AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.3

Cell specialisation

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**13**
Available paper years	**2010–2022**

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.

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme

January 2010 | BLY2H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	both parents **Aa**	accept other upper and lower case letters without key **or** symbols with a key allow shown as gametes in punnet square	1
	aa in offspring correctly derived from parents / **aa** correctly derived from the parents given	ignore other offspring / gametes for this mark parents do not have to be correct	1
	offspring **aa** identified as having cystic fibrosis	may be the only offspring shown **or** circled / highlighted / described	1
5(b)(i)	any **one** from: • sure / greater chance of healthy / non-cystic fibrosis egg / embryo / child • greater chance of fertilisation	accept converse if clear eg if you (only) took one it might have cystic fibrosis / might not be fertilised accept some may have the allele reference to suitable embryo is insufficient	1

Question 5 continues on the next page

BLY2H

Question 5 continued

question	answers	extra information	mark
5(b)(ii)	**advantages** any **two** from • greater / certain chance of having child / embryo without cystic fibrosis / healthy • child with cystic fibrosis difficult / expensive to bring up • cystic fibrosis (gene / allele) not passed on through generations **disadvantages** any **two** from: • operation dangers eg infection • ethical or religious issues linked to killing embryos • (high) cost • possible damage to embryo (during testing for cystic fibrosis / during operation) **plus** **conclusion** a statement that implies a valued, qualified judgement eg it is right because the risk of infection is small **or** eg it is wrong because embryos are killed	**to gain 3 marks both advantages <u>and</u> disadvantages must be given** ignore references to abortion unless qualified by later screening ignore risk unqualified accept wrong / cruel to kill embryos accept right to life **Note:** the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage has (already) been made do **not** award the mark if the conclusion only states that advantages outweigh disadvantages	max 3 1
Total			**8**

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme January 2010 | BLY2H | Original Q5 | Legacy

BLY2H

Answer 02 · Mark scheme March 2010 | BLY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	sexual reproduction	**2**
	B	tissue culture	**3**
	C	embryo transplants	**1**
	D	adult cell cloning	**4**

4.1.1.3 Cell specialisation

Answer 03 · 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**

4.1.1.3 Cell specialisation

Answer 03 · Mark scheme June 2010 | BLY2H | Original Q4 | Legacy

BLY 2H

Answer 04 · Mark scheme June 2011 | BLY2H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	release energy	allow provide / supply / give energy do **not** accept produce / create / generate / make energy do **not** allow release energy for respiration	1
4(a)(ii)	contain half the (number of) chromosomes **or** contains one set of chromosomes **or** contains 23 chromosomes	allow genetic information / DNA / genes / alleles instead of chromosomes accept haploid	1
4(b)	any **two** from: • (stem cells) are unspecialised / undifferentiated • are able to become differentiated **or** can form other types of cell / tissue / organ • stem cells can / able to divide / multiply	allow description eg 'no particular job'	2
Total			**4**

Answer 04 · Mark scheme June 2011 | BLY2H | Original Q4 | Legacy

BLY2H

4.1.1.3 Cell specialisation

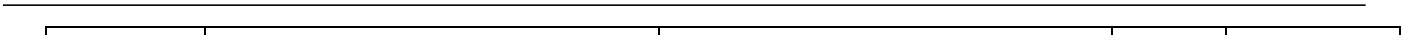
Answer 05 · Mark scheme June 2015 | BL1HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	part of a chromosome controls a characteristic	allow piece of DNA allow parts of chromosomes allow controls characteristics allow codes for (**or** controls production of) protein / enzyme ignore examples of characteristics	1 1	AO1 1.7.1b/c
8(b)	(iPS method) *similarities* • (both) use of skin / body cell • (both) ref to (formation of) embryo • (both) transfer (embryo) into womb / uterus • (both) use surrogate mothers *differences* • (iPS) uses sexual reproduction • (iPS) surrogate mother is different species • (iPS) no nucleus transfer / removal • (iPS) offspring genetically different from parent • (iPS) no electric shock	max **3** similarities or differences allow converse if clearly referring to adult cell cloning allow ref to egg **and** sperm **or** gamete**s or** fertilisation allow not a clone	4	AO1 / AO3 1.7.2a/c
8(c)	any **one** from: • idea of retaining biodiversity • may be (economically) useful (in the future) • idea of maintaining food chain / ecosystem		1	AO3 1.7
Total			**7**	

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

June 2015 | BL1HP | Original Q8 | Legacy



4.1.1.3 Cell specialisation

Answer 06 · Mark scheme June 2016 | BL2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	testis / testes	allow testicle(s)	1	AO1 2.7.1f
5(b)(i)	**B** = 13.2 **C** = 6.6 **E** = 3.3	all 3 correct = 2 marks 2 or 1 correct = 1 mark If no marks awarded allow ecf for C **and** E based on answer to B ie C = ½ B **and** E = ½ C for one mark	2	AO2 2.7.1e/h
5(b)(ii)	6.6	allow twice answer for cell **E** in 5bi	1	AO2 2.7.1e/h/i
5(b)(iii)	mitosis	correct spelling only	1	AO1 2.7.1a/d/i
5(c)(i)	any **two** from: • cells that are able to divide • undifferentiated cells / not specialised • can become other types of cells / tissues **or** become specialised /differentiated	allow pluripotent	2	AO1 2.7.1k/l
5(c)(ii)	4-day embryo is a (potential) human life **or** destroying/damaging (potential) human life	allow cord would have been discarded anyway ignore reference to miscarriage allow cannot give consent	1	AO3 2.7
5(c)(iii)	perfect tissue match **or** hard to find suitable donors	allow same/matching antigens allow no danger of rejection allow no need to take immunosuppressant drugs (for life) ignore genetically identical **or** same DNA	1	AO2 2.7.1c

4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

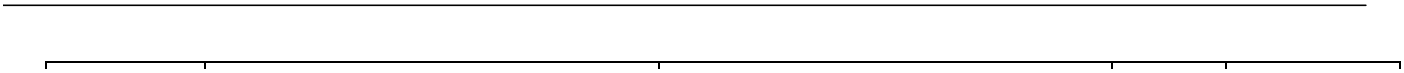
June 2016 | BL2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(c)(iv)	stem cells have same faulty gene / allele / DNA / chromosomes	allow genetically identical ignore cells have the same genetic disorder	1	AO2 2.7.1c
Total			10	

4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

June 2016 | BL2HP | Original Q5 | Legacy



4.1.1.3 Cell specialisation

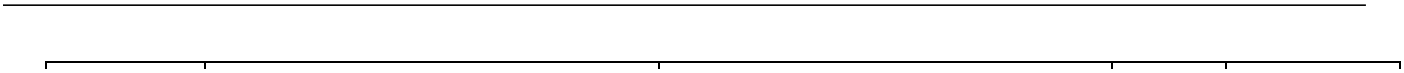
Answer 07 · Mark scheme June 2016 | BL3HP | Original Q1 | Legacy

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

4.1.1.3 Cell specialisation

Answer 07 · Mark scheme

June 2016 | BL3HP | Original Q1 | Legacy



4.1.1.3 Cell specialisation

Answer 08 · Mark scheme June 2017 | BL1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	idea that sexual reproduction results in genetic variation	allow converse if clearly referring to asexual reproduction allow reference to natural selection / evolution (if conditions change)	1	AO1 1.7.2a
7(b)(i)	any **four** from: • nucleus taken from egg (cell) (of female) **A or** cytoplasm (and membrane) discarded • nucleus removed / discarded from egg (cell) (from female) **B or** only cytoplasm (and membrane) kept • nucleus from **A** inserted into (enucleated / empty cell / cytoplasm from) egg (cell) (of female) **B** • fertilised / fertilisation (of 'hybrid' cell) • electric shock (after fertilisation) **or** grown into embryo	accept throughout: female **A** = person with faulty mitochondria female **B** = person without faulty mitochondria allow egg and sperm fuse allow cell division / mitosis	4	AO1/3 1.7.2a/c
7(b)(ii)	idea of cytoplasm / mitochondria of 'hybrid' / fertilised cell / embryo comes from cell / female / B with 'normal' mitochondria **OR** only the nucleus is used from A (1) the nucleus does not contain mitochondria **or** these faulty genes (1)		1 1	AO2 1.7.2c

4.1.1.3 Cell specialisation

Answer 08 · Mark scheme

7(b)(iii)	any **one** from: • idea that child has unknown parentage **or** 3 parents • against religious beliefs / teachings • could cause (more) prejudice (against people with perceived imperfection)	ignore ref to unethical / immoral ignore ref to being against religion / God's will unqualified	1	AO3 1.7
Total			**8**	

4.1.1.3 Cell specialisation

Answer 08 · Mark scheme

June 2017 | BL1HP | Original Q7 | Legacy

4.1.1.3 Cell specialisation

Answer 09 · Mark scheme June 2017 | BL2HP | Original Q6 | Legacy

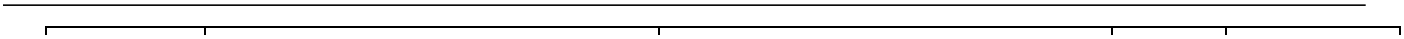
Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	46 **or** 23 pairs		1	AO1 2.7.2b
6(a)(ii)	(alternative / different) form(s) of a gene / of the same gene		1	AO1 2.7.2c
6(a)(iii)	only expressed if the dominant (allele) is not present / if the other (allele) is not present **or** only expressed if 2 (recessive alleles) are present	allow won't be expressed if the dominant allele is present	1	AO1 2.7.2e
6(b)(i)	having 2 different alleles	do **not** allow 2 different genes ignore carrier	1	AO1 2.7
6(b)(ii)	genetic diagram including: correct gametes **or** parental genotypes **N** and **n** and **N** and **n** **or** **Nn** and **Nn** offspring genotypes correctly derived: **NN** **Nn** **Nn** **nn** identification of **nn** as AKU correct probability only: 0.25 / ¼ / 1 in 4 / 25% / 1 : 3	allow alternative symbols if defined do **not** allow if alternative symbols used and not defined allow genotypes correct for student's parental gametes allow correct identification of student's offspring genotypes do **not** allow 3 : 1 / 1 : 4 do **not** allow if extra incorrect probabilities given	1 1 1 1	AO2/3 2.7 2.7.3a

6(c)(i)	mitosis	correct spelling only	1	AO1 2.7.1a/d
6(c)(ii)	4		1	AO2 2.7.1a,d
6(d)(i)	any **one** from: • may lead to damage to embryo **or** may destroy embryos • embryo cannot give consent • ref to possible miscarriage (of implanted embryo) • idea of avoiding prejudice against disabled people • idea of not producing designer babies	allow emotive terms e.g. murder allow disposal of embryos allow embryos used in research ignore religion unqualified	1	AO3 2.7 2.7.3d
6(d)(ii)	any **one** from: • prevent having child with the disorder **or** reduce incidence of the disease / inherited / genetic diseases **or** prevent future suffering of child from the disease • embryo cells could be used in stem cell treatment • can have another child without need for IVF • provides embryos for research • ref to avoiding long term cost of treating a child (with a disorder) **or** avoid parental stress	ignore ref to having a healthy child ignore ref to selection of gender allow reference to parents being prepared in advance	1	AO3 2.7 2.7.3d
Total			**12**	

4.1.1.3 Cell specialisation

Answer 09 · Mark scheme

June 2017 | BL2HP | Original Q6 | Legacy



Answer 10 · Mark scheme

November 2020 | 8461/1H | Original Q2

The full source mark scheme begins on page 29. Follow original question 2 in that document.

4.1.1.3 Cell specialisation

Answer 11 · 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

4.1.1.3 Cell specialisation

Answer 11 · Mark scheme

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**

4.1.1.3 Cell specialisation

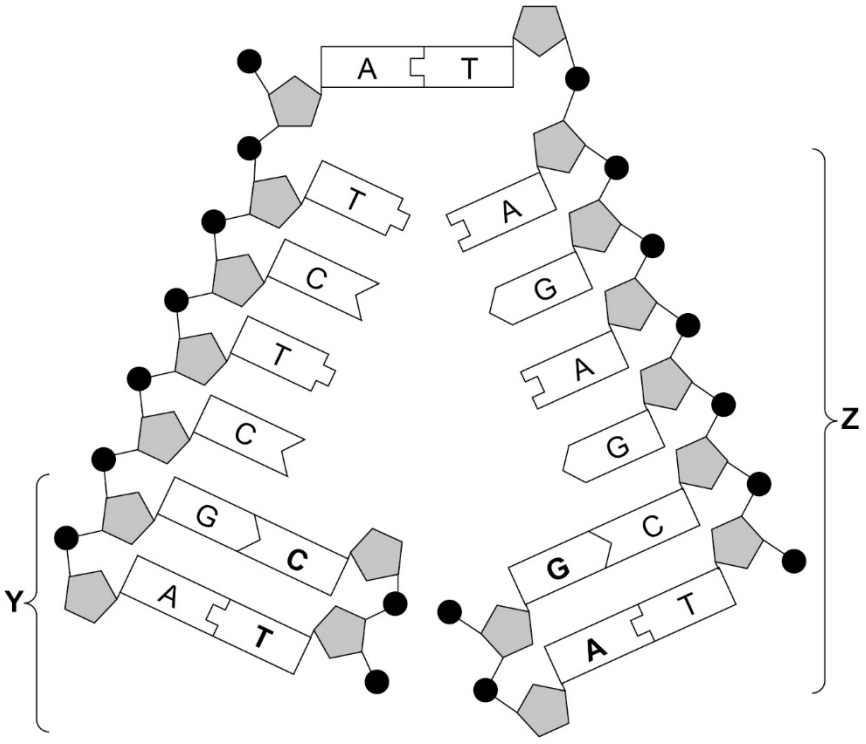
Answer 11 · Mark scheme

November 2021 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.1.1.3 Cell specialisation

Answer 12 · Mark scheme November 2021 | 8461/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	chromosome(s)	allow chromatid(s) / gene(s) / allele(s)	1	AO1 4.6.1.4
01.2	sugar	allow deoxyribose allow pentose do **not** accept ribose	1	AO1 4.6.1.5
01.3	base(s)	allow nitrogenous base(s) allow adenine **and** cytosine **and** guanine **and** thymine	1	AO1 4.6.1.5
01.4		all four required for the mark	1	AO3 4.6.1.5

4.1.1.3 Cell specialisation

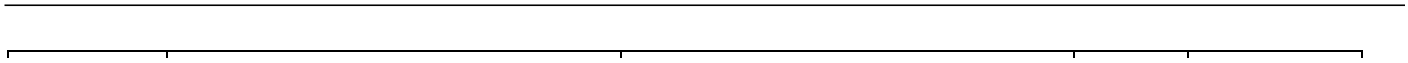
Answer 12 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	replication		1	AO3 4.6.1.5 4.1.2.2
01.6	protein	allow polypeptide	1	AO1 4.6.1.4
01.7	3×10^{-12} grams		1	AO2 4.6.1.2
01.8	meiosis		1	AO1 4.6.1.2
Total			**8**	

4.1.1.3 Cell specialisation

Answer 12 · Mark scheme

November 2021 | 8461/2H | Original Q1



4.1.1.3 Cell specialisation

Answer 13 · Mark scheme

June 2022 | 8461/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Thick, waxy layer on leaf surface: ✓ Berries that are poisonous: ✓ Bark on trees that falls off: ✓ all three rows correct = **2** marks two rows correct = **1** mark one row correct = **0** marks		2	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(it looks like the hornet so) predators / animals are tricked / deceived (by the colouring) **and** so avoid eating it	allow (it looks like the hornet so) predators / animals are warned off **and** so avoid eating it allow correctly named predators eg birds	1	AO2 4.3.3.2

4.1.1.3 Cell specialisation

Answer 13 · Mark scheme

June 2022 | 8461/1H | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.2.3.1 4.2.3.2 4.4.1.1 4.4.1.3 4.3.3.1
	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
	
	• less absorption of water
	  ○ less water so lower rate of photosynthesis
	  ○ so less glucose produced
	  ○ for respiration / energy release
	  ○ so less cellulose produced so fewer cells walls / cells made
	  ○ so fewer amino acids produced to make new proteins
	  ○ cells lose turgidity
	
	• less absorption of (named) ions / minerals
	  ○ fewer nitrates so fewer proteins made for growth
	  ○ fewer magnesium ions so less chlorophyll produced
	  ○ so lower rate of photosynthesis
	
	• damage to phloem
	  ○ less transport of sugars to root cells
	  ○ for respiration / energy release
	
	• damage to xylem
	  ○ less water transported (to cells)
	  ○ fewer nitrates reach cells
	  ○ so fewer proteins made for growth
	  ○ fewer magnesium ions reach cells
	  ○ so less chlorophyll produced
	  ○ less magnesium / chlorophyll so lower rate of photosynthesis
	
	• less anchorage		

4.1.1.3 Cell specialisation

Answer 13 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	genetic material / DNA / chromosomes is doubled / replicated / copied / duplicated		1	AO1 4.1.2.2
	the (replicated) chromosomes are pulled / moved apart	the (replicated) chromosomes are separated	1	
	cytoplasm divides into two (cells) **or** cell membrane divides to form two cells	allow two new nuclei form allow the nucleus divides (into two)	1	
	the set of chromosomes in each new cell are identical (to one another)	allow each new cell has the same set of DNA / alleles / genes (as the other)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	differentiation	ignore specialisation	1	AO1 4.1.2.3 4.1.1.4

Total Question 4		**14**

AQA

GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2020

Version: 1.0 Final

206G8461 1H/MS

4.1.1.3 Cell specialisation

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.

Further copies of this mark scheme are available from aqa.org.uk

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4.1.1.3 Cell specialisation

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.

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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**	

4.1.1.3 Cell specialisation

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	

4.1.1.3 Cell specialisation

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		

4.1.1.3 Cell specialisation

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**	

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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**	

4.1.1.3 Cell specialisation

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

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**	

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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**	

4.1.1.3 Cell specialisation

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

4.1.1.3 Cell specialisation

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**

4.1.1.3 Cell specialisation

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**

4.1.1.3 Cell specialisation

Answer 10 · 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 11 · 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.

4.1.1.3 Cell specialisation

Answer 12 · Examiner comments

November 2021 | 8461/2H | Original Q1

Question 1 (standard demand)

This question was about DNA and its replication. Answers to most parts of this question were satisfactory, with most students knowing that DNA was found in chromosomes, recognising the term replication with respect to a diagram showing this process, being able to assign symbols for bases on the same diagram, and knowing that meiosis was the type of cell division used in sperm production.

The names of specific parts of the DNA molecule (sugar and base) and the substance coded for by a gene (protein) were less well known – but success here might have been limited by the fact that the questions were open rather than being multiple choice.

More than half of the students were able to deal with numbers in standard form, showing understanding that a sperm cell has half the usual amount of DNA and that half of 6×10^{-12} is 3×10^{-12}.

One-fifth of the students did not attempt **01.4**. This was probably due to there being no answer lines, and the answer having to be written on the diagram (Figure 2).

4.1.1.3 Cell specialisation

Answer 13 · Examiner comments

June 2022 | 8461/1H | Original Q4

Question 4 (Standard, standard/high and high demand)

04.1 Nearly 90% of students gained full marks in this question.

04.2 At standard/high demand, there were multiple parts needed in the response to this question, which only 19% of students achieved. Most students understood the idea that animals avoid eating the hornet moth because it looks like a hornet, but the higher level idea that the animals have 'learned' that they get stung was missed by most.

04.3 The most common score in this extended response question was 2 marks out of 6. Students were required to provide a response detailing the reasons why a tree might die if moth larvae damaged the roots, with a link(s) to the impact the reason(s) would have on the tree. Although there are clear mark points on the mark scheme, the list was not exhaustive, so non-listed appropriate indicative content was also acceptable. The impact of less absorption of water and mineral ions was more commonly cited compared to damage to xylem or phloem, with numerous students referencing support and anchorage for the tree. Many students understood the consequence of a lack of magnesium ions and nitrates and these were common responses seen. However, on occasion, some students confused the two or did not make it clear which ion linked to which consequence they were writing about. To achieve marks in both levels 2 and 3, correct linking was required, hence why many students limited themselves to level 1, as they failed to make the link between the effect of the damage and the consequence.

04.4 Only 1% of students gained full marks in this question, highlighting several misconceptions or surface levels of understanding of the events of mitosis. The majority of students who gained marks on this question did so with MPs 1 and 3, although a number of students continue to use the term 'genetic information' which is not sufficient at this level. As seen in previous years, students continue to find the idea of the separation of the chromosomes difficult and many failed to obtain MP2 because of messy written language, sometimes describing all of the chromosomes moving to one side of the cell. Many answers also clearly confused the arrangement of the chromosomes at the centre of the cell between mitosis and meiosis for this mark point. Very few students were able to access MP4, with most simply repeating the stem of the question, that two genetically identical daughter cells are produced

04.5 Over three quarters of students answered this question correctly, and on the whole, spelling was correct. Of the incorrect answers, many were erroneous biological terms. Specialisation was ignored as it was given in the question stem.