AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.3.2

Osmosis

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**6**
Available paper years	**2013–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.1.3.2 Osmosis

Answer 01 · Mark scheme

June 2013 | BL3HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	solution in soil is more dilute (than in root cells)	concentration of water higher in the soil (than in root cells)	1
	so water moves from the dilute to the more concentrated region	so water moves down (its) concentration gradient **or** water moves from a high concentration of water to a lower concentration	1
	concentration of ions in soil less (than that in root cells)		1
	so energy needed to move ions **or** ions are moved against concentration gradient	the direction of the concentration gradient must be expressed clearly accept correct reference to water potential or to concentrations of water	1
4(b)	any **three** from: • movement of water from roots / root hairs (up stem) • via xylem • to the leaves • (water) evaporates • via stomata		3
4(c)(i)	0.67/0.7	accept 0.66, 0.6666666... or ⅔ or $0.\dot{6}$ correct answer gains **2** marks with or without working if answer incorrect allow evidence of $\frac{100}{150}$ for **1** mark do **not** accept 0.6 or 0.70	2

Question 4 continues on the next page . . .

4.1.3.2 Osmosis

Question 4 continued

question	Answers	extra information	mark
4(c)(ii)	during the first 30 minutes any **one** from: • it was warmer • it was windier • it was less humid • there was more water (vapour) in the leaves		1
	so there was more evaporation **or** stomata open during first 30 minutes **or** closed after 30 minutes (1) so faster (rate of) evaporation in first 30min **or** reducing (rate of) evaporation after 30min (1)	ignore 'water loss'	1
Total			**11**

4.1.3.2 Osmosis

Answer 02 · Mark scheme June 2014 | BL3HP | Original Q3 | Legacy

3(a)	any **three** from: • (water through a) partially permeable • membrane • from dilute to (more) concentrated solution • (it's a) passive (process)	 accept 'semi permeable' / selectively permeable allow 'from a high concentration of water to a lower concentration (of water)' allow 'from high water potential to low water potential' allow 'down a concentration gradient of water' do **not** accept 'along a concentration gradient of water' allow requires no energy	3	AO1 3.1.1b
3(b)	(there are) many <u>hairs</u> **or** thin <u>hairs</u> **or** <u>hairs</u> are one cell thick (which gives) large / increased surface area **or** short diffusion pathway (so there is) more diffusion / osmosis (of water into the root)	 ignore absorption	1 1 1	AO1 / AO2 3.1.1h, 3.1.3b
Total			6	

4.1.3.2 Osmosis

Answer 02 · Mark scheme

June 2014 | BL3HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.1.3.2 Osmosis

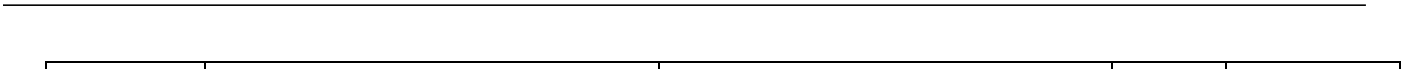
Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	diffusion active transport	this order only	1 1	AO2 3.1.1a/g
1(b)(i)	concentration (of sugar) in the bag was higher (than in the drink) **or** higher concentration of water outside the bag **or** in the drink / boiling tube (so) water moved in (to the tubing) by osmosis	allow concentration (of sugar) in the drink was lower (than in the bag) allow higher water potential outside the bag **or** lower water potential inside the bag allow water moves down **its** concentration gradient do **not** allow sugar moving allow diffusion (of water) do **not** allow sugar moving by osmosis **or** water moving by active transport	1 1 1	AO2 3.1.1.a/b/c
1(b)(ii)	**B**		1	AO3 3.1.1a/b/c
1(b)(iii)	close(st) to the concentration in the bag **or** to 5% (so rate of) diffusion / osmosis is slow	allow small(est) diffusion gradient **or** close(st) to an equilibrium allow (so) less water moves in (to the bag) ignore ref. to sugar	1 1	AO2/3 3.1.1a/b/c
Total			**8**	

4.1.3.2 Osmosis

Answer 03 · Mark scheme

June 2016 | BL3HP | Original Q1 | Legacy



4.1.3.2 Osmosis

Answer 04 · Mark scheme

June 2022 | 8461/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		must be in this order		AO1 4.1.1.1 4.1.1.2
	nucleus	allow chromosomes allow plasmid	1	
	(site of aerobic) respiration	allow makes ATP **or** releases energy do **not** accept produces / makes / creates energy do **not** accept anaerobic respiration	1	
	(cell) membrane		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	photosynthesis	allow produce glucose / sugar allow to absorb (sun) light ignore contains chlorophyll	1	AO1 4.1.1.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	root (hair)	allow xylem / phloem / epidermis / meristem	1	AO1 4.1.1.3 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	concentration of salt solution		1	AO1 4.1.3.2 RPA3

4.1.3.2 Osmosis

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to make sure **only** the potato mass was measured **or** if water / solution / liquid was left on (the potato), the mass would be higher / affected	allow (to) remove **excess** water / solution / liquid do **not** accept if water / solution / liquid was left on (potato) the mass would be lower ignore to remove water / solution / liquid on the outside / surface (of potato)	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$\frac{0.2}{2.5} \times 100$ 8(%)	allow $\frac{2.7 - 2.5}{2.5} \times 100$ if no other mark awarded allow **1** mark for $\frac{2.5 - 2.7}{2.5} \times 100 = -8\ (\%)$	1 1	AO2 4.1.3.2 RPA3

4.1.3.2 Osmosis

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 Mark with 01.8	correct scale **and** axis labelled (concentration (of salt solution) in mol/dm^3)	max **3** marks for bar chart scale must take up at least 50% of grid	1	AO2 4.1.3.2 RPA3
	all points plotted correctly	allow a tolerance of ± ½ small square allow 3 or 4 correct plots for **1** mark	2	
	curved line of best fit	ignore line extended beyond 0.4 mol/dm^3 ignore line joined point to point with straight lines	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 Mark with 01.7	correct answer from their line drawn on **Figure 1**	allow a tolerance of ± ½ small square ignore line joined point to point with straight lines if a line of best fit is drawn if no line of best fit is drawn, allow an answer in the range 0.31 – 0.33 (mol/dm^3)	1	AO2 4.1.3.2 RPA3

4.1.3.2 Osmosis

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	<u>water</u> moves out of cells / potato	allow 'pieces' for potato throughout	1	AO2 4.1.3.2 RPA3
	by osmosis	allow by diffusion through a partially / selectively / semi permeable membrane	1	
	(because) the solution in the cells / potato is less concentrated than outside **or** (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water concentration</u> / <u>potential</u> ignore reference to amount of water or salt do **not** accept water moves from an area of high (solute) concentration to an area of low (solute) concentration	1	

Total Question 1		17

4.1.3.2 Osmosis

Answer 05 · Mark scheme

June 2024 | 8461/1H | Original Q5

Question 5

Question	Answers	Mark	AO / Spec Ref.
05.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.1.3.2 RPA3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • (measure and) record mass of potato pieces • place potato pieces into different concentrations of salt solution o use at least 3 different concentrations of salt solution • leave potato pieces in salt solutions • remove potato pieces from salt solutions • blot potato pieces dry • (measure and record mass of potato pieces and) calculate change in mass • repeat each concentration o repeat each concentration 2 **more** times • calculate mean change in mass **Control variables** • use same size / mass potato pieces • use same potato **or** use same type of potato • use same blotting technique • ensure no skin on potato pieces • keep potato pieces in solution for the same amount of time (≥10 minutes) • keep potato pieces in solutions at the same temperature For **Level 1**, the method must allow the determination of the change in mass for a piece of potato. For **Level 3**, the method must allow the production of the graph in **Figure 4**.		

4.1.3.2 Osmosis

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	(pieces) lost mass because <u>water</u> left cells / potato		1	AO2 4.1.3.2 RPA3
	(because) the solution in the cells / potato is less concentrated than outside **or** (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water concentration</u> / <u>potential</u> ignore reference to amount of water or salt do **not** accept water moves from an area of high (solute) concentration to an area of low (solute) concentration	1	
	water left cells / potato by osmosis	allow water left cells by diffusion through a partially / selectively / semi permeable membrane	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	(pieces at 1.0 mol/dm^3) lost more mass because more water left potato / cells	(pieces at 1.0 mol/dm^3) lost more mass because more osmosis occurred out of the potato / cells	1	AO3
	(because) there is a steeper concentration gradient (at 1.0 mol/dm^3)	allow there is a greater difference in the concentration between inside and outside the cells / potato at 1.0 mol/dm^3	1	AO2 4.1.3.1 4.1.3.2 RPA3

Total Question 5	11

4.1.3.2 Osmosis

Answer 06 · Mark scheme

June 2025 | 8461/1H | Original Q3

Question 3

Question	Answers	Mark	AO / Spec Ref.
03.1	**Level 3**: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO3
	No relevant content.	0	4.1.3.2 RPA3

	Indicative content: *(strengths)* • same / a / one plant / potato used • all potato pieces used were cubes • mass was recorded before and after • change in mass was calculated • different concentrations of salt solution were used *(improvement and reason)* • use the same / a / one potato for all pieces o (because the student) may have used different potatoes • remove skin **or** peel the potato o (because) skin (may still be) present • blot / dry cube before measuring mass o (because) cube will have excess water on surface • use same / set size / surface area of potato piece each time o (because) size / surface area of cubes not controlled / specified • repeat (whole investigation **or** at each concentration) o (because there were) no repeats o to spot anomalies • calculate mean (from repeats) o (because there was) no mean calculated • same time for each piece to be in solution o (because) length of time in solution not specified • control temperature of solution using water bath o (because) temperature (of solution) not controlled / specified • use same volume of solution for each piece of potato **or** ensure all pieces are completely submerged o (because) volume of solution not specified / controlled • calculate percentage change in mass o (because) percentage change in mass not calculated **or** (because) each potato piece had a different starting mass • include control experiment with boiled cube o (because) no control experiment included • increase the number of concentrations (of salt solution) used o (because) only 3 different concentrations (of salt solution) used For **Level 3**, a strength and improvements / reasons must be included.		

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.2	the solution in the potato cells was more concentrated than the distilled water		1	AO2 4.1.3.2

4.1.3.2 Osmosis

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
03.3	any **one** from: • requires energy • (transports substances) against / up a concentration gradient • transports minerals / ions (and not water)	ignore it is active allow it is not passive allow (transports substances) from low concentration to high concentration ignore (transports substances) along / across the concentration gradient do **not** accept (transports substances) down a concentration gradient allow transports other named substances such as glucose allow does not transport water	1	AO2 4.1.3.2 4.1.3.3

Total Question 3	8

4.1.3.2 Osmosis

Answer 04 · Examiner comments

Question 1 (Standard demand)

01.1 Students' knowledge of sub-cellular structures was generally well evidenced in this question, with over 70% of students scoring full marks; however, the common error of referring to energy production / creation in the mitochondria was still seen. In addition, students often referred to energy being released 'for respiration', which is not creditworthy. There was also frequent confusion between cell membranes and cell walls.

01.2 Over 90% of students were able to correctly reference the function of chloroplasts. A few students simply stated that the role was to make the cell or plant green, which was insufficient.

01.3 65% of students were able to name a plant cell that was lacking in chloroplasts, however, several incorrect answers giving other types of cell (such as a bacterium), or other sub-cellular structures, were commonly seen.

01.4 Nearly 85% of students were able to correctly identify the independent variable in the investigation.

01.5 It was clear that many students had carried out the Required Practical Activity on osmosis assessed in this question. The three quarters of students who gained credit in this question were able to articulate the need to remove excess water, or that any extra water would add to the mass recorded, rather than just repeat the stem of the question.

01.6 The vast majority of students were able to use the equation provided to correctly calculate the percentage increase. Some students used an alternative method which would have led to a correct value if they had remembered to subtract 100 from their final answer. Students should therefore be reminded that, in questions where they are given an equation to use, they should use that equation to avoid missing out on vital marks.

01.7 Graph drawing skills still prove challenging for some students, and many make their lives more difficult by using unusual scales or, as often seen in this question, by shifting their *x*-axis scale. These ideas in themselves are acceptable, but only when the scales remain even and the zero is clearly identified, which often, they were not. While many students were able to plot accurately, a number incorrectly transcribed the reading of (0.3, 0.4) from the table, instead plotting the *x*-value at 4.0. Many students were unable to draw a correct curve of best fit, either drawing a straight line, or a curve that did not hit all of the points, or that was broken or 'feathered'. Curves of best fit should fall within ½ a small square of all of the points and should be a single, unbroken line. Students should also be reminded that their scale should take up at least 50% of the grid space provided.

01.8 Over a third of students understood the idea that where the curve crosses the x-axis is where there is no net loss or gain of water in osmosis, however, some students did not gain credit because of inaccurate readings. Again, readings must be within ½ a small square to be creditworthy.

4.1.3.2 Osmosis

Answer 04 · Examiner comments June 2022 | 8461/1H | Original Q1

01.9 As in previous years, many students continue to make the same error when describing 'concentration' in osmosis explanations and less than 45% of students gained full marks in this question. If water concentration is not specified, it is assumed that solute concentration is being described and this often results in an incorrect answer (for example, 'water moves from an area of high concentration to an area of low concentration' is **not** correct). Some students correctly articulate themselves in terms of water concentration, but then go on to contradict themselves with incorrect references to concentration gradients (again, solute is assumed unless water is specifically quoted).

4.1.3.2 Osmosis

Answer 05 · Examiner comments

Question 5 (standard, standard/high demand and high demand)

05.1 In this extended response question, students were asked to plan a method that would have provided a valid outcome and allowed collation of the results shown in the graph provided. Whilst it was clear that many students had carried out this Required Practical Activity as part of their studies (with only 5% of students scoring no marks), many were not able to modify the method they had used personally to match what the question was asking. For example, many students incorrectly included information about how to calculate the percentage change in mass, and a number did not realise a mean mass change was required. As a result, a large proportion of responses were capped at Level 2 (70%).

15% of students achieved a mark within the Level 3 criteria, which required reference to more than two concentrations of solution with repeats and the calculation of a mean, alongside at least two control variables. Length was often referred to as a control variable, rather than mass or size, and was not credited. Another problematic control variable was the reference to the same amount of time. Many students incorrectly stated a submersion time of 5 minutes or less or used vague time periods such as ‘a day’ or ‘overnight’, all of which again, were not creditworthy.

05.2 The concept of the movement of water by osmosis remains one that students find difficult, with many not gaining marks due to including detailed or repetitive information that contradicts itself. Frequently, students missed out on credit by stating that water moves ‘from an area of high concentration to low concentration’ or ‘from a high water concentration to a low concentration’. Weak articulated answers also often confused which molecules were moving, and some students believed that the salt or the entire solution moved out of the potato. Students using the terms ‘concentrated’ and ‘dilute’ generally made the correct link to the potato and solution.

35% of students scored full marks in this question, with 25% scoring two or zero marks, respectively.

05.3 This question was set a high demand and less than 10% of students scored full marks. 32% of students scored one mark. However, the concept of concentration gradients was relatively widely understood. For the first marking point, students often struggled to include both parts of the answer, stating either that ‘the potato lost more mass’ or ‘more water left the potatoes’, without linking the two ideas together. Many students did not use the data from the graph and instead talked about the potato in 1.0 mol/dm^3 *gaining* mass and some made up their own question, changing the concentrations they were comparing. As in question 05.2, a number of students talked about salt or salt solution moving, or about the potato needing or trying to balance out the difference. Others incorrectly referred to the salt or solution drying out the potato, which is a common misconception.

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4.1.3.2 Osmosis

Answer 06 · Examiner comments

June 2025 | 8461/1H | Original Q3

Question 3 (standard demand)

03.1 This was a levelled, extended response question based on a required practical. Students were asked to evaluate a given method to investigate osmosis in pieces of potato. Students achieving Level 1 (11%) made very few relevant points. Students achieving Level 2 (78%) suggested further improvements to the method and often gave reasons as to why these might be required, but judgements were always incomplete. Students achieving Level 3 (10%) made full use of the command word 'evaluate' and considered both strengths and weaknesses of the method in addition to indicating the ways the method could be improved.

Few students gave responses which allowed them to match the Level 3 requirements. Most omitted any consideration of strengths, and their judgements were incomplete. Many, nevertheless, seemed confident in their attempts at answers and this was pleasing to see.

The question asked for ways to improve the validity of results, and these needed to be clear. Discussion of controlled variables such as size, time and volume required quantification, or clarification that they needed to be the same or specific on each occasion, rather than just 'similar', 'recorded' or 'precise'. A large number of students suggested that the mass of the cubes should be kept the same, but this was neither plausible, nor required.

The use of specific pieces of equipment only gained credit if they were linked to clear improvements to validity. Several responses referred to the use of a cork borer to obtain cylinders of potato but then did not add anything about the control of length; others suggested the use of stop watches but with no link to control of time.
Points which were frequently seen from the indicative content included drying the cubes before measuring mass, repeats and calculation of mean values and the use of more different concentrations. Some students focused on aspects such as safety considerations, tables of results, graphs or explanations of osmosis. These were not appropriate additions to an evaluation, which asked for ways to improve the validity of results. Discussion of a 'wider range' of concentrations was only relevant if mention was made of 'more than 3' values within it.

03.2 39% of students scored the mark in this question.

03.3 This question asked for one way in which active transport differs from osmosis. It was most easily answered by one clear, distinctive point about active transport being given, without any further mention of osmosis. 82% of students achieved the mark in this question. For BP2, it was common for students not to gain credit for including incorrect biology when describing osmosis, for example 'active transport goes from low to high concentration, but osmosis goes from high to low'. Incorrect reference to particles moving from a low concentration gradient to a high concentration gradient were seen more commonly than in previous years.