AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.3.1

Diffusion

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**16**
Available paper years	**2008–2025**

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.

4.1.3.1 Diffusion

Answer 01 · Mark scheme

Question 7

question	answers	extra information	mark
(a)(i)	ref. access of <u>fungus</u> to reactants / food / oxygen **or** maintain even temperature throughout **or** prevents sedimentation of fungus		1
(a)(ii)	any **two** from: • maintain constant / suitable / optimum temperature • prevent denaturation of enzymes / prevent death of microorganisms • microorganisms release / produce heat / energy **or** respiration releases / produces heat / energy	ignore 'to cool' – needs qualification re. <u>reason</u> for cooling do **not** allow death of enzymes **or** denaturation of microorganisms	2
(b)(i)	66 – 72		1
(b)(ii)	glucose concentration falls first	allow falls faster	1

continued…

4.1.3.1 Diffusion

BLY3H

Question 7 continued…

question	answers	extra information	mark
(b)(iii)	description:		
	glucose concentration falls as biomass / fungus / Cephalosporium increases		1
	Cephalosporin C increases after biomass increase	must imply after	1
	explanation:		
	glucose used in respiration / as source of energy for Cephalosporium **or** glucose used as material to make cells / to make hyphae	**not** just 'used for growth'	1
	Cephalosporin C is a product from Cephalosporium (so Cephalosporium must be present to produce it) **or** Cephalosporium not produced until growth has ceased		1
total			9

4.1.3.1 Diffusion

Answer 02 · Mark scheme June 2008 | BLY3H | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)	protein is large (molecule) / too big to pass through filter		1
5(a)(ii)	glucose is present in the filtrate **or** 0.8 in filtrate	ignore units	1
	no glucose is present in the urine **or** 0 in urine		1
5(a)(iii)	active transport – up / against (concentration) gradient **or** from low to high (concentration)	it = active transport throughout	1
	uses energy / ATP	accept needs specific carrier / specific protein (in cell membrane) for **1** mark	1
5(b)	<u>water</u> <u>re</u>absorption / taken out **or** water taken into blood / body	other substances cancel mark	1
Total			**6**

4.1.3.1 Diffusion

Answer 02 · Mark scheme

June 2008 | BLY3H | Original Q5 | Legacy

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: June 2008

4.1.3.1 Diffusion

Answer 03 · Mark scheme

question	answers	extra information	mark
5(a)(i)	glucose **and** galactose		1
5(a)(ii)	any **three** from: Evidence: • absorption reduced by cyanide • absorb faster (than other sugars) Explanation: • active transport needs <u>energy</u> • less / no <u>energy</u> available / released if cyanide is there **or** less / no <u>energy</u> if no / less respiration	allow converse allow <u>energy</u> produced ignore cyanide prevents respiration	3
5(b)	all / the sugars / they can be absorbed <u>when gut poisoned</u> / <u>with cyanide</u> **or** <u>when no respiration</u> (diffusion) does not need an <u>energy</u> supply		1 1
Total			**6**

4.1.3.1 Diffusion

Answer 03 · Mark scheme

January 2009 | BLY3H | Original Q5 | Legacy

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

4.1.3.1 Diffusion

Answer 04 · Mark scheme

June 2009 | BLY3H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	No	no mark if yes max 1 for correct statement	
	diffusion is down the concentration gradient	accept by diffusion ions would leave the root	1
	to enter must go up / against the concentration gradient **or** concentration higher in the root **or** concentration lower in the soil		1
5(b)(i)	0.9 **or** 3.25	for correct answer with or without working if answer incorrect 1.3 **or** their rate – 0.4 gains 1 mark **or** 130 – 40 **or** 90 gains 1 mark	2
5(b)(ii)	(uptake) by active transport		1
	requires energy		1
	more energy from aerobic respiration **or** more energy when oxygen is present		1
Total			**7**

4.1.3.1 Diffusion

Answer 04 · Mark scheme

June 2009 | BLY3H | Original Q5 | Legacy

BLY3H

4.1.3.1 Diffusion

Answer 05 · Mark scheme

June 2010 | BLY2H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	B large(r) surface / area **or** large(r) membrane	no mark for "B", alone accept reference to microvilli accept reasonable descriptions of the surface do **not** accept wall / cell wall ignore villi / hairs / cilia	 1
4(b)(i)	any **one** from: • insulin / hormone • enzyme / named enzyme	 if named hormone / enzyme must be correct for pancreas	1
4(b)(ii)	many ribosomes (ribosomes) produce protein **or** allow many mitochondria (1) provide energy to build protein **or** to make protein (1)	 accept insulin / hormone / enzyme named is (made of) protein accept ATP for energy	1 1
Total			**4**

4.1.3.1 Diffusion

Answer 05 · Mark scheme

June 2010 | BLY2H | Original Q4 | Legacy

BLY 2H

4.1.3.1 Diffusion

Answer 06 · Mark scheme

June 2010 | BLY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	movement of atoms / molecules / ions	accept particles allow dissolved substances ignore reference to membranes	1
	(substance) moves from high to low concentration	allow down the gradient ignore across / along / with a gradient	1
6(a)(ii)	any **two** from: • movement of molecules / ions	accept particles allow dissolved substances this point once only in (a)(i) and (a)(ii)	2
	• from low to high concentration	allow up / against the gradient ignore across / along / with a gradient	
	• requires energy / respiration	accept requires ATP	

Question 6 continues on the next page

4.1.3.1 Diffusion

BLY 3H

Question 6 continues

question	answers	extra information	mark
6(b)	• **<u>filtration</u>** of blood **or** described re small (molecules) through / large not	ignore diffusion	1
	max **four** from: • **<u>reabsorption</u>** / substances taken back into blood • (reabsorption) of <u>all</u> of the sugar / glucose • (reabsorption) of <u>some</u> of ions / of ions <u>as needed</u> by body • (reabsorption) *of* <u>some</u> *of* water / of water <u>as needed</u> by the body • urea present in urine • reabsorption of water by <u>osmosis</u> / <u>diffusion</u> ***or*** reabsorption of sugar / ions by <u>active transport</u>	accept urea not reabsorbed	4
Total			**9**

4.1.3.1 Diffusion

Answer 07 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	maintain / constant / suitable / optimum temperature **or** to prevent overheating	ignore to cool (= question)	1
	high temperature denatures enzymes / proteins / high temperature kills microorganisms / fungus	do **not** allow death of enzymes / denatures microorganisms	1
	microorganisms / fungus / respiration release energy	allow release heat	1
6(b)	any **four** from: • very little / no measurable fungus / biomass before 20 h • need fungus present to make protease enzyme **or** protease is a product from the fungus **or** protease not made until the fungus is made • protease not made until glucose is used • glucose needed for energy / respiration **or** glucose as material for growth / to make more fungus • equipment not sensitive enough to measure low concentrations	 allow spores take about 20 h to start growth allow protease increases as glucose decreases	4

Question 6 continues on the next page

4.1.3.1 Diffusion

BLY3H

Question 6 continued

question	answers	extra information	mark
6(c)	40 (no mark) any **two** from: • (40) gives the highest yield / activity of enzyme per g glucose • (40) gives highest yield / activity of enzyme per g fungus produced. • (40) is more economic / saves money	if neither point made allow **1** mark for (40) gives the highest yield / activity of enzyme	2
Total			**9**

4.1.3.1 Diffusion

Answer 07 · Mark scheme

January 2011 | BLY3H | Original Q6 | Legacy

BLY3H

4.1.3.1 Diffusion

Answer 08 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	xylem **and** phloem	either order allow words ringed in box allow mis-spelling if unambiguous	1
1(b)(i)	movement / spreading out of particles / molecules / ions / atoms from high to low concentration	ignore names of substances / 'gases' accept down concentration gradient ignore 'along' / 'across' gradient ignore 'with' gradient	1 1
1(b)(ii)	oxygen / water (vapour)	allow O_2/O2 ignore O^2/O allow H_2O/H2O ignore H^2O	1
Total			**4**

4.1.3.1 Diffusion

Answer 09 · Mark scheme

June 2014 | BL2HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.
2			6	AO1 2.1.2a,b, c, 2.2.1d, 2.3.1a,b, c,g, 2.6.1

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	An example is given of a named substance **or** a process **or** there is an idea of why diffusion is important eg definition.	At least one example of a substance is given **and** correctly linked to a process in either animals or plants.	There is a description of a process occurring in either animals or plants that is correctly linked to a substance **and** a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response

Importance of diffusion:

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O_2 in / CO_2 out
- for gas exchange / photosynthesis: CO_2 in / O_2 out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information

Description of processes might include:

- movement of particles / molecules / ions
- through a partially permeable membrane
- (movement of substance) down a concentration gradient

osmosis: turgor / support / stomatal movements

Total			6

4.1.3.1 Diffusion

Answer 09 · Mark scheme

June 2014 | BL2HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.1.3.1 Diffusion

Answer 10 · Mark scheme

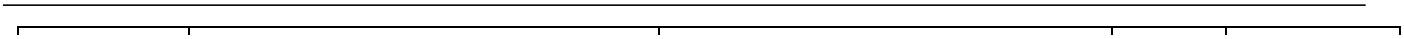
June 2017 | BL2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	surface of organ(s)	allow covering / lining organ allow named example of an organ, e.g. surface of stomach allow the skin	1	AO1 2.2.1b/c
1(a)(ii)	**A** (cell) membrane **B** cytoplasm	allow phonetic spelling allow cell surface membrane do **not** allow (cell) wall	1 1	AO1 2.1.1a
1(b)	Protein synthesis		1	AO1 2.1.1a
1(c)	movement of <u>particles</u> / <u>molecules</u> from high to low concentration / down a concentration gradient	allow movement of ions / atoms ignore carbon dioxide or other named substance ignore along / across gradient ignore through membrane	1 1	AO1 2.1 2.1.2a/b
Total			**6**	

4.1.3.1 Diffusion

Answer 10 · Mark scheme

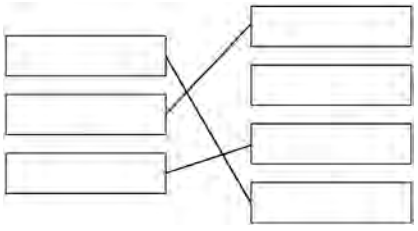
June 2017 | BL2HP | Original Q1 | Legacy



4.1.3.1 Diffusion

Answer 11 · Mark scheme

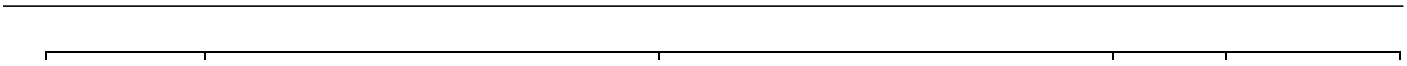
June 2018 | 8461/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	to prevent water affecting the direction of root growth		1	AO3 4.5.4.1
06.2	gravity acts evenly on all sides	allow cancel out the effect of gravity do **not** accept there is no gravity	1	AO3 4.5.4.1
06.3	(mean) includes the (anomalous) result for seedling 4	allow (mean) includes the (anomalous) result which only grew 1 mm	1	AO3 4.5.4.1
06.4	calculate (mean) from just seedlings 1, 2, 3 and 5 **or** repeat the investigation **and** recalculate (a new mean)	allow omit seedling 4 from (mean) calculation	1	AO3 4.5.4.1
06.5	uneven distribution of hormone in (root / seedling of) A even distribution of hormone in B (so) top grows fast(er) (than bottom) in (root / seedling of) A (and equal growth in B)	allow reference to auxin allow more hormone at bottom do **not** accept more hormone at the top allow B does not have an uneven distribution of hormone allow (more) cell elongation or cell division on top of A allow converse for lower surface	1 1 1	AO1 4.5.4.1 AO1 4.5.4.1 AO3 4.5.4.1
06.6		extra line for a hormone cancels mark for that hormone	1 1 1	AO1 4.5.4.2
Total			**10**	

4.1.3.1 Diffusion

Answer 11 · Mark scheme

June 2018 | 8461/2H | Original Q6



4.1.3.1 Diffusion

Answer 12 · Mark scheme

June 2019 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	plasma		1	4.2.2.3 AO1
06.2	Benedict's (reagent / solution)	allow Fehling's (reagent / solution)	1	4.2.2.1 AO1
06.3	add chemical / Benedict's (reagent to urine) **and** boil / heat positive result – (colour changes from blue to brick) red	allow ecf from question **06.2** allow any temperature above 65 °C ignore water bath unqualified allow orange / yellow / green / brown if no other mark awarded, allow **1** mark for reference to glucose testing stick / strip	1 1	4.2.2.1 AO1
06.4	the blood is more concentrated **or** less dilute (than the solution in the cells) (so) water moves out of cells by osmosis water moves through a partially permeable membrane	allow the solution in the cells is less concentrated **or** more dilute than the blood allow correct references to water concentration **or** water potential **or** hypotonic / hypertonic ignore reference to amount of water or glucose allow (so) water moves into the blood by osmosis allow semi-permeable / selectively permeable membrane	1 1 1	4.1.3.2 AO2

4.1.3.1 Diffusion

Answer 12 · Mark scheme

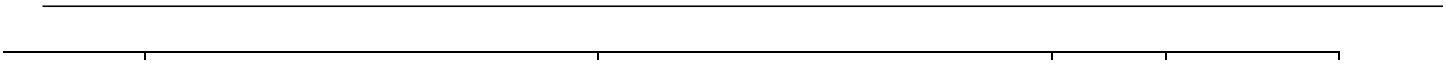
June 2019 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	projections / folds / villi provide a large surface area	ignore small intestine has a large surface area do **not** allow cilia	1	4.1.3.1 4.1.3.3 4.2.2.1 4.1.1.2 AO1
	walls of projections / folds / villi / capillaries are thin / one cell thick for shorter absorption / diffusion distance		1	AO2
	(small intestine is) very long, increasing time (for absorption)		1	AO1
	good / efficient blood supply to maintain concentration gradient	allow many capillaries to maintain concentration gradient	1	AO2
	cells have many mitochondria for (aerobic) respiration for active transport **or** cells have many mitochondria for energy release for active transport	do **not** accept anaerobic do **not** accept producing energy	1	
Total			**12**	

4.1.3.1 Diffusion

Answer 12 · Mark scheme

June 2019 | 8461/1H | Original Q6



Answer 13 · Mark scheme

November 2020 | 8461/1H | Original Q2

The full source mark scheme begins on page 35. Follow original question 2 in that document.

4.1.3.1 Diffusion

Answer 14 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$\frac{9.96 \times 10^{-3}}{1.35 \times 10^{-4}}$ 73.77… 74 (:1)	if no answer in answer space allow answer in **Table 6** allow $\frac{0.00996}{0.000135}$ allow a correctly derived whole number from an incorrect calculation do **not** accept if unit is given	1 1 1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	as size increases, (surface area to volume) ratio decreases	allow they are inversely proportional **or** they are negatively correlated allow as one increases, the other decreases allow as size decreases, (surface area to volume) ratio increases	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	**D** has a smaller surface area to volume ratio (than **B**) (so) diffusion distance is too large (to meet demands of cells / organism)	allow converse for **B** throughout allow (so) diffusion takes too long (to meet demands of cells / organism)	1 1	AO3 AO2 4.1.3.1

4.1.3.1 Diffusion

Answer 14 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4		allow converse for **E** throughout		AO3
	D has a larger surface area to volume ratio **and** so will lose heat more quickly (per unit volume than **E**)	allow **D** has a larger surface area to volume ratio **and** so temperature of **D** will drop more quickly ignore **E** loses more heat (overall)	1	AO2
	(**D**) requires greater rate of respiration		1	AO2
	(as) respiration is a (large) part of metabolism		1	AO2
	(so) need to generate more <u>heat</u> (to keep itself warm)	allow (so) needs to release more <u>heat</u> (to keep itself warm) do **not** accept energy produced / made / created	1	4.1.3.1 4.4.2.1 4.4.2.3

4.1.3.1 Diffusion

Answer 14 · Mark scheme

June 2022 | 8461/1H | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.5	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.3.1 4.1.3.3 4.2.2.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • **both** have a large surface area o to maximise diffusion • **both** have thin walls **or** have walls that are one cell thick o to reduce diffusion distance / time • **both** are in close proximity to blood supply o to reduce diffusion distance / time • **both** have a good blood supply **or** both have a capillary network o to maintain concentration gradient • villi have microvilli o to (further) increase surface area • cells of villi contain many mitochondria o for active transport For **Level 2** reference to functions of structural details of **both** alveoli and villi is required.		

Total Question 6		**14**

4.1.3.1 Diffusion

Answer 15 · Mark scheme

June 2022 | 8461/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	any **two** from: • (same volume of) water • (same) temperature • (same) species / type of plant • (same) age of shoot	allow (same amount of) water allow (amount of) minerals / ions / salts ignore (same) time ignore (same) height of shoot ignore carbon dioxide (concentration) do **not** accept light	2	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	**B** shows response (in **A**) is due to light (as **B** has no light)	allow **B** gives a comparison between no light and (one-sided) light ignore **B** shows the effect of no light	1	AO2 4.5.4.1 RPA8
	C shows response (in **A**) is due to one-sided light (as **C** has light from all sides)	allow **C** gives a comparison between all-round light and one-sided light ignore **C** shows the effect of light from all sides	1	

4.1.3.1 Diffusion

Answer 15 · Mark scheme

June 2022 | 8461/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3		ignore reference to auxin ignore reference to left and right sides		AO3 4.5.4.1 RPA8
	growth / elongation occurs (just) behind / below / at the tip	allow no growth **or** very little growth at the base ignore shoot is taller	1	
	bending occurs (just) behind / below / at the tip **or** more growth on the side away from the light		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	phototropism / phototropic	allow positive phototropism ignore tropism do **not** accept negative phototropism do **not** accept phototrophic / phototrophism	1	AO1 4.5.4.1 RPA8

4.1.3.1 Diffusion

Answer 15 · Mark scheme

June 2022 | 8461/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5		ignore references to **D** and **E** ignore references to left and right sides unless at least one is identified as side nearer to or further from the light		AO3 4.5.4.1
	in **F** there is more auxin in the side furthest from the light		1	
	in **G** there is the same mass of auxin in each side		1	
	in **F** auxin can move through the shoot but in **G** the glass prevents this		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	all four (blocks) have (approximately) the same mass of auxin	allow examples such as mass of auxin in **D** / **E** is (about) the same as in **F** / **G** **or** those in light have same mass of auxin as those in dark	1	AO3 4.5.4.1

Total Question 9		11

4.1.3.1 Diffusion

Answer 16 · Mark scheme

June 2025 | 8461/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	movement / spreading of particles from (an area of) high(er) concentration to low(er) concentration	allow movement / spreading of substances / chemicals / gases / liquids from (an area of) high(er) concentration to low(er) concentration allow movement / spreading of substances / chemicals / gases / liquids down a concentration gradient ignore reference to membrane do **not** accept reference to against the concentration gradient	1	AO1 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2		allow blood vessels for capillaries do **not** accept arteries / veins for capillaries		AO1 4.1.3.1
	(gills / filaments) provide a large surface area for (maximum) diffusion / absorption		1	
	good blood supply to maintain concentration gradient **or** has a capillary network to maintain concentration gradient		1	
	filaments / capillaries have thin walls for a short diffusion distance / time **or** filaments / capillaries have walls that are one cell thick for a short diffusion distance / time	ignore membranes / filaments / capillaries are one cell thick do **not** accept reference to cell walls	1	
	water in close proximity to blood supply for a short diffusion distance / time	allow blood supply is close to gill surface for a short diffusion distance / time allow a counter-current flow to maintain a concentration gradient	1	

4.1.3.1 Diffusion

Answer 16 · Mark scheme

June 2025 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3		allow converse if clearly describing resting fish		AO2 4.4.2.3 4.4.2.1
	(increased) movement	ignore swimming	1	
	(which) needs (more) energy **or** (more) energy provided (by respiration)	do **not** accept energy produced / made / created do **not** accept energy for respiration	1	
	(so) more respiration needs to take place		1	
	(for increased) muscle <u>contract</u>ion		1	

Total Question 6	9

4.1.3.1 Diffusion

AQA

GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final



4.1.3.1 Diffusion

MARK SCHEME – GCSE BIOLOGY – 8461/1H – JUNE 2020

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.1.3.1 Diffusion

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives, level of demand and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

4.1.3.1 Diffusion

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		allow correct chemical symbols ignore any attempt at balancing equation ignore light / chlorophyll		AO1 4.4.1.1
	before arrow carbon dioxide **and** water	either order	1	
	after arrow glucose	ignore sugar / carbohydrate do **not** accept starch	1	
01.2		ignore description of subsequent parts of the photosynthesis reaction		AO1 4.1.1.2 4.4.1.1
	<u>light</u>	allow sun<u>light</u> ignore sun	1	
	(light) is captured / trapped / absorbed by chlorophyll / chloroplasts	allow (light) is used by chlorophyll / chloroplasts	1	
01.3	$\frac{18.5 + 19.3 + 19.5}{3}$ **or** $\frac{57.3}{3}$		1	AO2 4.4.1.2 RPA 6
	19.1 (cm^3/hour)	allow an answer correctly calculated using only two correct values	1	
01.4	a ring around 14.2	allow clear indication of correct result	1	AO3 4.4.1.2 RPA 6

4.1.3.1 Diffusion

01.5	any **one** from: • scale / value was misread • there was air / oxygen in the syringe / measuring cylinder / apparatus • the lamp / light was moved • temperature changed • had different mass / length of pondweed • pondweed had not acclimatised	ignore human error ignore references to counting bubbles or time allow measurement error allow light intensity changed ignore different bulb / lamp unqualified	1	AO3 4.4.1.2 RPA 6
01.6	did not use it in calculation (of mean)		1	AO3 4.4.1.2 RPA 6
01.7	any **one** from: • light (intensity) • carbon dioxide (concentration) • pondweed size / amount • pondweed species	do **not** accept temperature ignore time allow distance / power / colour of lamp / light allow same (piece of) pondweed	1	AO3 4.4.1.2 RPA 6
01.8	enzyme(s) lose the shape of the active site	allow enzyme(s) (start to) denature allow enzyme(s) destroyed / damaged do **not** accept enzyme(s) killed	1	AO2 4.2.2.1

4.1.3.1 Diffusion

01.9	y-axis labelled '(rate of) photosynthesis in cm^3/hour'		1	AO2 4.4.1.2 RPA 6
	suitable scale on y-axis	must take up half or more of grid provided	1	
	all points plotted to within ± ½ small square	allow 3 or 4 correct plots for **1** mark ignore any attempt to plot a point at 20 °C	2	
	correct curved line of best fit	ignore line joined point to point with straight lines ignore extrapolation	1	
Total			**16**	

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	movement / spreading out of molecules / particles	allow movement / spreading out of (named) substances / chemicals / gases / liquids ignore reference to membranes / cells	1	AO1 4.1.3.1
	from (an area of) high(er) concentration to (an area of) low(er) concentration	allow down / with the concentration gradient ignore along / across the concentration gradient do **not** accept movement from / to a concentration gradient	1	
02.2	increased carbon dioxide concentration in the air		1	AO2 4.1.3.1 4.2.3.2
	increased number of stomata that are open		1	

4.1.3.1 Diffusion

02.3	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.1.3.1 4.2.2.2 4.2.2.3
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	

	Indicative content
	• (many) alveoli
	  • provide a large(r) surface area (**:** volume)
	• capillaries are thin
	  or alveoli / capillary walls are thin **or** one cell thick
	  or capillaries are close to the alveoli
	  • which provides short diffusion path (for oxygen / carbon dioxide)
	• breathing (mechanism) moves air in and out
	or lungs are ventilated
	  • to bring in (fresh) oxygen
	  • to remove carbon dioxide
	  • to maintain a concentration / diffusion gradient
	• large capillary network (around alveoli)
	or good blood supply
	  • to remove oxygen(ated blood) quickly
	  • to bring carbon dioxide to the lungs quickly
	  • to maintain a concentration / diffusion gradient		

4.1.3.1 Diffusion

02.4	osmosis	allow diffusion	1	AO1 4.1.3.1 4.2.3.2 4.1.3.2
02.5	active transport (because) energy is needed (to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell)	 allow (to move nitrate ions) against / up the concentration gradient allow (because) there is a lower concentration (of nitrate ions) in the soil **or** (because) there is a higher concentration (of nitrate ions) in the root / cell ignore reference to amount / number of nitrate ions ignore along / across the concentration gradient do **not** accept if reference to molecules / atoms moving	1 1 1	AO3 AO2 AO2 4.1.1.3 4.2.3.2 4.1.3.3
Total			**14**	

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: (both have) • cytoplasm • (cell) membrane • DNA / genetic material • ribosomes	ignore reference to shape allow RNA ignore genetic information if no other mark awarded allow sub-cellular structures for **1** mark if no other mark awarded allow correct cellular process, e.g. respiration for **1** mark	2	AO2 4.1.1.1 4.1.1.2 4.1.2.1
03.2	any **three** from: • prokaryotic cell is smaller • prokaryotic cell has no mitochondria • prokaryotic cell has no nucleus **or** DNA is free in the cytoplasm **or** genetic material is free in the cytoplasm • prokaryotic cell has a single loop of DNA **or** prokaryotic cell has a single loop of genetic material • prokaryotic cell has plasmids	allow converse for eukaryotic cells allow reference to bacterium instead of prokaryotic cell ignore reference to features not shown in Figure **5** if neither mark awarded, allow prokaryotic cell has no membrane-bound organelles ignore genetic information ignore genetic information ignore circular / rings of DNA allow prokaryotic cells have smaller ribosomes	3	AO2 4.1.1.1 4.1.1.2 4.1.2.1

03.3	1 µm = 0.001 mm **or** 1 mm = 1000 µm **or** 0.05 mm = 50 µm **or** 0.05 × 1000 (1:) 50	 do **not** accept if a unit is given	1 1	AO2 4.1.1.1 4.1.1.2
03.4	mitosis	correct spelling only	1	AO1 4.1.2.2
03.5	35%		1	AO2 4.1.2.2
03.6	 (stage 1) DNA / chromosomes replicate / duplicate mitochondria / ribosomes / sub-cellular structures increase in number **or** mitochondria / ribosomes / sub-cellular structures replicate (stage 2) one set of chromosomes is pulled / moved to each end of the cell (stage 3) the cytoplasm **and** cell membrane divides (to form two cells)	ignore names of the stages of the cell cycle ignore genetic material ignore DNA / chromosomes double / reproduce allow cytoplasm increases ignore cell grows unqualified allow one of each chromosome is pulled / moved to each end of the cell ignore nucleus divides allow cytoplasm divides **and** (new) cell membranes form ignore nucleus divides	 1 1 1 1	AO1 4.1.2.2
Total			**13**	

MARK SCHEME – GCSE BIOLOGY – 8461/1H – JUNE 2020

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	fatty acids glycerol		1 1	AO1 4.2.2.1 4.4.2.3
04.2	enzyme binds to the substrate because they are complementary (shapes) (so) substrate is broken down (into products) (so) products are released **or** enzyme is not changed	allow enzyme joins to the substrate because they fit together exactly allow enzyme joins to the substrate because the substrate fits the active site ignore reference to specificity do **not** accept same shape allow (so) substrate splits (into products) ignore products are formed, unqualified allow enzyme is not used up allow reference to activation energy for either marking point 2 **or** marking point 3	1 1 1	AO2 4.2.2.1
04.3	each active site has a specific shape (so only fits one type of lipid molecule)	allow each active site is a different shape do **not** accept reference to the substrate having an active site	1	AO2 4.2.2.1
04.4	add Benedict's (solution / reagent to the liquid) boil / heat (if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick)red	 allow any temperature of 65 °C or above 	1 1 1	AO1 4.2.2.1 RPA 4

04.5	add iodine solution / reagent (to the liquid) (if starch is present) it changes colour to blue / black (from yellow / orange / brown)	allow add a drop of iodine ignore iodine unqualified	1 1	AO1 4.2.2.1 RPA 4
04.6	glucose from photosynthesis (excess) glucose converted to starch	do **not** accept starch made in photosynthesis allow (excess) glucose is stored as starch	1 1	AO2 4.2.2.1 4.4.1.1 4.4.1.3 4.4.2.3
04.7	starch (stores) have been converted to glucose (so the glucose can be) used for respiration / (named) metabolic reactions **or** (so the glucose can be) used to release energy (because) there is no light to make (new / more) glucose by photosynthesis	ignore reference to residual glucose from previous photosynthesis do **not** accept idea of energy being produced / created / made	1 1 1	AO3 4.4.1.1 4.4.2.1 4.4.1.3
04.8	any **one** from: • test roots / stems of plants (in the light and dark) • test other species of plant • measure the concentrations of glucose **and** starch • vary the time in the dark / light • test variegated leaves	do **not** accept reference to changing the independent variable allow test other parts of the plants allow test other types of plant ignore mass / amount allow any other valid extension ignore repeats	1	AO3 4.4.1.2 4.4.1.3
Total			**17**	

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	mechanical	allow physical allow structural	1	AO3 4.3.3.2
05.2	any **one** from: • to deter herbivores • to prevent animals damaging it	ignore to injure animals, unqualified allow to deter animals eating it do **not** accept to deter predators	1	AO2 4.3.3.2
05.3	chemical		1	AO3 4.3.3.2

4.1.3.1 Diffusion

05.4	any **two** from : • lack of magnesium (ions) (1) (so) not enough chlorophyll for (efficient) photosynthesis (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • infection by pathogen / bacteria / virus / fungus (1) (so) leaves become discoloured / yellow so less photosynthesis (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • infected by aphids (1) (which) remove sugars from phloem (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1) • lack of (available) light (1) (so) chlorophyll breaks down (1) (so) not enough glucose to make proteins for growth **or** not enough glucose to release energy for growth (1)	allow (so) lack of chlorophyll produced causes yellow leaves (1), (so) not enough photosynthesis to produce glucose which is used to make proteins for growth (1) allow correctly named pathogen allow has rose black spot / TMV allow other symptoms of named pathogens / disease award once only award once only award once only	5	AO2 4.3.3.1 4.3.1.1 4.3.1.2 4.3.1.4 4.4.1.1 4.4.1.2 AO1 4.4.2.3 4.4.1.3

4.1.3.1 Diffusion

05.5	(bacteria) obtain glucose / sugar (from the plant) (glucose used) for respiration **or** (glucose used) for making other named substances	 allow (glucose used) to release energy	1 1	AO3 AO2 4.2.3.2 4.4.1.3
05.6	(gorse plant) obtains nitrate (ions) needed for amino acids / proteins	 allow needed to make chlorophyll / DNA	1 1	AO2 4.1.3.3 4.4.2.3 AO1 4.3.3.1
05.7	willow bark		1	AO2 4.3.1.9
Total			**13**	

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any **two** from: • BMI / morphology / obesity level • smoking habits • diet • medication • family history of liver disease • fitness levels • ethnicity • area of UK they live in	ignore genetic factors allow mass / weight **and** height allow previous drinking habits allow medical conditions allow drug use allow level of exercise allow race	2	AO3 4.2.2.6
06.2	2.55 – 1.60 (= 0.95) $\left(\frac{0.95}{2.55} \times 100 = \right)$ 37 (.2549019608…) (%)	allow 1.60 – 2.55 (= –0.95) allow value for with meals in range 1.60 to 1.65 (for 1.60) allow answer correctly calculated from values in ranges 1.60 to 1.65 and 2.50 to 2.60 allow – 37(.2549019608...)(%)	1 1	AO2 4.2.2.6
06.3	12 × 2 × 7 = 168 (g/week) 1.8	 allow in range 1.8-1.9 allow correct reading from a calculation that omits the 2 **or** the 7 do **not** accept if a unit is given	1 1	AO2 4.2.2.6

4.1.3.1 Diffusion

06.4	any **two** from: • consuming alcohol increases the RR (with / without meals) **and** supporting data • consuming less than 50 g/week of alcohol with meals does not increase the RR • even (small amounts of alcohol at) 25 g/week increases the RR if not with meals	allow risk for RR throughout allow data in terms of number of glasses of wine allow increasing alcohol consumption increases the RR at an increasing rate allow any value between 35 and 60 g/week	2	AO3 4.2.2.6
06.5	any **two** from: • large number in survey • long term / 15 year survey • well controlled	allow 800 000 in survey if neither mark awarded allow large study allow many controls	2	AO3 4.2.2.6
06.6	any **one** from: • people underestimate / overestimate alcohol consumption • people may change (lifestyle / drinking) habits over time • some people may drink all their weekly alcohol at once	allow people lie about alcohol consumption **or** people lie about other named control variables ignore survey only tested women	1	AO3 4.2.2.6

06.7	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3-4	AO2 4.4.2.3 4.2.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-2	AO1 4.4.2.2 4.2.2.6 4.2.2.5 4.5.3.3
	No relevant content	0	
	Indicative content Responses may refer to either total or partial liver failure • no bile made (in the liver) ○ fats / lipids are not emulsified ○ surface area of fats / lipids not increased ○ pH of small intestine will not be alkaline / neutralised ○ enzymes (in small intestine) will not work effectively **or** (named) food not digested / absorbed ○ so may lose weight • lactic acid not broken down / oxidised ○ accumulation of lactic acid in blood / body ○ lactic acid is toxic **or** body will be poisoned ○ oxygen debt higher / prolonged ○ so muscle pain / fatigue • proteins / amino acids will not be broken down (in liver) ○ (amino acids) not deaminated ○ amino acids not made into urea **or** will not form ammonia ○ (however) any ammonia formed is toxic ○ so accumulation of amino acids in blood / body • liver does not break down / remove other toxins (like alcohol) ○ toxins accumulate in blood / body ○ body will be poisoned ○ so pain **or** jaundice **or** swollen liver **or** portal hypertension occurs • glycogen stores will not be formed ○ cannot control blood glucose ○ so hyperglycaemia / hypoglycaemia / diabetes / coma may occur		

Total			**15**

4.1.3.1 Diffusion

Question	Answers	Extra information	Mark	AO / Spec.Ref.
07.1		ignore add mAbs and dye to slide (unbound)		AO2 4.3.2.2
	bind fluorescent dye to mAbs		1	
	put (bound) fluorescent mAbs on the slide (and rinse off)		1	
	mAbs will bind to Candida albicans / pathogens and show up under the microscope	allow mAbs will bind to Candida albicans / pathogens and show up under UV (lamp)	1	
07.2	more Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells	allow Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells more quickly do **not** accept white blood cells produce antibodies do **not** accept lymphocytes engulf Candida albicans	1	AO2 4.2.2.3 4.3.1.6 4.3.1.7
	therefore less damage to cells / tissues / organs	ignore less toxin released (by Candida albicans)	1	

07.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		4-6	AO1 4.3.1.9
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1-3	
	No relevant content		0	
	Indicative content • given first to healthy volunteers o at (very) low dose o to test it is safe **or** to test for toxicity **or** to check for any side effects • then to some patients (with the disease) **or** people with the disease o to test for the correct / optimum dose o to check for any side effects o to test for efficacy **or** to test if it works o in a double blind trial o where neither patients nor doctors know who has the mAbs and who has a placebo (or alternative treatment) • reference to large trial **or** long duration **or** control variables			
07.4	any **one** from: • (the body will) not reject the mAbs **or** (the body is) less likely to reject the mAbs • mouse mAbs are (more likely to be) rejected • the human lymphocytes have already responded to that infection / cancer cell so they are known to work against the disease	do **not** accept idea of rejection of cells	1	AO3 4.3.2.2 4.3.2.1 4.3.1.6
Total			**12**	

4.1.3.1 Diffusion

Answer 13 · Examiner comments November 2020 | 8461/1H | Original Q2

Question 2 (standard demand)

The use of the term concentration gradient was confused by many students throughout this question. Movement 'along/across' a concentration gradient gives no clear indication of direction and requires further qualification; movement to/from a high/low concentration 'gradient' is incorrect. Some students described cells moving, instead of ions or particles.

Students should take care when reading the command word for each question. **02.3** asked for explanation(s), and without this, level 2 and level 3 could not be accessed. Many students referred incorrectly to the cell walls of the alveoli or capillaries being thin, and several didn't to refer to walls; the alveoli being thin was not creditworthy. Some students stated that the alveoli contained villi. It is important to note that the alveoli having 'moist linings' is not a creditworthy answer to a question about adaptations for gas exchange. The gas exchange surfaces are moist **due** to diffusion, and therefore, a moist surface is a feature of the lungs but not a feature that maximises the diffusion of gases.

Answer 14 · Examiner comments June 2022 | 8461/1H | Original Q6

Question 6 (Standard/high and high demand)

06.1 Over three quarters of students scored full marks in this question, selecting the correct numbers for surface area and volume from the table, dividing surface area by volume and then correctly rounding their answer of 73.77... to 74, the nearest whole number. Some students simply selected the correct numbers and wrote them as a ratio, but didn't progress to simplify this by dividing, so scored no marks. Another relatively common mistake that was seen was when students converted the standard form numbers to 'normal' numbers, but in doing so missed out one of the nines from 0.00996.

4.1.3.1 Diffusion

Answer 14 · Examiner comments

June 2022 | 8461/1H | Original Q6

06.2 60% of students answered correctly, stating that as the size of the organism increased, the ratio decreased. The converse of this was also commonly seen and credited. A few noted the creditworthy relationship of inverse proportionality also. Students were asked for a relationship between two factors, but some did not refer to these factors in their response. This was the most obvious reason for students not achieving the mark. Some students got the relationship the wrong way round and others appeared to compare surface area to volume for each organism i.e. volume increasing as surface area increases, for example, stating that surface area is always bigger than volume.

06.3 Over 60% of students scored zero marks in this question. Just over 35% of students gained the first marking point, for the idea that organism **D** has a smaller surface area to volume ratio than organism **B**. Those that didn't achieve the mark failed to make their answer comparative. The converse was also credited. Very few students achieved the second mark point, which was for the idea that either the diffusion distance is **too** large or that diffusion would take **too** long. Many students just repeated the question stem and didn't mention the word diffusion.

06.4 This high demand question was not accessible to most students, with nearly 85% scoring zero marks. Most students recognised that **D** had a larger surface area to volume ratio, however failed to link this to losing heat more quickly. Some, but not many, realised that more respiration would be needed. Many students realised that metabolism is the sum of the chemical reactions in the body, but few made the link that respiration was a key part of it. Consequently, very few scored the final two marking points, with many students just stating that the rate of metabolism had increased, using information from the table in the question.

06.5 This levelled response question required students to make links between the adaptations of both villi and alveoli, which many students found difficult. The most common mark on this question was 1. Some students very competently described how the alveoli and villi are adapted to increase absorption. Some students, however, knew lots of detailed and correct information, but did not answer the question and refer to features of both alveoli and villi in their answer. Some answers lacked precision; many students lost marks referring to absorption rather than diffusion. There was also a number of references to thin membranes as opposed to thin walls. Other common mistakes were: the villi being one cell thick, reference to cell walls and the villi containing mitochondria, rather than the cells of the villi. Students who talked about both alveoli and villi and linked the adaptation to the correct consequence scored well.

4.1.3.1 Diffusion

Answer 15 · Examiner comments

June 2022 | 8461/2H | Original Q9

Question 9

This question was about investigations involving phototropism and the redistribution of auxin.

09.1 The amount of water given, the temperature and the type of plant were common correct answers for control variables in the investigation shown in **Figure 13**. 'Light' was an inappropriate suggestion as this was different in each of the three experiments. 'Time' was not rewarded as this was given as 12 hours in the diagram. More than three-quarters of students were able to suggest at least one correct control variable, with almost one third giving two.

09.2 Most responses to this question were very weak, with only one in eight scoring any marks. Most answers simply described experiments **B** (in the dark) and **C** (with all-round light) rather than stating these could be compared with experiment **A** (one-sided light) to show that light caused the effect in experiment **A** and that this light had to come from one side.

09.3 Careful inspection of **Figure 13** was necessary to answer this question – which showed the ink marks just behind the tip of the shoot were further apart in all three seedlings after 12 hours and that this region was also the part that bent towards the light in experiment **A**. Hence growth and response/bending occurred in this region. Both points were evident to only one in 20 students.

09.4 Nearly three-quarters of students knew that the response shown by seedling **A** was called *phototropism*. There was the inevitable confusion with the term 'phototropism', and 'tropism' unqualified was considered inadequate. Some correctly used the term 'positive phototropism' but the qualification 'negative' cancelled what would otherwise have been worth the mark.

09.5 This question, and the next, examined the ability to select appropriate information from **Figure 14** about the distribution of auxin in shoot tips under different light regimes. Most answers (two-thirds of students) correctly referred to shoot tip **F** which showed that a higher amount of auxin had moved into the agar beneath the side receiving less light. Far fewer students chose to compare this with the situation in shoot tip **G** where auxin was prevented from moving sideways through the shoot by the thin sheet of glass and thus resulted in equal amounts of auxin in the agar beneath the shaded and the illuminated sides. Many made inappropriate references to the results from the shoot tips kept in the dark (**D** and **E**).

4.1.3.1 Diffusion

Answer 15 · Examiner comments

June 2022 | 8461/2H | Original Q9

09.6 The hypothesis that light causes the breakdown of auxin was easily refuted by the observation that all four blocks of agar, whether beneath shoot tips in the light or in the dark, contained approximately equal amounts of auxin. Only one fifth of students made relevant observations about the shoot tips in the light compared with those in the dark, while many simply focused on the results for shoot tip **G** and did not gain credit.

4.1.3.1 Diffusion

Answer 15 · Examiner comments

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.1.3.1 Diffusion

Answer 16 · Examiner comments

June 2025 | 8461/1H | Original Q6

Question 6 (standard, standard/high demand and high demand)

06.1 This question was very well answered in a succinct way by 90% of all students. Occasionally, students omitted to refer to what was moving, and a very small number got the concentrations the wrong way around. It is worth reinforcing with students that the particles do not move from a high concentration *gradient* to a low concentration *gradient*. A significant number of students still included terms such as 'along the concentration gradient' despite this appearing as a frequent flag in previous examiner reports.

06.2 It was pleasing to see that students were able to attempt to apply their knowledge of the adaptations of the lungs to the diffusion of gases in the gills, with most students (nearly 40%) achieving MP1. It was not uncommon to see a long answer containing only descriptions of the gills, rather than explanations, and again, students are advised to acknowledge the command word for each question to ensure that they have included all of the relevant information. Occasionally MP1 could not be awarded where students simply copied the information from the question (gas exchange) rather than linking this to their knowledge of how the gases move. Less than 5% were able to score 3 or 4 marks due to a lack of specificity regarding the structures involved, often just mentioning gills, rather than the filaments within them. Whilst this was acceptable for MP1 and MP2, the higher demand marking points required a more specific description of the feature. There is a subtle difference between having a 'good blood supply' (number of blood vessels) and having a 'good blood flow' (speed of blood) and the insufficient reference to blood flow was a common reason why MP2 was not credited. The most common mistake seen for MP3 was reference to the 'gills' being thin, rather than the filaments, and without reference to the walls of these. As in previous years, occasionally, students confuse the walls of exchange surfaces with cell walls. Very few students accessed MP4 as their answer lacked the detail required at this level, but of those that did, a significant number made a very good attempt at describing counter-current flow linked to concentration gradient. Students should be reminded of the need for clarity and appropriate terminology in their responses. Reference to a constant or steady concentration gradient does not imply steepness, and 'a' gradient in place of a concentration gradient is insufficient. As in previous years, the misconception relating to 'moist linings' was frequently seen.

06.3 A range of marks were seen across this question, with roughly equal numbers of students scoring 1, 2, and 3 marks. 13% scored zero marks in this question. Of the marking points achieved, MPs 2 and 3 were the most commonly credited, with the most frequent omission being reference to movement – many students just repeated

4.1.3.1 Diffusion

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the stem of the question and referred only to 'swimming'. It was pleasing to see only a small number of students stating that energy was produced, although some did state that energy is needed for respiration. MP3 required reference to 'more' respiration, and this was often inferred earlier in the student's answer. It would be beneficial for students to remember to repeat this idea at each stage of their answer i.e. more movement, requires more respiration to release more energy for more muscle contraction, to ensure that all marking points are achieved. Only a small number of students scored MP4. A number of students wrote in the converse, stating that there would be *no* respiration in a resting fish (the fish would be dead!) and a number used the incorrect word 'respirate' in place of respire. As in previous years, a small minority of students think that glucose is a product of respiration.