AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.4

Cell differentiation

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**10**
Available paper years	**2011–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

4.1.1.4 Cell differentiation

Answer 01 · 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 01 · Mark scheme June 2011 | BLY2H | Original Q4 | Legacy

BLY2H

4.1.1.4 Cell differentiation

Answer 02 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)(i)	allele expressed even when other allele present **or** expressed if just one copy of allele is present **or** expressed if heterozygous	if present other allele not expressed	1
6(a)(ii)	2 affected parents have unaffected child **or 1** and **2** → **5** / **6** **or** if recessive all of **1** and **2**'s children would have CADASIL		1
6(a)(iii)	heterozygous – has unaffected children **or** because if homozygous all children would have CADASIL		1
6(b)	genetic diagram including: correct gametes: **D** and **d** **and** **d** (and **d**) derivation of offspring genotypes: **Dd** **Dd** **dd** **dd** identification of **Dd** as CADASIL **or dd** as unaffected correct probability: 0.5 / ½ / 1 in 2 / 50 % / 1 : 1	accept alternative symbols, if defined ignore 7 / 8 or male / female allow just **Dd** **dd** if ½-diagram allow ecf if correct for student's gametes allow ecf if correct for student's gametes	1 1 1 1
6(c)(i)	stem cells can differentiate **or** are undifferentiated / unspecialised can form blood vessel cells / brain cells **or** stem cells can divide		1 1

Question 6 continues on the next page . . .

BL2HP

Question 6 continued . . .

question	answers	extra information	mark
6(c)(ii)	ethical argument – eg no risk of damage to embryo **or** adult can give consent for removal of cells **or** adult can re-grow skin **or** if from a relative then less chance of rejection **or** if from self then no chance of rejection **or** skin cells more accessible	more ethical qualified ignore religion unqualified	1
Total			**10**

4.1.1.4 Cell differentiation

Answer 02 · Mark scheme

January 2013 | BL2HP | Original Q6 | Legacy

BL2HP

4.1.1.4 Cell differentiation

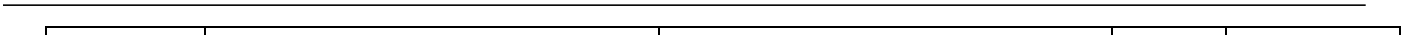
Answer 03 · Mark scheme June 2015 | BL1HP | Original Q8 | Legacy

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**	

4.1.1.4 Cell differentiation

Answer 03 · Mark scheme

June 2015 | BL1HP | Original Q8 | Legacy



4.1.1.4 Cell differentiation

Answer 04 · 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

4.1.1.4 Cell differentiation

Answer 04 · Mark scheme

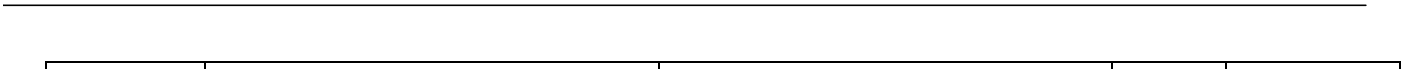
June 2016 | BL2HP | Original Q5 | Legacy

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	

4.1.1.4 Cell differentiation

Answer 04 · Mark scheme

June 2016 | BL2HP | Original Q5 | Legacy



4.1.1.4 Cell differentiation

Answer 05 · Mark scheme June 2016 | BL3HP | Original Q9 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)(i)	fewer cows any **one** from: • less methane • less CO_2 in the atmosphere because of less deforestation **or** less plants consumed.	 do **not** allow CH^4 allow less CO_2 released into the atmosphere because less fuel used e.g. to heat cowsheds **or** to transport meat do **not** allow CO^2	1 1	AO2/3 3.4.2c 3.4.3a
9(a)(ii)	any **two** from: • could be mass produced to feed an increasing population • disease free meat • no / low fat • no harm to animals or less intensive farming • antibiotic free meat • more land available for farming crops	 allow (may be) suitable for vegetarians allow no energy loss along a food chain	2	AO3 3.4.4a/b
9(b)	 fungus / *Fusarium* with glucose (syrup) in aerobic conditions **or** in presence of oxygen mycoprotein is harvested / purified	ignore stirring / mixing and temperature ignore air allow ammonia added (as source of nitrogen)	 1 1 1 1	AO1 3.4.4d
Total			**8**	

4.1.1.4 Cell differentiation

Answer 06 · Mark scheme June 2018 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	DNA / deoxyribo(se)nucleic acid		1	AO1 4.1.2.1
06.2	controls the movement of substances in / out of cell	ignore allows substances in / out of cell	1	AO1 4.1.1.2
06.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.		5–6	AO2 4.2.2.1 4.2.2.2 4.4.2.1
	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 fewer (digestive) enzymes enter small intestine • (so) enzymes break down / digest less food • (therefore) less absorption of nutrients • (so) less glucose can enter the blood(stream) • (so) less (glucose) available for respiration • (less absorption of nutrients so) fewer amino acids can enter the blood(stream) • (so) less protein is made (for growth) ignore ref to bile less oxygen enters blood(stream) / reaches cells / organs / tissues (ignore body / lungs) • (so) less (oxygen) available for (aerobic) respiration • (so) less energy released / available (for growth) do **not** accept energy produced for **level 3**, reference to both enzymes and oxygen is required			

4.1.1.4 Cell differentiation

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	put ages in (ascending / descending / chronological) order		1	AO2 4.2.2.5
	find middle value	allow a way of achieving this ie $\frac{(n+1)}{2}$ where n is the number of people	1	AO1 4.2.2.5
06.5	most common in young people **or** (more) don't live to an old age	allow causes of this	1	AO3 4.2.2.5
06.6		an answer of 10 584 scores **2** marks		AO2 4.2.2.5
	$0.98 \times 10\,800$	allow $\frac{98}{100} \times 10\,800$	1	
	10 584	allow $10\,800 - (0.02 \times 10\,800)$ or equivalent	1	
06.7	take stem cells from patient (bone marrow / skin)		1	AO2 4.1.2.3
	remove / change / fix the faulty / CF gene		1	
	create embryo using these stem cells	allow idea of transferring nucleus from stem cells into enucleated egg / ovum	1	
	remove stem cells (from embryo) and stimulate / allow them to divide / differentiate into lung (cells)	if no other marks awarded allow **1** mark for therapeutic cloning	1	

4.1.1.4 Cell differentiation

Answer 06 · Mark scheme

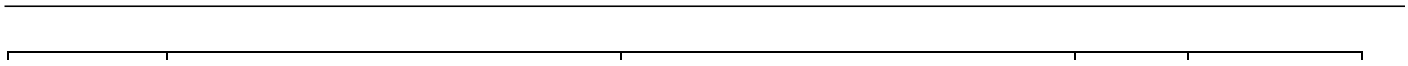
June 2018 | 8461/1H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	idea of ethical / religious concerns about use of embryos such as loss of (potential) human life	allow idea that embryo cannot give consent ignore idea of against human rights of embryo unqualified ignore religious / ethical reasons unqualified	1	AO3 4.1.2.3
Total			18	

4.1.1.4 Cell differentiation

Answer 06 · Mark scheme

June 2018 | 8461/1H | Original Q6



4.1.1.4 Cell differentiation

Answer 07 · 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

4.1.1.4 Cell differentiation

Answer 07 · 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**	

4.1.1.4 Cell differentiation

Answer 07 · Mark scheme

November 2021 | 8461/1H | Original Q1

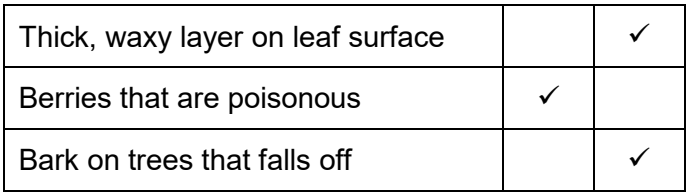
Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.1.1.4 Cell differentiation

Answer 08 · Mark scheme

June 2022 | 8461/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1			2	AO1 4.3.3.2

all three rows correct = **2** marks
two rows correct = **1** mark
one row correct = **0** marks

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

4.1.1.4 Cell differentiation

Answer 08 · 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		

4.1.1.4 Cell differentiation

Answer 08 · Mark scheme

June 2022 | 8461/1H | Original Q4

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

4.1.1.4 Cell differentiation

Answer 09 · Mark scheme

June 2023 | 8461/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.1	a group of the same / similar cells **or** a group of cells with a (similar / specific) function	ignore a group of cells unqualified ignore examples of tissue functions	1	AO1 4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	meristem (tissue)		1	AO1 4.1.1.4 4.1.2.3 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	willow	ignore named parts of willow	1	AO1 4.3.1.9

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	any **one** from: • (berries are) easy to access / pick • easier to extract chemical • taking berries will not harm the plant	ignore berries are not underground allow taking leaves / roots might damage / kill the plant (so it cannot produce more chemical) allow idea that the lower mass / amount (of chemical) will be less toxic / harmful allow greater mass of berries than of leaves / roots	1	AO3 4.2.3.1

4.1.1.4 Cell differentiation

Answer 09 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	(0.6 × 1.2 =) 0.72 (0.72 × 2 =) 1.44 1.44 × 1000 1440 (mg) **alternative route** (2 × 1.2 =) 2.4 (1) (2.4 × 0.6 =) 1.44 (1) 1.44 × 1000 (1) 1440 (mg) (1)	allow conversion to mg at any point in calculation allow conversion of a correct mass calculated for berries / roots allow a correct answer using an incorrect conversion factor of a multiple of 10	1 1 1 1	AO2 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	any **one** from: • lack of chlorophyll • lack of magnesium (ions)	 allow lack of chloroplasts allow lack of mineral (ions) **or** named example such as iron / nitrate / potassium / zinc (ions) ignore lack of nutrients / nitrogen allow lack of water allow incorrect pH of soil allow acidic / alkaline soil allow (named) infection allow lack of light allow other correct suggestions	1	AO1 4.3.3.1 4.3.1.2 4.3.1.4

4.1.1.4 Cell differentiation

Answer 09 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.7	any **two** from: • to check toxicity • to check dosage • to check its efficacy	allow to check it is safe allow to check for side effects allow to check it is not poisonous / dangerous / harmful allow to check how much is needed allow to check it works allow to check it does not interact with other drugs	2	AO1 4.3.1.9

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.8	(writers / companies may get) financial gain **or** (competitor may suffer) financial loss	ignore because the report has not been peer reviewed ignore have not used a double-blind trial	1	AO3 4.3.1.9

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.9	have the claims peer reviewed		1	AO1 4.3.1.9

Total Question 1	13

4.1.1.4 Cell differentiation

Answer 10 · Mark scheme

June 2025 | 8461/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	(stem cells) can differentiate into any type of cell	allow (stem cells) can differentiate into liver cells ignore specialisation	1	AO1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	any **one** from: • (it is) destroying a (potential) life / embryo • embryo cannot give consent • (against) religious / cultural / personal beliefs	 allow the embryo does not have a choice allow against (someone's) faith ignore against God's will ignore religion unqualified	1	AO2 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	**A** = lymphocyte (specific to the antigen) **B** = tumour (cell) **C** = hybridoma	ignore white blood cell allow myeloma allow other specific types of tumour (cell) ignore cancer (cell)	1 1 1	AO2 4.3.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	(the mouse is) injected with (liver) antigens	allow (by) injecting (the mouse) with liver cells do **not** accept (by) injecting (the mouse) with a pathogen	1	AO2 4.3.2.1

4.1.1.4 Cell differentiation

Answer 10 · Mark scheme

June 2025 | 8461/1H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5	monoclonal antibodies bind to (liver) antigens / cells (because) monoclonal antibodies are complementary (in shape) to (liver) antigen (so) antibodies released by white blood cells cannot bind to (liver) antigens / cells	allow drug sticks to (liver) antigens / cells allow description of complementarity ignore reference to specificity do **not** accept (because) monoclonal antibodies are the same shape as (liver) antigen allow (so) antibodies released by lymphocytes cannot bind to (liver) antigens / cells allow (so) phagocytes are unable to identify / detect cells to engulf do **not** accept (so) antibodies released by phagocytes cannot bind to liver antigens / cells	1 1 1	AO2 4.2.2.3 4.3.1.6 4.3.2.1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	any **one** from: • tests to detect pathogens • tests to detect hormones / chemicals / drugs • to locate / identify (specific) molecules in a cell / tissue • to locate / detect cancer (cells) • to deliver (toxic) chemicals / drugs to cells	allow COVID tests **or** lateral flow tests **or** LFTs allow chemotherapy / immunotherapy allow to treat named disease ignore to diagnose / treat disease unqualified	1	AO1 4.3.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.7	gall bladder		1	AO1 4.2.2.1

4.1.1.4 Cell differentiation

Answer 10 · Mark scheme

Question	Answers	Mark	AO / Spec Ref.
07.8	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3-4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2	AO1
	No relevant content.	0	4.2.2.1
	Indicative content • less / no bile produced (by liver) so less / no emulsification of fats o (so) fats not made into small(er) droplets o (so) surface area (of fat) not increased o (so) lipase cannot digest fat as quickly / much (due to smaller surface area) • less / no bile produced (by liver) so acid not neutralised o (because) bile is alkaline o (so) lipase **or** small intestine not at optimum pH o (so) lipase denatures o (so) lipase cannot digest fat as quickly / much (due to reduced / incorrect pH) For **Level 3**, there must be consideration of the effect on lipase activity and on both emulsification **and** the effects of pH.		

Total Question 7	17

4.1.1.4 Cell differentiation

Answer 06 · Examiner comments

June 2018 | 8461/1H | Original Q6

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

Following updated research information and communications with parents of children with cystic fibrosis, we have decided to withdraw the question on this topic from this paper.

It has been decided not to provide a replacement question as it would not be possible to determine accurately how a replacement question would have performed if it had been part of the original paper taken in 2018.

The following statistics may help you to make effective use of the remainder of the paper:
Mean mark (maximum mark)

06.1	0.47 (1)
06.2	0.65 (1)
06.3	2.27 (6)
06.4	1.27 (2)
06.5	0.69 (1)
06.6	1.33 (2)
06.7	0.56 (4)
06.8	0.42 (1)
Question 6	7.66 (18)

Answer 07 · 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.

4.1.1.4 Cell differentiation

Answer 08 · 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.

4.1.1.4 Cell differentiation

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Question 1 (Standard demand)

01.1 Whilst a large majority of students knew that a tissue consists of 'a group of cells', often adding 'working together'; these were insufficient to gain the mark. In order to be credited, students also needed to qualify this answer in terms of structure or appearance (ie 'being similar') or their functions being similar, and around 67% of students successfully gained the mark. As the question was asked in general terms, answers which gave the roles of specific tissues were not credited.

01.2 67% of students knew the name of this tissue. Common answers that failed to gain the mark included other cells or tissues that might be found in roots, such as 'root hairs' and 'xylem'.

01.3 63% of students were able to name 'willow' as the plant from which aspirin originates. Many students qualified their answers with specific parts of the willow, such as 'bark' or 'leaves' or just added 'tree' These details were ignored as being beyond expected knowledge. Incorrect answers included 'foxgloves' and 'fungus' as students mixed up the original sources of traditional drugs. Those who appeared not to have revised this area of the specification could only come up with improbable guesses such as 'the aspirin tree'.

01.4 Just over half of students gave correct responses in this question, with the most common correct responses referring to not causing damage or harm to the plant, or the idea that berries are easier to access. A number of students suggested that the berries would be 'easier to extract', which fell between the ideas of the berries being easier to access and the chemical being easier to extract; this idea was considered to be just sufficient to gain the mark. Suggestions that berries would 'grow back' after picking were insufficient as this would also be true of leaves and to some extent, of roots.

4.1.1.4 Cell differentiation

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01.5 The most problematic part of this calculation was the conversion of grams to milligrams. Many students made no attempt at the conversion, stopping at '1.44', gaining 2 marks or alternatively '0.72' or '2.4', either of which gained just the first mark.
Students who attempted a conversion, using factors such as 100, 10 or even 0.001, were able to gain the fourth mark, provided their answers matched this conversion factor.
Unlike for more complicated calculations, most students laid out their calculations in a way that made interpretation fairly straightforward. Only a small minority of students appeared to have no idea of how to go about the calculation.

01.6 Many students were able to quote from their revision, that a 'lack of magnesium' would cause chlorosis. Whether this was expressed as a small deficiency or the plant getting no magnesium was not critical in gaining the mark. Other students were likely to offer ideas such as a 'lack of chlorophyll' or a 'lack of sunlight'. Only 17% of students failed to give a correct response with some suggesting that chlorosis might have been 'caught' or passed on' from other plants, without reference to a pathogen or infection.

01.7 Students were generally well-versed in the need for drug tests or trials, and 82% of students gained full marks. The most common error was to offer both the idea of checking toxicity and checking for side effects, as these amount to the same thing so could only be credited once. For many students the technical term 'efficacy' was well used, although some offered the idea of 'checking for efficiency', for which a mark was not awarded.

01.8 Although there may be many possible subordinate reasons for the writing of a biased report, all of these come down to one party or another being affected financially. Thus, only this idea was credited and the various reasons for this, such as 'disagreeing with the ethics' of the company were ignored.

01.9 A pleasing 90% of students correctly identified the need to have the claims peer reviewed.

Answer 10 · Examiner comments

June 2025 | 8461/1H | Original Q7

Question 7 (standard, standard/high demand and high demand)

07.1 Nearly 60% of students were able to use the correct terminology to achieve the mark in this question. Common incorrect answers included referring to the process of differentiation as 'specialisation' or describing undifferentiated cells turning into specialised cells.

07.2 47% of students achieved the mark in this question, with the most common correct answer being the idea of embryos or a potential life being destroyed or killed. A smaller proportion of students achieved credit for the idea that embryos are unable to give consent but very few were able to articulate ideas about beliefs clearly enough to be awarded the third bullet point in the mark scheme. Incorrect responses were often less biological or were emotive in nature e.g. 'it's murder', 'a baby is killed', 'embryos are a potential life', and 'it would have grown into a baby', that did not answer the question.

07.3 62% of students scored full marks in this question, with a further 17% scoring 2 marks, and 9% scoring 1 mark. The majority were able to identify and spell hybridoma (for MP3) correctly, but credit could not be awarded for reference to cancer, rather than tumour cell (for MP2), and white blood cell rather than lymphocyte (for MP1). A small number of students incorrectly named cell A as 'spleen cell' and cell B as a dead or weakened pathogen.

07.4 42% of students scored the mark for this question with most referring to injection of antigens rather than liver cells. Incorrect answers were almost always related to injecting the mouse with a pathogen or disease, confusing this context with that of vaccination against infectious disease.

07.5 Around 30% of students scored a mark on this question with only 11% scoring 2 marks and 1% scoring full marks. MP1 was most frequently scored, with the statement that monoclonal antibodies bind to antigens (on liver cells). A common incorrect response was that the monoclonal antibody would bind to white blood cells to stop them rejecting the liver cells. MP3 was scored infrequently, mostly with the idea that antibodies made by the patient's white blood cells would be blocked from binding to the liver antigens, after MP1 had already been scored. A few students did correctly describe that phagocytes could not detect the liver cells as the monoclonal antibodies

4.1.1.4 Cell differentiation

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were bound to the antigens on their surface. MP2 was very rarely scored. Whilst most students had attempted this question using some correct terminology, the responses were often confused and either showed that the information provided in the stem of the question had not been used, or that the student had misunderstood the nature of the monoclonal antibody treatment for liver disease. It was very common to see the idea that if the monoclonal antibody was bound to the liver cell antigens, that the white blood cells would not produce antibodies at all.

07.6 This question was well-answered by most students with 67% scoring the mark. A range of answers was seen, although responses relating to cancer detection and treatment were most common. Drug and COVID testing were also seen frequently. Most incorrect answers were due to students not fully qualifying their responses for example 'treat diseases' or 'fighting cancer'.

07.8 This was a levelled response question about the function of the liver during liver failure. The majority of students attempted the question, but 43% of students achieved no marks. Level 2 responses were the most common with 24% of students achieving marks. 11% of students achieved Level 3 and 20% Level 1. The majority of Level 2 responses that did not match the criteria for Level 3, were due to an omission to refer to the role of lipase, or to distinguish that the rate of breakdown of fats would be slow*er* with liver disease. In addition, students were limited to Level 2 if they only described the effect on emulsification **or** on the neutralisation of acid.

In Level 1, the majority of students did not develop their answers, scoring 1 mark for reference to the effect on emulsification and neutralisation, but with no further detail, or scoring 2 marks for a linked idea about either emulsification or neutralisation. Common misconceptions included lipase being made in the stomach, fat *molecules* being broken down by the process of emulsification (rather than by lipase action), the liver producing lipase and bile neutralising acid in the stomach. Other incorrect answers included the idea that there would be no digestion of fat without bile, that lipase is found within bile, that bile is an enzyme and that lipase engulfs fats. The context of many students' responses related to the usual role of bile in a healthy liver, whilst mentioning less bile production in patients with liver disease. Some students scored no marks for this approach as they did not reference the disease causing less bile production, or said that the patient had *difficulty* producing bile, which was not creditworthy. Occasionally, some students did not mention bile at all, despite it being in the stem of the question. A few students thought that the diseased liver would stop producing enzymes or lipase which is why digestion of fat was difficult.