AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.2

Meiosis

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**14**
Available paper years	**2008–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

4.6.1.2 Meiosis

Answer 01 · Mark scheme

Question 3

	answers	extra information	mark
(a)	characteristics		1
(b)	genes		1
(c)	chromosomes		1
(d)	mitosis		1
(e)	asexual		1
total			5

4.6.1.2 Meiosis

Answer 01 · Mark scheme January 2008 | BLY2F | Original Q3 | Legacy

BLY2F

Answer 02 · Mark scheme January 2009 | BLY2F | Original Q3 | Legacy

question	answers	extra information	mark
3(a)	2 and 3		1
3(b)	cell **P** has an X chromosome; cell **R** has a Y chromosome		1
3(c)	any **two** from: • (formed from) different egg / 2 eggs • (formed from) different sperm / 2 sperm • have different genes / alleles / chromosomes / DNA	allow genetics	2
3(d)(i)	stem cells		1
3(d)(ii)	the cells divide the cells differentiate		1 1
3(d)(iii)	(medical) research / named eg growing organs **or** medical / patient treatment	allow (embryo) cloning do **not** allow designer babies / more babies	1

Question 3 continued on next page…

4.6.1.2 Meiosis

COMPONENT NUMBER: BLY2F

COMPONENT NAME: Additional Science / Biology

STATUS: Final

DATE: January 2009

Question 3 continued…

question	answers	extra information	mark
3(d)(iv)	any **one** from: • ethical / moral / religious objections • potential harm to embryo	ignore cruel / not natural / playing God allow deformed ignore harm to mother	1
Total			**9**

4.6.1.2 Meiosis

Answer 02 · Mark scheme

COMPONENT NUMBER: BLY2F

COMPONENT NAME: Additional Science / Biology

STATUS: Final

DATE: January 2009

4.6.1.2 Meiosis

Answer 03 · Mark scheme

June 2009 | BLY2F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	chromosomes		1
5(b)	diagram showing four separate chromosomes two long and two short (as in diagram 1)	allow each chromosome shown as two joined chromatids do **not** allow if chromosomes touching each other	1
5(c)(i)	any **two** from: • can grow into any type of tissue / named tissue • used in medical research • used to treat human diseases • large numbers can be grown		2
5(c)(ii)	any **two** from: • expensive • grow out of control / ref cancers • may be rejected • need for drugs (for rest of life)		2
Total			**6**

4.6.1.2 Meiosis

Answer 03 · Mark scheme June 2009 | BLY2F | Original Q5 | Legacy

BLY2F

Answer 04 · Mark scheme March 2010 | BLY1BP | Original Q3 | Legacy

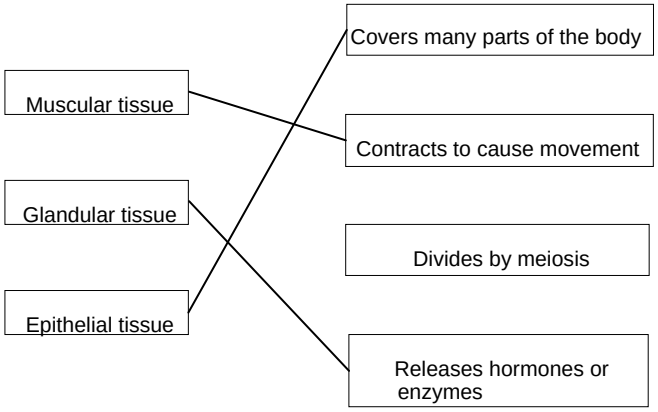
Three	**A**	genes	**2**
	B	gametes	**1**
	C	characteristics	**4**
	D	nucleus	**3**

4.6.1.2 Meiosis

Answer 05 · Mark scheme

June 2012 | BL2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	in sequence: 2 = tissue(s) 3 = organ(s) 4 = system(s)		1
2(b)		**1** mark for each correct line extra line(s) from one tissue cancel	3
Total			**4**

4.6.1.2 Meiosis

Answer 05 · Mark scheme

June 2012 | BL2FP | Original Q2 | Legacy

BL2FP

4.6.1.2 Meiosis

Answer 06 · Mark scheme

January 2013 | BL2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	DNA		1
2(b)	X and Y		1
2(c)(i)	46 chromosomes		1
2(c)(ii)	half the number		1
2(d)	meiosis		1
Total			5

4.6.1.2 Meiosis

Answer 06 · Mark scheme

January 2013 | BL2FP | Original Q2 | Legacy

BL2FP

4.6.1.2 Meiosis

Answer 07 · Mark scheme

June 2013 | BL2FP | Original Q3 | Legacy

Question 3

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>3(a)(i)</td><td>
<table>
<tr><th>Feature</th><th>Mitosis only</th><th>Meiosis only</th></tr>
<tr><td>Produces new cells during growth and repair</td><td>✓</td><td></td></tr>
<tr><td>Produces gametes (sex cells)</td><td></td><td>✓</td></tr>
<tr><td>Produces genetically identical cells</td><td>✓</td><td></td></tr>
</table>
All 3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks
</td><td></td><td>2</td></tr>
<tr><td>3(a)(ii)</td><td>(a man) testis / testes
(a woman) ovary / ovaries</td><td>accept testicle(s)
do not accept ‘ova’ / ovule</td><td>1
1</td></tr>
<tr><td>3(b)(i)</td><td>XY / YX
or
X and Y</td><td></td><td>1</td></tr>
<tr><td>3(b)(ii)</td><td>XX
or
X and X or 2 X’s</td><td>accept X</td><td>1</td></tr>
<tr><td>3(c)</td><td>½ / 0.5 / 50% / 1:1 / 1 in 2</td><td>do not accept 1:2 / 50/50
allow 50:50
allow 2 in 4</td><td>1</td></tr>
<tr><td>Total</td><td></td><td></td><td>7</td></tr>
</table>

4.6.1.2 Meiosis

Answer 08 · Mark scheme

June 2014 | BL2FP | Original Q5 | Legacy

5(a)(i)	fertilisation		1	AO1 2.7.1i
5(a)(ii)	in sequence: 1 gene 2 chromosome 3 nucleus	accept 1 next to gene, 2 next to chromosome and 3 next to nucleus in box allow 1 mark for smallest **or** largest in correct position	2	AO2 2.1.1a, 2.7.1b,e, 2.7.2f,g
5(a)(iii)	DNA		1	AO1 2.7.2f
5(b)(i)	On diagram: tick drawn next to **X** and / or **Y** from Parent 1	tick(s) must be totally outside grid squares allow ticks around “parent 1” extra ticks elsewhere cancel	1	AO1 2.7, 2.7.2a,b
5(b)(ii)	0.5 / ½ / 50% / 1:1 / 50:50 / 1 in 2 2 (out of 4) boxes are **XX** **or** half of the sperm contain an **X**-chromosome	allow 2/4 / 2 in 4 / 2 out of 4 / ‘even(s)’ / ‘fifty – fifty’ do **not** allow 1:2 or ‘50 / 50’ or ‘50 – 50’ allow **XY** is male and 2 (out of 4) boxes are **XY**	1 1	AO2 2.7, 2.7.2a,b
Total			**7**	

4.6.1.2 Meiosis

Answer 08 · Mark scheme

June 2014 | BL2FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.6.1.2 Meiosis

Answer 09 · Mark scheme

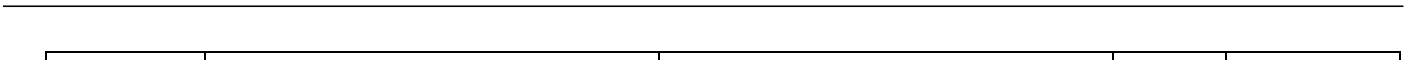
June 2018 | 8461/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	nucleus		1	AO1 4.1.2.1
01.2	gene(s)	allow allele(s)	1	AO1 4.6.1.4
01.3	copying of chromosomes		1	AO2 4.1.2.2
01.4	mitochondria		1	AO1 4.1.1.2
01.5	60 – 45 **or** 120 – 105 15 (minutes)	an answer of 15 (minutes) scores **2** marks	1 1	AO2 4.1.2.2
01.6	C		1	AO2 4.1.2.2
01.7	8		1	AO2 4.1.2.2
01.8	to repair tissues		1	AO1 4.1.2.2
Total			**9**	

4.6.1.2 Meiosis

Answer 09 · Mark scheme

June 2018 | 8461/1F | Original Q1



4.6.1.2 Meiosis

Answer 10 · Mark scheme

June 2019 | 8461/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	46		1	AO1 4.6.1.2 4.6.1.8
03.2	half the mass of the DNA in cell **A**		1	AO2 4.6.1.2
03.3	meiosis		1	AO1 4.6.1.2
03.4	mutation		1	AO1 4.6
03.5	any **two** from: • different egg / sperm each time • genes from two parents • each gamete / egg / sperm has different alleles / genes / DNA / genetic information	ignore different chromosomes ignore the children have different genes / alleles	2	AO2 4.6 4.6.1.1
03.6	8		1	AO2 4.1.2.2 4.6.1.2
03.7	40	allow in range 39 to 41	1	AO2 4.6.1.2
03.8	$\frac{40}{500}$ × 1000 80	an answer of 80 scores **3** marks allow ecf from Question **03.7** for **3** marks an answer of 0.08 scores **2** marks allow $\frac{\text{answer to Question 03.7}}{500}$ an answer from mp1 but not × 1000 scores **2** marks	1 1 1	AO2 4.6.1.2

4.6.1.2 Meiosis

Answer 10 · Mark scheme

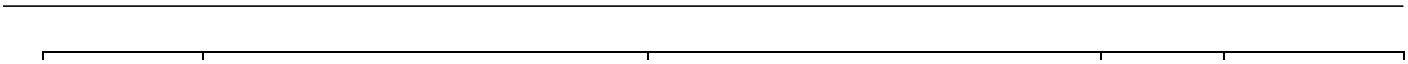
June 2019 | 8461/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.9	embryo is (very) small		1	AO2 4.5 4.5.3.4
	(so) embryo not seen / felt **or** lost in normal menstrual flow	ignore not noticed	1	AO3
Total			**13**	

4.6.1.2 Meiosis

Answer 10 · Mark scheme

June 2019 | 8461/2F | Original Q3



4.6.1.2 Meiosis

Answer 11 · Mark scheme

November 2020 | 8461/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	4 / four		1	AO1 4.6.1.2
03.2	23 / twenty three	do **not** accept 23 pairs	1	AO1 4.6.1.2
03.3	a different form of a gene		1	AO1 4.6.1.6
03.4	heterozygous		1	AO2 4.6.1.6
03.5 mark with 3.6 and 3.7		allow 2 correct for **1** mark	2	AO2 4.6.1.1 4.6.1.2 4.6.1.6
03.6 mark with 3.5 and 3.7	ring around any **Dd**	allow ecf from question **03.5**	1	AO2 4.6.1.6
03.7 mark with 3.5 and 3.6	percentage must match answer given to questions **03.5** and **03.6**	if no answer in question **03.5** allow 50 %	1	AO3 4.6.1.6
03.8	mutation / mutated	do **not** accept mutant	1	AO1 4.6.2.1

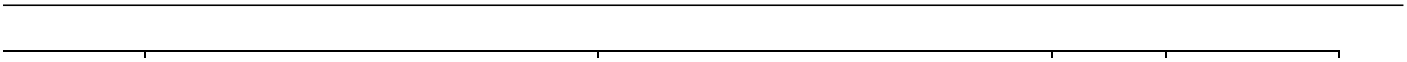
4.6.1.2 Meiosis

03.9	any **one** from: • to help them prepare • to inform whether to consider having an abortion • to find out if they have passed on the disorder	allow to see if the child / embryo has the disorder allow answers referring to genetic disorders, or specific example such as Dupuytren's / cystic fibrosis	1	AO3 4.6.1.7
Total			**10**	

4.6.1.2 Meiosis

Answer 11 · Mark scheme

November 2020 | 8461/2F | Original Q3

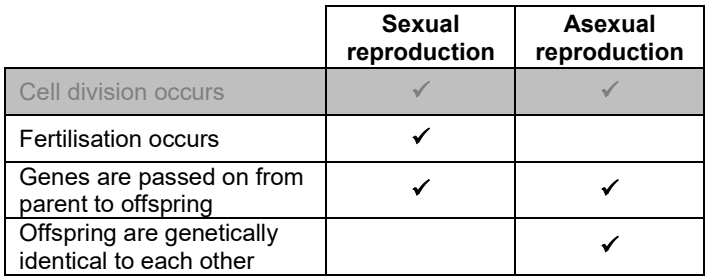


4.6.1.2 Meiosis

Answer 12 · Mark scheme

June 2022 | 8461/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1			2	AO1 4.6.1.1

	Sexual reproduction	Asexual reproduction
Cell division occurs	✓	✓
Fertilisation occurs	✓	
Genes are passed on from parent to offspring	✓	✓
Offspring are genetically identical to each other		✓

allow **1** mark for 1 or 2 correct rows
ignore 'x' in blank boxes

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	pollen (grain)	allow nucleus in pollen (grain)	1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	between 3 and 4 hours		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	5 hours 6 hours		1 1	AO2 4.6.1.2

4.6.1.2 Meiosis

Answer 12 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	2		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	4		1	AO2 4.6.1.2

Total Question 8		**8**

4.6.1.2 Meiosis

Answer 13 · Mark scheme

June 2023 | 8461/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.1	vector		1	AO1 4.3.1.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.2	any **two** from: • (it has) mitochondria • (it has a) nucleus • (it has) no plasmids	if neither mark awarded, allow **1** mark for protist has membrane-bound structures allow it does not have a loop of DNA allow other appropriate features do **not** accept (it has) cytoplasm do **not** accept (it has) a (cell) membrane do **not** accept it has no cell wall	2	AO2 4.3.1.5 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.3	Salmonella		1	AO2 4.1.1.1 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.4	only one parent is involved		1	AO1 4.3.1.5 4.6.1.1

4.6.1.2 Meiosis

Answer 13 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.5	14		1	AO2 4.3.1.5 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.6	decreased haemoglobin		1	AO2 4.3.1.5 4.2.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.7		allow alternative route allow correct conversion to standard form at any stage		AO2 4.3.1.5
	$\frac{210\ 000\ 000}{2}$ **or** 105 000 000	allow $\frac{210 \text{ million}}{2}$ **or** 105 million	1	
	105 000 000 × 3	allow 105 million × 3	1	
	315 000 000	allow 315 million	1	
	3.15×10^8		1	

4.6.1.2 Meiosis

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.8	any **two** from: • wear long(er) sleeves / clothes • use insect repellent or insecticides • don't go out in the evening • avoid going to countries / places with malaria / mosquitos • destroy breeding grounds • release sterile male mosquitos	ignore vaccination / anti-malarial drugs allow reduce bare skin exposure allow insect repellent methods such as citronella candles allow close doors / windows in the evening allow methods of destroying breeding grounds such as drain water holes allow other correct suggestions	2	AO2 4.3.1.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
04.9	percentage / chance (of getting malaria) decreases (with age) correct use of data such as two pairs of data from **Table 4**	do **not** accept percentage / chance of having disorder **S** decreases with age allow use of processed data	1 1	AO3 4.2.2.5 4.3.1.5

Total Question 4	15

4.6.1.2 Meiosis

Answer 14 · Mark scheme

June 2025 | 8461/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	testis / testes / testicle(s)		1	AO1 4.5.3.4 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	**A** = 46 **D** = 23	if no other mark awarded allow **1** mark for **A** = 92 **and D** = 46	1 1	AO1 4.6.1.2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	fertilisation		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	pollen		1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	mitosis		1	AO1 4.1.1.6 4.1.2.2 4.6.1.1 4.6.1.2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	sugar water		1 1	AO2 4.4.1.3 4.2.3.2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **one** from: • produces (genetic) variation (in offspring) • (seeds / fruits) can be dispersed (to new areas) • many seeds / offspring produced • offspring not competing (for light / water / ions) • can survive in a new environment • enables evolution	allow offspring are not (genetically) identical allow description of an advantage of variation eg not all killed by one pathogen / disease	1	AO1 4.6.1.1 4.6.1.3 4.6.2.2 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any **one** from: • fast • many offspring produced • (genetically) identical offspring • only one parent needed • offspring less vulnerable (as attached to parent) • offspring receive water from parent • can out-compete other species • can colonise local area • less energy is needed	allow they are clones allow offspring receive named example of nutrient from parent allow pollinators / bees not required	1	AO1 4.6.1.1 4.6.1.3 4.6.2.2 4.6.3.1

Total Question 3	10

4.6.1.2 Meiosis

Answer 11 · Examiner comments — November 2020 | 8461/2F | Original Q3

Question 3 (low & standard demand)

This question was about meiosis, chromosomes and an inherited disorder in humans. A little over one-third of students gave the correct answer of '4' cells being formed by meiosis in **03.1**. There were many other alternatives offered: '2' was, not unexpectedly, a common incorrect response and other suggestions included '8' and as many as '50 million' as these last students presumably either misread the question or misunderstood the process of meiosis.

For **03.6** most students ringed an appropriate offspring genotype although a significant minority (about 1 in 15) did not answer this question. The most likely reason for this is that students missed the question, rather than not understanding what they had to do. The lack of answer lines, spaces or boxes to tick should not be seen by students to mean that nothing needs to be done. Students should be reminded to read all of the words on the paper and respond accordingly. Those students who gave incorrect responses often ringed contradictory genotypes, showing a lack of understanding of genetic principles.

Answer 12 · Examiner comments — June 2022 | 8461/2F | Original Q8

Question 8

This was the first of three questions common to both the Foundation and Higher Tier papers. The topic was reproduction and meiosis.

08.1 Almost one third of students correctly selected whether each of the three statements applied to sexual and/or asexual reproduction. The most common error was not knowing that in *both* types of reproduction genes are passed from parents to offspring. A large proportion appeared to be using little more than guesswork.

08.2 A variety of plant parts, often not even of a flower, along with processes, sub-cellular structures and occasionally plant or even animal organs were suggested as the name of the male gamete in flowering plants. Fewer than a quarter gave the correct name, *pollen*.

08.3 and **08.4** Interpretation of the graph in **Figure 12**, which showed changing amounts of DNA in a cell before, during and after meiosis, was fairly good where, respectively, around 50 percent and 40 percent of students chose the correct period of DNA synthesis and the correct times of cell division. But it was odd that so many others chose 4-5 hours for copying of the DNA, a time when its mass remained constant, and chose times for cell division when the mass of DNA was not being halved.

08.5 and **08.6** Only one in seven suggested that the lowest value on the graph, at the end of meiosis, would be the amount of DNA in a sperm cell. In **08.6**, the suggested amount of DNA in an embryo was frequently a value lower than that given for the sperm cell, with fewer than one-third suggesting the same value as that found at the start of the graph.

4.6.1.2 Meiosis

Answer 13 · Examiner comments

June 2023 | 8461/1F | Original Q4

Question 4 (Low and standard demand)

04.1 Nearly two thirds of students knew the term 'vector' correctly describes the mosquito.

04.2 Although the question states that Figure 2 showed a (single) cell of a malarial protist, some students remained confused and believed that there were 'cells depicted within a cell'. Others incorrectly discussed the absence of plant cell features, such as 'no chloroplasts', while others got prokaryotic and eukaryotic cells muddled. Reference to size was ignored. While 25% of students failed to gain any marks, the most frequently seen correct feature was 'nucleus', followed by 'mitochondria'. Phonetic spellings were obviously allowed as students have difficulty in spelling both of these words. As in all questions of this nature, the 'list rule' applied so that where a student gave 3 answers, 2 of which were correct and 1 wrong, only one mark could be given.

04.3 Over two thirds of students gained the mark by selecting *Salmonella* to be prokaryotic. While the remaining students indicated 'cow' or 'grass', in equal amounts.

04.4 Around 77% of students knew that asexual reproduction involved only one parent.

04.5 It is clear that many students still remain unclear about the number of chromosomes involved in mitosis. Only around a third of students correctly selected '14' as the number of chromosomes each new protist cell would have after mitosis. The most common incorrect answer seen was '28', which was selected by a further third of the students.

04.6 Around half of students were correct in selecting 'decreased haemoglobin' as a change that would happen in the blood of a person with malaria.

04.7 Nearly 35% of students who are adept at mathematics found this question very straightforward and an easy route to four marks. A further 31% managed three marks, via many routes, but most commonly by reaching the point of 350 million but then failing to convert to standard form or incorrectly doing so. Others forgot that the question referred to 'millions' of people being infected and used 105 and 315 but, nevertheless, an answer of 3.15×10^2 was still awarded three marks.

04.8 Many students were aware of what should be done to reduce the chance of being bitten by mosquitoes but then used inadequate scientific language to express themselves and as such only around 13% of students gained both available marks. Answers such as 'cover yourself up' or 'use bug spray / repellent' were not credited. 'Wear more / thicker clothes' was also deemed insufficient and 'close windows / doors' also failed to get credit without qualifying that this was only important in the evenings. Some correctly suggested not going to places with mosquitoes or where there was an incidence of malaria and a few answers referred to destruction of breeding grounds. Other correct suggestions were also awarded credit, but overall 42% of students scored zero marks.

04.9 Nearly three quarters of students gained one mark here for correctly describing that the chance of getting malaria decreased with age. A few incorrectly understood the context of disorder S, however, and said that the likelihood of having this, rather than malaria, was lower as age increased. Even though the instruction given in the question was to use data

4.6.1.2 Meiosis

Answer 13 · Examiner comments June 2023 | 8461/1F | Original Q4

from Table 4 only around 10% of students went on to gain the second mark for an appropriate use of figures. Some, unfortunately, glanced too quickly at the results and believed there was a decrease of 5% every 2 years.

Answer 14 · Examiner comments

June 2025 | 8461/2F | Original Q3

Question 3 (Low and Standard demand)

03.1
Three quarters of students knew that sperm are produced in the testes/testicles. There were many alternative phonetic spellings of testes and testicles seen which were given credit. The most common incorrect answers were ovaries and penis along with other parts of the male and female reproductive organs. 'Genitalia' and colloquial terms were also frequently seen uncreditworthy answers, along with a few unexpected parts such as pancreas, stomach and spine.

03.2
All combinations of numbers were seen, including that for the compensation mark. Just under 40% of students gained both marks.

03.3
95% of students knew that fertilisation was the process where a sperm cell joins with an egg cell.

03.4
Over 50% of students knew that pollen is the male gamete in a flower.

03.5
60% of students knew that mitosis produces new cells in runners.

03.6
Over half of students could identify at least one substance that passes through the runners, with a further 25% being able to identify both sugar and water.

03.7
A third of students were able to give one advantage of reproducing sexually.
The most commonly awarded mark was for the idea of variation, either given in those terms or that the offspring would not be the same. All other bullet points were seen, with the idea of dispersal being the next most common. The most frequent reason for not gaining the mark here was for giving an advantage of asexual reproduction, possibly through having misread the question.

03.8
Over 50% of students were able to give one advantage of reproducing asexually with bullet points 1, 3 and 4 most commonly seen. Several students gave more than one idea in a single sentence e.g. ' it is faster because there is no need to find a mate'. A few students implied the idea of the offspring gaining resources from the parent plant but did not specify water or a named nutrient, instead referring to 'nutrients', so were unable to gain credit for bullet point 6. Others referred to asexual reproduction as being 'easier' without elaborating as to how this manifested itself. As with question **03.7** some students were unable to gain this mark because they gave an advantage of the other type of reproduction.