AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.5

Microscopy

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**15**
Available paper years	**2007–2024**

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.

4.1.1.5 Microscopy

Answer 01 · Mark scheme

June 2007 | BLY1H | Original Q8 | Legacy

The full source mark scheme begins on page 33. Follow original question 8 in that document.

4.1.1.5 Microscopy

Answer 02 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	C		1
3(b)(i)	guard (cell)		1
3(b)(ii)	water movement / transpiration through stomata / pores / holes / (region) X **or** petroleum jelly blocks / covers stomata / pores / holes / X stomata / pores / holes / X found on lower surface		1 1
Total			**4**

4.1.1.5 Microscopy

Answer 02 · Mark scheme

January 2010 | BLY3H | Original Q3 | Legacy

BLY3H

Answer 03 · Mark scheme

March 2010 | BLY1AP | Original Q9 | Legacy

Nine	**2**	**4**	**4**	**2**

4.1.1.5 Microscopy

Answer 04 · Mark scheme

June 2011 | BLY2H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a) E	because water enters (the cell / it / named cell)	do **not** accept salt / sugar / solution entering	1
	by osmosis / diffusion	if osmosis / diffusion not given accept concentration inside cell greater than outside cell assume concentration refers to solute concentration unless answer indicates otherwise allow water goes up the concentration gradient allow water goes down its concentration gradient do **not** accept if diffusion of salt / sugar	1
	through a partially permeable membrane	allow semi / selectively permeable membrane **or** description	1
1(b) E	(plant cells) have (cell) wall	accept animal cells have no (cell) wall ignore reference to cell membrane do **not** accept reference to other organelles **or** any implication that animal cells have a cell wall eg plant cells have a thicker cell wall	1
Total			**4**

4.1.1.5 Microscopy

Answer 04 · Mark scheme

June 2011 | BLY2H | Original Q1 | Legacy

BLY2H

4.1.1.5 Microscopy

Answer 05 · Mark scheme

Question 5

question	answers	extra information	mark
5	D – many microvilli (1) Ex – provide large surface area (1) D – many capillaries / good blood supply (1) Ex – maintain concentration / diffusion gradient **or** quickly removes food (1) D – thin wall / one cell thick surface / capillaries near surface (1) Ex – short distance for food to travel (1) D – many mitochondria (1) Ex – provide energy / ATP for active uptake / transport (1)	**five** points made max **3** descriptions max **3** explanations allow villi are thin ignore villi are one cell thick	max 5
Total			**5**

4.1.1.5 Microscopy

Answer 05 · Mark scheme

June 2011 | BLY3H | Original Q5 | Legacy

BLY3H

4.1.1.5 Microscopy

Answer 06 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	any **one** suitable product: eg • penicillin / antibiotic / other named antibiotic • mycoprotein / described / quorn • lactic acid / yoghurt • enzymes • ethanol / alcohol / beer / wine • hormones / insulin / GH / somatotrophin • blood-clotting protein / factor VIII • methane / biogas • vaccines		1
6(b)(i)	otherwise too many colonies <u>to count</u> **or** too many bacteria <u>to count</u> **or** make it easier to count		1
6(b)(ii)	a colony is <u>many</u> bacteria **or** cannot see one bacterium each bacterium produces one colony		1 1

Question 6 continues on the next page

Question 6 continued

question	answers	extra information	mark
6(c)	correct answer: 8 800 000 / 8.8 million / 8.8×10^6	correct answer gains **2** marks with or without 1st two lines if answer incorrect, 1 error in calculation eg 88 000 / 880 000 gains **1** mark **or** allow error carried forward from incorrect 1st line for **1** mark	2
6(d)(i)	on graph: line starts at x and decreases downward sloping s – shaped curve not reaching zero before 30 hours		 1 1
6(d)(ii)	(graph **A**) rises: because glucose <u>is used</u> for reproduction / growth / cell division / multiplication (graph **A**) falls: less / no glucose available **or** glucose is limiting causes some bacteria to die	 allow food for glucose must relate to previous point	 1 1 1
6(d)(iii)	method B counts living and dead bacteria / includes dead bacteria		1
Total			**12**

The AQA UMS Conversion Calculator is available on the **Results statistics** page of the AQA Website

4.1.1.5 Microscopy

Answer 07 · Mark scheme

June 2012 | BL2HP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	makes / produces / synthesises protein / enzyme		1
2(a)(ii)	plant cell has nucleus / vacuole / chloroplasts / chlorophyll **or** plant cell is much larger	'It' = plant cell allow correct reference to DNA or chromosomes allow plant cell has fewer ribosomes allow cellulose (cell wall)	1
2(b)(i)	200	correct answer with or without working gains **2** marks if answer incorrect, allow **1** mark for $\frac{2 \times 50{,}000}{500}$ **or** $\frac{100{,}000}{500}$ **or** 100	2
2(b)(ii)	bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'	ignore references to respiration	1
Total			**5**

4.1.1.5 Microscopy

Answer 07 · Mark scheme

June 2012 | BL2HP | Original Q2 | Legacy

BL2HP

4.1.1.5 Microscopy

Answer 08 · Mark scheme

January 2013 | BL2HP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	mitochondrion / mitochondria	must be phonetically correct	1
3(a)(ii)	carbon dioxide / CO_2 water / H_2O	in either order accept CO2 but **not** CO^2 accept H2O **or** HOH but not H^2O	1 1
3(a)(iii)	diffusion high to low concentration through (cell) membrane **or** through cytoplasm	 allow down a concentration gradient do **not** accept cell wall	1 1 1
3(b)	ribosomes make proteins / enzymes using amino acids part A / mitochondria provide the energy for the process	 allow ATP do **not** accept produce or make energy	1 1 1
Total			**9**

4.1.1.5 Microscopy

Answer 08 · Mark scheme

January 2013 | BL2HP | Original Q3 | Legacy

BL2HP

4.1.1.5 Microscopy

Answer 09 · Mark scheme

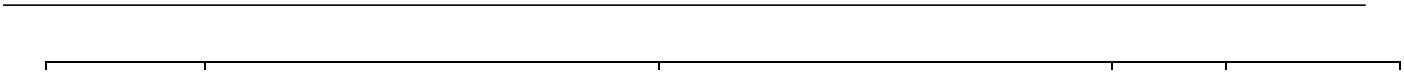
June 2015 | BL2HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	contract / shorten to churn / move / mix food	ignore relax do **not** allow expand accept peristalsis / mechanical digestion ignore movement unqualified	1 1	AO1 2.1, 2.2.1b,c, 2.1.1e
4(b)	400	acceptable range 390-410 allow 1 mark for answer in range of 39 to 41 allow 1 mark for answer in range of 3900 to 4100	2	AO2 2.2.1b,c
4(c)	to transfer energy for use by (aerobic) respiration **or** from glucose	allow to release / give / supply / provide energy do **not** allow to 'make' / 'produce' / 'create' energy allow to make ATP ignore to store energy do **not** allow anaerobic energy released **for** respiration = max 1 mark	1 1	AO1 2.1.1a, 2.6.1d
4(d)(i)	to make protein / enzyme	ignore 'antibody' or other named protein	1	AO1 2.1.1a
4(d)(ii)	too small / very small	allow light microscope does not have sufficient magnification / resolution allow ribosomes are smaller than mitochondria ignore not sensitive enough ignore ribosomes are transparent	1	AO2 2.1.1a
Total			8	

4.1.1.5 Microscopy

Answer 09 · Mark scheme

June 2015 | BL2HP | Original Q4 | Legacy



4.1.1.5 Microscopy

Answer 10 · Mark scheme

June 2019 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	controls the (activities of the) cell	allow contains genetic information / genes / DNA / chromosomes do **not** accept brain do **not** accept controls substances entering / leaving the cell	1	4.1.1.2 AO1
01.2	red blood cell / RBC **or** bacteria / prokaryote **or** xylem (cell)	allow erythrocyte ignore blood cell unqualified ignore platelets allow named examples of bacteria do **not** accept virus	1	4.2.2.3 4.1.1.1 AO1
01.3	cell shape is similar to cell in **Figure 1 and** nucleus present any **two** features correctly identified and labelled: • nucleus • (cell) membrane • cytoplasm • mitochondria / mitochondrion • ribosome(s)	ignore shading do **not** accept a cell wall drawn allow cell wall if drawn and correctly labelled do **not** accept other plant sub-cellular structures	1 1	4.1.1.2 AO2 8.2.1 AO1
01.4	any **one** from: • (cellulose cell) wall • chloroplast • (permanent) vacuole	ignore chlorophyll allow starch grain	1	4.1.1.2 AO1

4.1.1.5 Microscopy

Answer 10 · Mark scheme

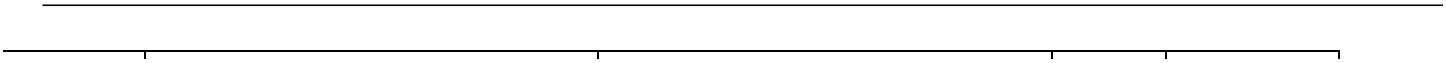
June 2019 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		an answer of (×) 400 scores **3** marks an answer of (×) 40 scores **2** marks		4.1.1.5 AO2
	24 (mm) **or** 2.4 (cm)	allow in range 23 to 25 (mm) **or** in range 2.3 to 2.5 (cm)	1	
	$\frac{24}{0.06}$ **or** $\frac{2.4}{0.06}$	allow correct calculation from their measurement of **X** to **Y** in the range 2.3 cm to 3.5 cm **or** 23 mm to 35 mm	1	
	(×) 400	allow correct magnification derived from their measurement in **mm** ignore rounding errors	1	
01.6	high(er) magnification high(er) resolution **or** high(er) resolving power	ignore bigger / zoom allow see more detail if neither mark awarded allow **1** mark for see smaller objects **or** see smaller sub-cellular structures allow 3D image	1 1	4.1.1.5 AO1
Total			**10**	

4.1.1.5 Microscopy

Answer 10 · Mark scheme

June 2019 | 8461/1H | Original Q1



Answer 11 · Mark scheme

November 2020 | 8461/1H | Original Q7

The full source mark scheme begins on page 45. Follow original question 7 in that document.

4.1.1.5 Microscopy

Answer 12 · Mark scheme November 2021 | 8461/1H | Original Q1

01.1	any **two** from: • (microscope) slide • cover slip • dye / stain • (mounted) needle • pipette / dropper • scalpel • forceps / tweezers	allow named dye / stain ignore water ignore knife allow swab (to collect cells)	2	AO1 4.1.1.5 RPA1
01.2	eyepiece / lens	do **not** accept objective lens	1	AO1 4.1.1.5 RPA1
01.3	to focus (the image / cells)	allow to make the cells / image clear(er) allow to improve resolution (of the image) ignore to move the stage up / down do **not** accept reference to magnification	1	AO1 4.1.1.5 RPA1
01.4	any **one** from: • no cells in the field of view • slide not in the correct position • mirror not in correct position • (objective) lens not clicked into place **or** (objective) lens dirty • (student is) looking at a (large) air bubble • (the microscope is) not focussed	allow light / microscope not switched on / plugged in allow student did not stain the cells allow idea of magnification not being high enough	1	AO3 4.1.1.5 RPA1

01.5	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO2
	Level 1: Relevant features are identified and differences noted.	1–3	AO1
	No relevant content	0	
	Indicative Content **Differences:** • red blood cell has no nucleus **or** plant cell has a nucleus • red blood cell has no cell wall **or** plant cell has a cell wall • red blood cell is a biconcave disc **or** there are many different shapes of plant cell • red blood cell contains haemoglobin **or** plant cells do not contain haemoglobin • red blood cells do not contain chlorophyll **or** plant cells (may) contain chlorophyll • red blood cell has no chloroplasts **or** plant cell has chloroplasts • red blood cell has no (permanent) vacuole **or** plant cell has (permanent) vacuole • red blood cells are (much) smaller than plant cells **Similarities:** both have: • cytoplasm • cell membrane • pigments (although they are different) ignore references to mitochondria and ribosomes for **Level 2**, consideration of both red blood cells and plant cells is required.		4.1.1.2 4.2.2.3

01.6	water enters (the cells) by osmosis / diffusion	allow water enters **and** the cell starts to swell ignore explanations of osmosis	1	AO2
	plant cell has a cell wall (which prevents it from bursting)	allow red blood cell has no cell wall (so it swells and bursts)	1	AO1 4.1.3.2 4.1.1.2

Total			**13**

4.1.1.5 Microscopy

Answer 12 · Mark scheme

November 2021 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.1.1.5 Microscopy

Answer 13 · Mark scheme

June 2022 | 8461/1H | Original Q3

Question 3

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>03.1</td><td>
<table>
<tr><th>Hazard</th><th>Risk</th><th>Plan to minimise risk</th></tr>
<tr><td>Iodine solution is an irritant</td><td>May cause allergic reaction or skin rash</td><td>wash skin immediately (after contact)
or
wear gloves
or
clean up spills

allow method to prevent spills e.g. use a dropper bottle

ignore do not spill</td></tr>
<tr><td>Sharp knife</td><td>may cut you / someone / skin</td><td>cut away from the body
or
cut on a chopping board
or
keep fingers away from blade (when cutting)

allow description of how to carry knife safely

ignore use a blunt knife</td></tr>
</table>
1 mark for each correct row
</td><td>1

1</td><td>AO3
4.1.1.5
RPA1</td></tr>
</table>

4.1.1.5 Microscopy

Answer 13 · Mark scheme

June 2022 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	**thin layer** (to) help see individual cells	allow so light can penetrate	1	AO2 4.1.1.5 RPA1
	iodine solution (to) stain / see the parts of the cell	allow visible named sub-cellular structures e.g. nucleus, cytoplasm, cell wall, starch grains ignore chloroplast ignore (to) stain the cell	1	
	at an angle (to) prevent / reduce air bubbles		1	

4.1.1.5 Microscopy

Answer 13 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	*recall of equation* magnification = $\frac{\text{size of image}}{\text{size of real object}}$	allow magnification = $\frac{\text{length of image}}{\text{length of real object}}$ ignore use of equation triangle	1	AO1
	rearrangement of equation size of real object = $\frac{\text{size of image}}{\text{magnification}}$	allow length of real object = $\frac{\text{length of image}}{\text{magnification}}$ allow recall and rearrangement of equation implied at any stage	1	AO2
	substitution $\frac{4.8}{400}$	allow substitution of incorrectly converted value	1	AO2
	0.012 (cm)	allow answer using incorrectly converted value	1	AO2
	conversion 120 (µm)	allow conversion to µm at any stage	1	AO2 4.1.1.5 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	any **two** from: • include magnification / scale • use continuous lines **or** ensure no gaps in lines • do not draw overlapping cells • draw (wider) cell walls • do not shade • draw all the cells present • draw correct cell shapes • do not have gaps between cells • draw nuclei in correct location • label cell part(s)	ignore make it neater allow do not colour allow label named cell part(s)	2	AO3 4.1.1.2 RPA1

4.1.1.5 Microscopy

Answer 13 · Mark scheme

June 2022 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(would) look more magnified / bigger	ignore reference to zoom	1	AO1 4.1.1.5
	(cell would) have more detail **or** (would) be at a higher resolution **or** (could) see more sub-cellular structures **or** sub-cellular structures seen in detail	allow correct examples of sub-cellular structures such as ribosomes, mitochondria, cell membrane ignore chloroplast allow (could) be in 3D allow would be in black and white	1	

Total Question 3		14

4.1.1.5 Microscopy

Answer 14 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any **one** from: a change in • DNA • base code **or** nucleotide sequence • a base (in DNA) • a gene / allele • part of a chromosome • number of chromosomes • genetic code / material	ignore genetic information	1	AO1 4.6 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	16 / sixteen		1	AO3 4.7.2.1 RPA9

4.1.1.5 Microscopy

Answer 14 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	*volume of sample in mm^3* 0.004		1	AO2 4.7.2.1 RPA9
	number of cells in 1 mm^3 ***diluted*** *pond water* 14 ÷ 0.004	allow 14 ÷ (0.2 × 0.2 × 0.1) allow use of an incorrectly calculated volume of 0.04	1	
	3 500	allow ecf from answer to q.07.2 for number of algal cells	1	
	correct dilution factor ¼	allow dilution = ×4 **or** 4 times	1	
	number of cells in 1 mm^3 ***undiluted*** *pond water* 3 500 × 4	allow a calculation based on a dilution factor of 5	1	
	14 000 **or** 1.4 × 10^4		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	to make it easier to count	ignore easier to see **or** more spread out ignore quicker to count	1	AO3 4.7.2.1 RPA9

4.1.1.5 Microscopy

Answer 14 · Mark scheme

June 2022 | 8461/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	smaller volume	allow (some) liquid / cells would leak out (from under the cover slip)	1	AO3 4.7.2.1 RPA9
	so fewer cells **or** lower cell count	allow this mark **only** if there is an attempt at an explanation	1	

Total Question 7		**11**

4.1.1.5 Microscopy

Answer 15 · Mark scheme

June 2024 | 8461/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.1	any **one** from: • (cell **or** sub-cellular structures) grows • increase in (number of) sub-cellular structures • increase in (number of) mitochondria • increase in (number of) ribosomes	do **not** accept nucleus ignore increase in cell parts / components allow increase in respiration allow increase in protein (synthesis) do **not** accept changes that occur as the cell divides	1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.2	(cell) membrane		1	AO1 4.1.2.2 4.1.1.2

4.1.1.5 Microscopy

Answer 15 · Mark scheme

June 2024 | 8461/1H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.3		allow use of π button on calculator for 3.14 allow use of $\frac{22}{7}$ for 3.14		AO2 4.1.1.5
	substitution length = $\frac{24\ 500\ 000}{3.14 \times 125^2}$		1	
	(length =) 499.363 (nm)	allow 499 (nm)	1	
	recall of equation magnification = $\frac{\text{image size}}{\text{real size}}$		1	
	correct conversion of mm to nm **or** nm to mm (4 mm = 4 000 000 nm)	allow conversion at any point	1	
	$\frac{4\ 000\ 000}{499.363}$	allow use of correctly rounded calculated value for length	1	
	×8010	allow ×8010.205 do **not** accept if unit given allow an answer consistent with an incorrectly rounded / calculated value for length	1	

4.1.1.5 Microscopy

Answer 15 · Mark scheme

June 2024 | 8461/1H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.4	chromosomes cannot be pulled (by the fibres) to each end of the cell (so) nucleus cannot divide	ignore chromosomes cannot be separated unqualified allow **two** (genetically identical) cells cannot be formed ignore cytokinesis ignore the cell cannot divide	1 1	AO3 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.5	tumour cannot grow / proliferate / spread	allow stops secondary tumours forming allow stops metastasis ignore stops uncontrolled cell division do **not** accept the cancer / tumour cannot become malignant	1	AO2 4.1.2.2 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
08.6	testing the drugs on live tissues in a laboratory		1	AO1 4.3.1.9

Total Question 8	**12**

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Biology 4411

BLY1H Unit Biology 1

Mark Scheme

2007 examination - June series

4.1.1.5 Microscopy

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell, Director General.

4.1.1.5 Microscopy

MARK SCHEME

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 and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

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

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 lines 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.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates 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.

4.1.1.5 Microscopy

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

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate 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

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

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 are 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 e.c.f. 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 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.1.1.5 Microscopy

BLY1H Question 1

	answers	extra information	mark
(a)	scientists figures based on research / calculations / data **or** scientists sample whole area	ignore reasons based on bias	1
	fishermen based on impression / hearsay / experience **or** fishermen fish in well-stocked / limited areas		1
		scientists sample a wider area = **2** marks fishermen only fish in well-stocked areas = **2** marks if no marks gained fishermens' opinion **and** scientists' opinion gains **1** mark	
(b)	any **two** from: • economic considerations • political impact • pressure groups **or** fears of extinction	 eg fear for jobs, profits, big demand for cod eg allow EU / government decide or laws will be passed	2
total			4

4.1.1.5 Microscopy

BLY1H Question 2

	answers	extra information	mark
(a)	any **two** from: • area of bed sampled • sampling time • size of net • kicking action • net position	control variables from information given	2
(b)	any **two** from: • some animals not dislodged • some animals missed / through / escaped net • invertebrates difficult to identify • invertebrates from outside area	must be ideas related to a sample ignore reliability etc	2
(c)	10 to 99 **or** 10 – 99 **or** 99 to 10 **or** 99 – 10		1
(d)	any **two** from: • increased / goes up • 0 at sample 4 • to (more than) 100	allow increase implied from all data described	2
(e)	mayfly because not found downstream of point where sewage enters stream **or** only in the unpolluted water		1 1
total			9

4.1.1.5 Microscopy

BLY1H Question 3

	answers	extra information	mark
	adaptation and linked advantage eg	max **2** for 3 adaptations	max 2 max 2
	• roots widespread / long (1) to collect water from large area (1)	ignore large roots accept to collect more water	
	• some roots deep / long (1) to collect water from deep down (1)	ignore large roots accept to collect more water	
	• absence of leaves (1) reduces water loss (1)		
	• swollen stem (1) to store water (1)		
	• roots near surface (1) to absorb rainwater (1)		
	• roots widespread (1) support in sandy soil (1)		
total			4

4.1.1.5 Microscopy

BLY1H Question 4

	answers	extra information	mark
(a)(i)	viruses live inside cells		1
	viruses inaccessible to antibiotic	allow drug / antibiotic (if used) would (have to) kill cell	1
(ii)	mutation	ignore mutation caused by antibiotic	1
	natural selection **or** no longer recognised by antibiotics	accept description of natural selection	1
(b)	(stimulate) antibody production	ignore antitoxin	1
	(by) white cells		1
	<u>rapidly</u> produce antibody on re-infection	ignore antibodies remain in blood	1
total			7

4.1.1.5 Microscopy

BLY1H Question 5

	answers	extra information	mark
(a)	ovary or ovaries		1
(b)	(hormone) implant		1
(c)	do not have to remember to take		1
(d)	does not involve hormone **or** it is a mechanical method	allow coil may be dislodged allow egg <u>is</u> fertilised / released allow not preventing egg fertilisation / release	1
(e)	involves death of fertilised egg **or** (regard) fertilised egg as human **or** stops fertilised egg developing	allow embryo / baby for fertilised egg ignore against religion only allow fertilised egg is alive ignore side effects	1
(f)(i)	inhibit FSH (production) so no eggs mature / develop / are produced	allow inhibits LH allow (LH) <u>stimulates</u> egg release ignore progesterone	1 1
(ii)	contains FSH which causes egg to mature / develop / be produced **or** in women whose FSH is low	allow contain LH allow (LH) <u>stimulates</u> egg release	1 1
total			9

4.1.1.5 Microscopy

BLY1H Question 6

	answers	extra information	mark
(a)	asexual reproduction / mitosis **or** no fusion of gametes **or** division after fusion **or** from fertilised egg **or** from same embryo **or** from same egg **and** sperm	ignore cloning	1
	each embryo has identical genetic information / genes / DNA / chromosomes		1
(b)	any **two** from: • experimental subject and control are identical **or** fair test since monkeys identical • monkeys similar to humans, so effect of drugs likely to be similar • all identical so will have same reaction to drugs / disease • it's better than catching wild ones	allow closely related so… ignore evolved from	2
total			4

4.1.1.5 Microscopy

BLY1H Question 7

	answers	extra information	mark
(a)	any **two** from: • balance between two important for good heart health • high LDL causes heart disease / high cholesterol • high HDL reduces heart disease / cholesterol	ignore blood pressure do **not** accept converse argument do **not** accept converse argument	2
(b)	heart attacks greater amongst patients with low HDL levels statins reduce heart attacks of patients **or** placebo is less effective	ignore statins cause heart disease ignore comparative effects of the two statins allow pravastatin is more effective supported by appropriate calculations eg pravastatin > 39 33% < 39 31.4% Average 32.4 > 39 32% < 39 28.2% Average 30.05%	1 1
total			4

4.1.1.5 Microscopy

BLY1H Question 8

	answers	extra information	mark
(a)	present day organisms have evolved from simpler organisms	ignore answers in terms of natural selection	1
	over long periods of time **or** millions / billions of years		1
(b)	(natural selection operates on successful) characteristics produced by chance / (random) mutation		1
	in this experiment caused by hormones / environment	allow this example indicates inheritance of acquired characteristics for **2** marks allow this is Lamarckism only for **1** mark	1
total			4

AQA

GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final

206G8461 1H/MS

4.1.1.5 Microscopy

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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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.

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.

4.1.1.5 Microscopy

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

4.1.1.5 Microscopy

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

4.1.1.5 Microscopy

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**	

4.1.1.5 Microscopy

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	

4.1.1.5 Microscopy

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		

4.1.1.5 Microscopy

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**	

4.1.1.5 Microscopy

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

4.1.1.5 Microscopy

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**	

4.1.1.5 Microscopy

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**	

4.1.1.5 Microscopy

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

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

4.1.1.5 Microscopy

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**	

4.1.1.5 Microscopy

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

4.1.1.5 Microscopy

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**

4.1.1.5 Microscopy

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 ○ at (very) low dose ○ 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 ○ to test for the correct / optimum dose ○ to check for any side effects ○ to test for efficacy **or** to test if it works ○ in a double blind trial ○ 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**	

4.1.1.5 Microscopy

Answer 11 · Examiner comments

November 2020 | 8461/1H | Original Q7

Question 7 (standard/high & high demand)

Many students unnecessarily explained how monoclonal antibodies were produced for **07.1**, and very few scored marks on this question. Many students misunderstood the context of the question, and indicated that the mAbs would be injected into the slide. Some students thought that the mAbs were made of lymphocytes. In **07.2**, several students incorrectly stated that the mAbs themselves or lymphocytes would engulf the pathogen.

In **07.3**, many students were able to access Level 2, however, a number of students made blanket statements about clinical trials that applied to all participants. Several students were unable to clarify the difference between patients and healthy volunteers, with some using confusing terminology such as ‘healthy patients’.

4.1.1.5 Microscopy

Answer 11 · Examiner comments

Concluding Remarks

Generally, the standard of this paper was broadly comparable to previous years. Students generally scored well on simple recall of knowledge questions (AO1) and the topics of cell structure, photosynthesis and movement across membranes were well answered. Most students were able to apply their knowledge effectively in straightforward questions (AO2), but some found application of knowledge to new situations more difficult. Many student's understanding of the structure and function of enzymes is limited and a lack of clear knowledge meant that some students articulated answers poorly on paper. Many students struggle to answer AO3 questions, particularly where complex data needs to be analysed or improvements to practical techniques need suggesting. A lack of precision when quoting, plotting or describing data is common.

As in previous years, details of the Benedict's test for sugar and iodine solution test for starch had not been recalled well, indicating that many students understanding of this practical activity was below expectations. Students continue to find the role of the liver in the human body a challenge.

4.1.1.5 Microscopy

Answer 11 · Examiner comments

Mark Ranges and Award of Grades

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

4.1.1.5 Microscopy

Answer 12 · Examiner comments

November 2021 | 8461/1H | Original Q1

Question 1 (standard demand)

A lack of correct terminology was seen throughout Question 1. Many students were confused over the apparatus used in the Required Practical Activity (RPA) assessed in **01.1** and the RPA on microbial growth. Unrelated equipment given as an answer included a spatula, microwave and petri dish and a number of students gave answers such as microscope, stage and objective lens, indicating that they had not read the question correctly.

Commonly, weak descriptions of the idea of focussing were given in **01.3**, with many students referring incorrectly to magnification, or more commonly, 'zoom'.

In **01.5**, most students were able to state some of the structures of a red blood cell and a plant cell, and some students were able to make comparisons between the two. Few students included similarities in their comparisons and several were confused about the different blood components, stating that red blood cells contain platelets, plasma and nuclei.

Confusion about the function of the cell wall was seen in **01.6**. Many students thought that the cell wall stops the movement of water into the cell and hence, this is the reason why the cell placed in water did not burst. Several students also thought that the plant cell already had lots of water inside of it and so would not take any additional water in, and therefore, would not burst.

4.1.1.5 Microscopy

Answer 13 · Examiner comments

June 2022 | 8461/1H | Original Q3

Question 3 (Standard and standard/high demand)

03.1 Over 60% of students gained the first mark point for identifying a plan to minimise the risk when using iodine solution. The second mark point for the sharp knife was less frequently awarded as students were less able to give a valid method to minimise the risk. The most common incorrect response referred to wearing goggles. Responses were often vague such as 'place it away from you'. Some students abdicated responsibility completely by recommending that the teacher or an adult cut the onion and some were more imaginative and suggested buying pre-cut onion. A few candidates transferred their knowledge from other subjects e.g. technology and talked about specific knife grips that protect the fingers.

03.2 Just over 10% of students achieved full marks in this question. Reponses for marking points 1 and 2 often lacked sufficient detail or failed to answer the question, for example describing that the layer is only one cell thick for MP1 and suggesting staining organelles that could not be seen with a light microscope for MP2. Similarly, some students concentrated on the problems of a thick slice, rarely giving an adequate converse argument. Those who scored at all on MP1 generally referred to light penetration rather than the alternative of seeing individual cells. MP2 responses often stopped at staining the whole cell, rather than its individual parts and some students described the test for starch. The purpose of the cover slip was well understood. Incorrect answers mostly referred to the angle of the coverslip having something to do with reflecting light to see the sample better.

03.3 This question was well answered, with 50% of students scoring 5 out of 6 marks, and few scoring below that. The most common error was an incorrect conversion to micrometres. Many students fail to recognise that they need to convert centimetres to millimetres before converting to micrometres and many divide by factors of 1000 rather than multiply.

03.4 In this question, some students found it difficult to articulate themselves, often contradicting themselves or tying themselves in knots by not reading their final response over for mistakes. Answers such as 'add labels', or 'label organelles / structures' that couldn't be seen with a light microscope were not creditworthy.

03.5 Despite this being a common question that students seem to be familiar with, many struggled to articulate the idea of greater magnification and resolution when faced with the idea in the context of actual cells. Just over 50% of students gained full marks. Students sometimes showed their lack of understanding of resolution, frequently giving two alternative answers for MP2, and failing to recognise that these alternatives are due to the effects of higher resolution, thus gaining only 1 mark overall.

Answer 14 · Examiner comments

June 2022 | 8461/2H | Original Q7

Question 7

This question was about the calculation of the population density of a microscopic unicellular alga and problems that might be encountered in the method of doing so.

07.1 Since the unusual colour of the alga had been caused by a mutation, students had to define the term *mutation*. Just under two-thirds understood that a mutation was a change in the genetic material, such as DNA, a base, a gene or a chromosome.

07.2 A description was given in the question of how a scientist set up a special slide with a counting grid in order to count the algal cells in a given volume of a suitably diluted sample of pond water. Section and plan diagrams of the special slide were given in **Figures 8** and **9**. Students then had to score the number of cells in a 0.2 mm × 0.2 mm square in **Figure 9**, observing the given rules for inclusion or exclusion of cells on the boundaries. Around three-quarters of students arrived at the correct answer of 16.

07.3 This question was a 6-mark calculation to find the number of algal cells in 1 mm^3 of undiluted pond water from a count of 14 cells in the 0.2 mm × 0.2 mm square. Many students presented their working in a manner that was very difficult to follow, with a series of mathematical operations that were clearly not equalities yet that were all interconnected with 'equals' signs. A large proportion of students regarded the volume of the sample on the special slide as being equal to 0.2 × 0.2 = 0.04, forgetting to multiply by the depth of 0.1 mm to obtain an actual volume of 0.004 mm^3. Some misinterpreted the scientist's dilution factor: 2.5 cm^3 made up to 10 cm^3 is a 4-fold dilution, not 5-fold as many thought. Many did not consider the dilution and ended up with an answer of 3500 (or 350 with the incorrect volume) instead of the correct value of 14 000.

The correct calculation was simply:

$$\frac{14 \times 4}{0.004} = 14\,000$$

but only around 1 in 8 students arrived at this answer.

4.1.1.5 Microscopy

Answer 14 · Examiner comments

07.4 To understand this question required thinking about the experimental situation and the results shown in **Figure 9**. If the pond water had not been diluted, there would have been 4 times the number of cells shown in **Figure 9** which would have made them impossible to count. Just over a quarter of students made any reference to the ease of counting. Some thought the algae would have been easier to see as the murky pond water had been diluted. Some answers were close – stating that dilution reduced the likelihood of cells overlapping – but did not then go on to state that they would thus be easier to count.

07.5 The original information about the scientist's investigation included mention of a thick coverslip over the sample. In this question, information was given about a student trying to repeat the investigation but with a thin coverslip that was pulled downwards slightly, and asking for an explanation of what difference this would make to the cell count. Fewer than half scored any marks and only one in six scored both marks for stating that the volume would be reduced and the cell count therefore also reduced. There were various, highly inventive but incorrect, ideas such as a thinner cover slip allowing light to pass through more easily so more cells would be counted, or that the curved coverslip would somehow refract the light and alter the count as a result. Many stated that the cell count would be 'altered' without being more specific about the direction of this alteration.

4.1.1.5 Microscopy

Answer 15 · Examiner comments

Question 8 (standard, standard/high demand and high demand)

08.1 59% of students achieved the mark in this question, with most stating that the cell grows in size or increases its number of organelles. The increase in number was expressed in many different ways (replication, duplication, multiplication, etc.), all of which were creditworthy.

The most common incorrect answers contained descriptions of what happens during mitosis, such as the chromosomes being pulled to either end of the cell, or of the cell membrane and cytoplasm dividing.

08.2 78% of students answered this question correctly. The most common incorrect answers seen were cell wall and nucleus/nuclear membrane.

08.3 There were many ways in which students achieved a variety of marks in this question. 34% of students achieved 6 marks, and 33% achieved 5 marks, with the conversion from nm to mm being the difference between them. The conversion method was not well understood, with both divisions and multiplications with a large range of factors of 10 seen. Some students began by trying to convert the volume given in the question, which often led to further mistakes later on. Many students were able to substitute the numbers from the question into the equation given and calculate an answer, thus gaining two marks if they went no further (13% of students). Answers using any representation of *pi* (3.1, π or $^{22}/_{7}$) were accepted and seen, despite students being told to use 3.14 in the question.

Students could gain credit for quoting the magnification equation or for showing its use without writing it out in words. However, just quoting the triangular representation of the equation was not creditworthy. A significant minority of students gave the equation upside down and so were not awarded marking point 3 and, if they used it in that incorrect form, were not able to access marking point 5 or marking point 6, either.

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4.1.1.5 Microscopy

Answer 15 · Examiner comments June 2024 | 8461/1H | Original Q8

08.4 47% of students scored no marks in this question, with 11% scoring full marks and 40% scoring one mark. A simple description of what normally happens during mitosis was not creditworthy, yet was seen regularly. Of the two marking points, marking point 1 was achieved more commonly than marking point 2. Where the mark for marking point 1 was not achieved, the most common errors included: a simple description of chromosomes not being pulled apart with no destination described; vague references to the edges/sides of the cell; or an implication that chromosomes were unable to move (unaided), rather than be moved. Attempts at marking point 2 were often too vague to be creditworthy, with a large number of answers just repeating that the cell couldn't divide, as was given in the question stem.

08.5 16% of students gained credit in this question and, as in question 08.4, a reference to what would be unable to happen in the situation described was required. Many students gave a simple statement linking cancer to uncontrolled cell division and those that went on to say that this could not happen often just paraphrased what had been written in the question, which was not creditworthy. Those that did score the mark mainly mentioned the prevention of the tumour growing, with a minority stating that secondary tumours would be stopped from forming. References to individual cancer cells rather than tumours were seen frequently and were not creditworthy. Some answers referred to preventing the formation of tumours rather than stopping the spread of tumours that were already there and thus did not answer the question.

08.6 83% of students answered this question correctly.

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4.1.1.5 Microscopy

Answer 15 · Examiner comments

Mark Ranges and Award of Grades

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