br><br>carry out investigation in (thermostatically controlled) water bath (to control temperature) / AW ✓<br><br>repeat the investigation, and calculate a mean (concentration of glucose in external solution) ✓ |

| | | |
|---|---|---|
| 2 | 3.4 | **ALLOW** repeat investigation, with named example(s) of wider range e.g. 7, 9, 11<br><br>**ALLOW** repeat investigation, with named example(s) of smaller increments within the existing range e.g. 2, 3, 4 etc |


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**(iii)** the thick**er** the tubing / high**er** the tubing grading, the slow**er** (the rate of) diffusion across the membrane ✓

any correct comparison using **TWO** sets of figures with **both** sets of appropriate units ('s' for time & 'mmol $dm^{-3}$' for concentration of glucose) ✓

| Grade of dialysis tubing | Concentration of glucose found in the samples of external solution taken at 30 s intervals (mmol $dm^{-3}$) | | | | |
|---|---|---|---|---|---|
| | 0 s | 30 s | 60 s | 90 s | 120 s |
| 1 | 0.00 | 1.31 | 2.52 | 3.59 | 4.80 |
| 3 | 0.00 | 0.82 | 2.24 | 2.39 | 3.31 |
| 5 | 0.00 | 0.31 | 0.64 | 0.96 | 1.22 |

**2 3.2** MP1 must be comparative

**ALLOW** 'the higher grading tubing, the longer it takes for glucose to diffuse across (the membrane)'

**ALLOW** '4.8' in place of '4.80' mmol $dm^{-3}$

Correct comparison or calculated difference referring to both time interval(s) **AND** glucose concentration(s) with both respective units

e.g.

*because at grade 5 only 1.30 mmol $dm^{-3}$ of glucose had diffused across in 120s, whereas at grade 1, 4.9 mmol $dm^{-3}$ of glucose had diffused across **ORA***

*because at grade 3 an additional 2.09 mmol $dm^{-3}$ of glucose had diffused across in 120s, compared to grade 5.*


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| | | |
|---|---|---|
| **24** | **(a)** **(ii)** | water potential inside the Visking tubing is reduced ✓<br><br>(water potential inside the Visking tubing) is lower than the water potential in the beaker ✓<br><br>(so) water moves, by osmosis / down water potential gradient, into the Visking tubing ✓<br><br>pushing water into the capillary ✓ |

| | |
|---|---|
| Max 2 | **ALLOW** pushing / moving, coloured water up |


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