AQA GCSE Biology | 8461

SPECIFICATION POINT 4.6.1.1

Sexual and asexual reproduction

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**36**
Available paper years	**2007–2025**

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.

4.6.1.1 Sexual and asexual reproduction

Answer 01 · Mark scheme

January 2007 | BLY1H | Original Q7 | Legacy

Question 7

	answers	extra information	mark
(a)	have identical genes / chromosomes / genetic material		1
	since asexual reproduction	accept mitosis	1
(b)	mixture of genes / chromosomes / genetic material from two parents	accept meiosis	1
	sexual reproduction / fusion of gametes		1
(c)	public misunderstand technique as cloning **or** worried about large numbers of clones **or** moral / ethical / religious issues **or** unnatural process **or** scientists must not play god **or** technique may lead to embryo death	do **not** allow mark for embryos lost	1
total			5

Answer 02 · Mark scheme

March 2007 | BLY1B | Original Q4 | Legacy

Four	**A**	evolved	**1**
	B	genes	**3**
	C	natural selection	**2**
	D	survived	**4**

4.6.1.1 Sexual and asexual reproduction

Answer 03 · Mark scheme

November 2008 | BLY1AP | Original Q9 | Legacy

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

Answer 04 · Mark scheme

November 2008 | BLY1BP | Original Q8 | Legacy

Eight	**3**	**4**	**4**	**3**

4.6.1.1 Sexual and asexual reproduction

Answer 05 · Mark scheme

November 2008 | BLY1BP | Original Q9 | Legacy

Nine	**2**	**3**	**1**	**2**

Answer 06 · Mark scheme

March 2009 | BLY1AP | Original Q9 | Legacy

Nine	**1**	**2**	**3**	**3**

Answer 07 · Mark scheme

March 2009 | BLY1BP | Original Q7 | Legacy

Seven	**3**	**2**	**4**	**4**

4.6.1.1 Sexual and asexual reproduction

Answer 08 · Mark scheme

March 2009 | BLY1BP | Original Q9 | Legacy

Nine	**1**	**3**	**2**	**3**

4.6.1.1 Sexual and asexual reproduction

Answer 09 · Mark scheme

June 2009 | BLY1H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	any **three** from • FSH <u>used / given / injected</u> • LH <u>used / given / injected</u> • FSH causes eggs to mature • LH stimulates egg release	if oestrogen **or** progesterone <u>used</u> = max 2 if both oestrogen **and** progesterone <u>used</u> = max 1 ignore <u>effects</u> of oestrogen and progesterone	3

Question 7 continues on next page…

BLY1H

Question 7 Continued

question	answers	extra information	mark
7(b)	max **two** pros for IVM / it from: • cheaper • less hormones used • ovarian hyperstimulation **or** the syndrome less likely • IVM treatment shorter	allow max **two** cons for IVF allow 'it's safer for the mother' ignore 'more risks' unqualified	2
	con for IVM • small risk of abnormal sex chromosomes / birth defects / baby cancer	allow max **one** pro for IVF allow 'more risk to baby' ignore 'more risks' unqualified	1
	evaluation eg IVM better because less risk to mother outweighs small risk to baby **or** IVF better because no risk to baby and a small risk to mother	must include an appreciation that there are two sides to the argument	1
Total			**7**

4.6.1.1 Sexual and asexual reproduction

Answer 10 · Mark scheme March 2010 | BLY1AP | Original Q7 | Legacy

Seven	**2**	**1**	**4**	**3**

Answer 11 · 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**

Answer 12 · Mark scheme June 2010 | BLY1AP | Original Q9 | Legacy

Nine	**3**	**2**	**3**	**4**

4.6.1.1 Sexual and asexual reproduction

Answer 13 · Mark scheme January 2011 | BLY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	FSH / follicle stimulating hormone LH / luteinizing hormone	allow FHS either order	1 1
3(b)	any **four** from: • egg(s) collected from ovary • *(eggs)* mixed with sperm **or** fertilisation occurs • fertilised egg divides • embryo formed • *(*embryos*)* inserted into womb / uterus • FSH matures egg **and** LH releases eggs	 allow eggs and sperm put into tube ignore references to vagina	4
Total			**6**

BLY1H

Answer 14 · Mark scheme March 2011 | BLY1AP | Original Q9 | Legacy

Nine	**1**	**3**	**3**	**2**

4.6.1.1 Sexual and asexual reproduction

Answer 15 · Mark scheme

March 2011 | BLY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	embryo transplants	**2**
	B	sexual reproduction	**4**
	C	taking cuttings	**1**
	D	tissue culture	**3**

4.6.1.1 Sexual and asexual reproduction

Answer 16 · Mark scheme

June 2011 | BLY1H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	any **two** from: • no fusion in asexual **or** sexual involves fusion **or** no mixing of genetic information in asexual **or** mixing of genetic information in sexual **or** asexual involves splitting (of one individual) • no gametes in asexual **or** sexual involves gametes • only one parent in asexual **or** sexual involves two parents • no variation in asexual **or** asexual produces clones **or** sexual leads to variations	assume it refers to asexual accept no fertilisation in asexual **or** fertilisation in sexual accept genes / alleles / chromosomes / genetics for genetic information accept named gametes allow offspring of sexual have characteristics of both parents for this point ignore sexual intercourse ignore external / internal ignore plants / animals ignore mitosis / meiosis	2
7(b)	nucleus of egg removed **or** involves empty egg cell so only one nucleus **or** one set of genetic information / genes / chromosomes **or** so genetic information / genes / chromosomes from one parent only		1 1
Total			**4**

4.6.1.1 Sexual and asexual reproduction

Answer 16 · Mark scheme June 2011 | BLY1H | Original Q7 | Legacy

BLY1H

Answer 17 · Mark scheme November 2011 | BLY1AP | Original Q7 | Legacy

Seven	**1**	**3**	**2**	**3**

Answer 18 · Mark scheme November 2011 | BLY1BP | Original Q1 | Legacy

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

Answer 19 · Mark scheme November 2011 | BLY1BP | Original Q6 | Legacy

Six	**4**	**3**	**4**	**1**

4.6.1.1 Sexual and asexual reproduction

Answer 20 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	fusion / joining / combining of gametes / egg **and** sperm / sex cells	accept fertilisation allow fusion / joining / combining DNA from two parents ignore meeting / coming together / mixing of gametes etc	1
1(a)(ii)	(mixture of) genes / DNA / genetic information / chromosomes from both parents / horse **and** zebra	ignore nucleus / inherited information but allow second mark if given dependent on sensible attempt at 1st mark	1 1

Question 1 continues on the next page . . .

BL1HP

Question 1 continued

1(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 2, and apply a 'best-fit' approach to the marking.		
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**
No relevant content	There is simple description of the early stages of adult cell cloning. However there is little other detail and the description may be confused or inaccurate.	There is an almost complete description of the early stages of the process and description of some aspects of the later stages. The description may show some confusion or inaccuracies.	There is a clear, detailed and accurate description of all the major points of how adult cell cloning is carried out.

Examples of Biology points made in the response could include: 6

- skin cell from zorse
- (unfertilised) egg cell from horse
- remove nucleus from egg cell
- take nucleus from skin cell
- put into (empty) egg cell
- (then give) electric shock
- (causes) egg cell divides / embryo formed
- (then) place (embryo) in womb / uterus

Total			**9**

4.6.1.1 Sexual and asexual reproduction

Answer 20 · Mark scheme

January 2012 | BL1HP | Original Q1 | Legacy

BL1HP

4.6.1.1 Sexual and asexual reproduction

Answer 21 · Mark scheme

June 2012 | BL2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	mitosis	correct spelling only	1
4(a)(ii)	replicates / doubles / is copied / duplicates	accept cloned ignore multiplied / reproduced	1
4(b)	fertilisation occurs / fusion (of gametes)	accept converse for asexual, eg none in asexual / just division in asexual	1
	so leading to mixing of genetic information / genes / DNA / chromosomes	genes / DNA / chromosomes / genetic information comes from 1 parent in asexual ignore characteristics	1
	one copy (of each allele / gene / chromosome) from each parent **or** gametes produced by meiosis **or** meiosis causes variation	meiosis must be spelt correctly	1
Total			**5**

4.6.1.1 Sexual and asexual reproduction

Answer 21 · Mark scheme

June 2012 | BL2HP | Original Q4 | Legacy

BL2HP

4.6.1.1 Sexual and asexual reproduction

Answer 22 · Mark scheme

January 2013 | BL1HP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	**A** – pituitary **B** – ovary / ovaries	allow hypothalamus	1 1
2(a)(ii)	in blood (stream)	accept in plasma ignore dissolved	1
2(b)(i)	FSH and Luteinising Hormone (LH)		1
2(b)(ii)	fertilised OR reference to sperm form embryos / ball of cells or cell division (embryo) inserted into mother's womb / uterus	 allow (fertilised egg) is inserted into mother's womb / uterus	1 1 1
2(b)(iii)	any **one** from: • multiple births lead to low birth weight • multiple births cause possible harm to mother / fetus / embryo / baby / miscarriages	 allow premature ignore reference to cost / ethics / population	1
2(c)(i)	any **one** from: • almost identical • both approximately 20%	 allow S (slightly) more successful	1
2(c)(ii)	larger numbers (in clinic R) (in 2007) results likely to be more repeatable (in 2008)	allow only 98 (in S) (compared to 1004 (in R)) allow more reliable do **not** accept more reproducible / accurate / precise	1 1
Total			**11**

4.6.1.1 Sexual and asexual reproduction

Answer 22 · Mark scheme

January 2013 | BL1HP | Original Q2 | Legacy

BL1HP

4.6.1.1 Sexual and asexual reproduction

Answer 23 · Mark scheme

June 2013 | BL1HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	auxin	accept other named plant hormones	1
5(b)(i)	any **three** from: • no (fusion of) gametes / fertilisation • only one parent • no mixing of genetic material • no genetic variation **or** genetically identical offspring	 allow no meiosis **or** new cells only produced by mitosis allow not two parents allow clones	3
5(b)(ii)	more / many offspring / plants (produced from one parent plant)	allow less damage to parent plant ignore speed / cost	1
Total			**5**

4.6.1.1 Sexual and asexual reproduction

Answer 24 · Mark scheme

June 2013 | BL2HP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	DNA replication / copies of genetic material were made	'it' = a chromosome allow chromosomes replicate / duplicate / are copied ignore chromosomes divide / split / double	1
8(a)(ii)	one copy of each (chromosome / chromatid / strand) to each offspring cell	ignore ref. to gametes and fertilisation	1
	each offspring cell receives a complete set of / the same genetic material	allow 'so offspring (cells) are identical'	1
8(b)(i)	meiosis	allow mieosis as the only alternative spelling	1
8(b)(ii)	Species A = 4 **and** Species B = 8		1
8(b)(iii)	sum of A + B from (b)(ii) e.g. 12		1

Question 8 continues on the next page...

Question 8 continued...

question	answers	extra information	mark
8(c)(i)	similarities between chromosomes **or** similarities between flowers described	 e.g. shape of petals / pattern on petals / colour / stamens	1
	can breed / can sexually reproduce	allow can reproduce with each other / they can produce offspring	1
8(c)(ii)	any **two** from: • offspring contain 3 copies of each gene / of each chromosome / odd number of each of the chromosomes • some chromosomes unable to pair (in meiosis) • (viable) gametes not formed / some gametes with extra / too many genes / chromosomes **or** some gametes with missing genes / chromosomes		2
Total			**10**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.6.1.1 Sexual and asexual reproduction

Answer 25 · Mark scheme June 2014 | BL1HP | Original Q8 | Legacy

8(a)	any **three** from: • (gene) cut out • (gene / cut out) from (bacterial) chromosome / DNA • ref to enzymes (at any point) • (gene spliced) into maize chromosome / DNA • (gene added) at an early stage of development	accept (gene / cut out) from (bacterial) plasmid	3	AO1 1.7.2d, e
8(b)	any **four** from: • justification based on comparison of the relative merits of at least one advantage and one disadvantage Advantages: • less effort for farmer **or** less likely to harm farmer • (pesticide) always there **or** doesn't wash away • less insects to eat crop / maize **or** carry disease • so greater crop production / yield Disadvantages: • (toxin) kills other insects • so (some) crops don't get pollinated / (sexually) reproduce • possible harm when eaten by humans / animals • damage to food chains • gene may spread to other species	max **3** marks if only advantages or disadvantages given ignore ref to cost allow examples eg no need to spray allow pesticide doesn't contaminate water courses ignore ref to cost allow maize not pollinated allow may have unpleasant taste allow reduced biodiversity	4	AO3 1.7.2e, f
Total			**7**	

4.6.1.1 Sexual and asexual reproduction

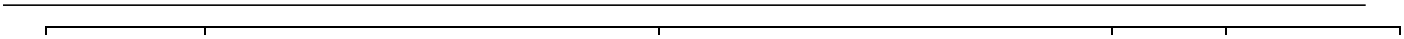
Answer 26 · Mark scheme June 2015 | BL1HP | Original Q8 | Legacy

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**	

4.6.1.1 Sexual and asexual reproduction

Answer 26 · Mark scheme

June 2015 | BL1HP | Original Q8 | Legacy



4.6.1.1 Sexual and asexual reproduction

Answer 27 · Mark scheme June 2015 | BL2HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)(i)	3.15 : 1	accept 3.147:1 **or** 3.1 : 1 **or** 3 : 1 do **not** accept 3.14 : 1 Ignore 705:224	1	AO2 2.7
8(a)(ii)	any **two** from: • fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes) • more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number • anomalies have limited effect / anomalies can be identified	 allow ref. to more representative / reliable do **not** allow more accurate **or** precise ignore fair / repeatable accept example of an anomaly	2	AO3 2.7, 2.7.2a
8(b)(i)	in sequence: Homozygous Homozygous Heterozygous	All 3 correct = 2 marks 2 correct = 1 mark 1 or 0 correct = 0 marks	2	AO3 2.7
8(b)(ii)	genetic diagram including: Parental genotypes: **Nn** and **Nn** **or** Gametes: **N** and **n** + **N** and **n** <u>derivation</u> of offspring genotypes: **NN Nn Nn nn** identification: **NN** and **Nn** as purple **and nn** as white	 allow other characters / symbols only if clearly defined allow genotypes correctly derived from candidate's P gametes allow correct identification of candidate's offspring genotypes but only if some F_2 are purple and some are white	 1 1 1	AO2 2.7

4.6.1.1 Sexual and asexual reproduction

Answer 27 · Mark scheme

June 2015 | BL2HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(c)	any **two** from: • did not know about chromosomes / genes / DNA **or** did not know chromosomes occurred in pairs • had pre-conceived theories • Mendel's (mathematical) approach was novel concept • Mendel was not part of academic establishment • work published in obscure journal / work lost for many years • peas gave unusual results cf other species • Mendel's results were not corroborated until later / 1900	 ignore genetics eg blending of inherited characters ignore religious ideas unless qualified allow his work was not understood or no other scientist had similar ideas allow he was not considered to be a scientist / not well known / he was only a monk allow he only worked on pea plants	2	AO1 2.7
Total			**10**	

4.6.1.1 Sexual and asexual reproduction

Answer 28 · 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

4.6.1.1 Sexual and asexual reproduction

Answer 28 · Mark scheme

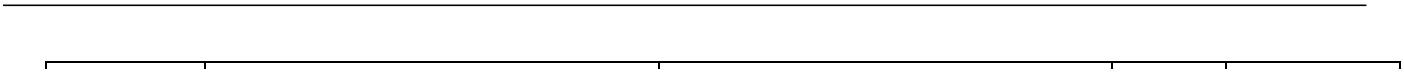
June 2016 | BL2HP | Original Q5 | Legacy

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**	

4.6.1.1 Sexual and asexual reproduction

Answer 28 · Mark scheme

June 2016 | BL2HP | Original Q5 | Legacy



4.6.1.1 Sexual and asexual reproduction

Answer 29 · 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

4.6.1.1 Sexual and asexual reproduction

Answer 29 · 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**	

4.6.1.1 Sexual and asexual reproduction

Answer 29 · Mark scheme

June 2017 | BL1HP | Original Q7 | Legacy

4.6.1.1 Sexual and asexual reproduction

Answer 30 · Mark scheme

June 2018 | 8461/2H | Original Q5

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>05.1</td><td>
<table>
<tr><th></th><th colspan="3">statement is true for</th></tr>
<tr><th></th><th>mitosis only</th><th>meiosis only</th><th>both mitosis and meiosis</th></tr>
<tr><td>all cells produced are genetically identical</td><td>✓</td><td></td><td></td></tr>
<tr><td>in humans, at the end of cell division each cell contains 23 chromosomes</td><td></td><td>✓</td><td></td></tr>
<tr><td>involves DNA replication</td><td></td><td></td><td>✓</td></tr>
</table>
3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks
</td><td></td><td>2</td><td>AO1
4.1.2.2
4.6.1.2</td></tr>
<tr><td>05.2</td><td>any two from:

• many offspring produced
• takes less time
• (more) energy efficient
• genetically identical offspring
• successful traits propagated / maintained / passed on (due to offspring being genetically identical)
• no transfer of gametes or seed dispersal
• not wasteful of flowers / pollen / seeds
• colonisation of local area</td><td>ignore references to one parent only

allow asexual is faster

allow offspring are clones

allow no vulnerable embryo stage
allow no need for animals

must imply local area</td><td>2</td><td>AO3
4.6.1.1
4.6.1.3</td></tr>
</table>

4.6.1.1 Sexual and asexual reproduction

Answer 30 · Mark scheme

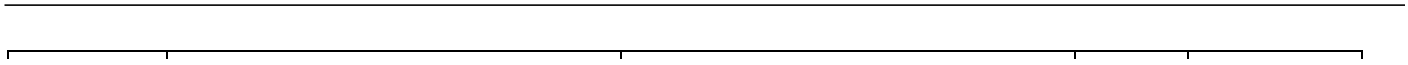
June 2018 | 8461/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow bluebell example described (**max 3** if not bluebell)		
	genetic variation (in offspring)		1	AO1
	(so) better adapted survive	allow reference to natural selection or survival of the fittest	1	AO1
	(and) colonise new areas by seed dispersal **or** can escape adverse event in original area (by living in new area)	must imply new area	1	AO3
	many offspring **so** higher probability some will survive		1	AO3 4.6.1.1 4.6.2.1 4.6.1.3 4.7.1.1
Total			**8**	

4.6.1.1 Sexual and asexual reproduction

Answer 30 · Mark scheme

June 2018 | 8461/2H | Original Q5



4.6.1.1 Sexual and asexual reproduction

Answer 31 · Mark scheme

June 2018 | 8461/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	3.7		1	AO2 4.7.2.1
08.2	2		1	AO1 4.6.1.6
08.3	(different combinations of alleles cause) many / 22 values **or** in-between values **or** large range of values **or** there are not only two values	allow continuous variation allow there are not only 3 values if 3 is given in question **08.2**	1	AO3 4.6.1.6 4.6.2.1
08.4	different protein made active site changed so substrate does not fit / bind	allow change in shape (of enzyme) or change in 3-D structure ignore denature allow description of substrate allow cannot form E-S complex ignore lock and key description	1 1 1	AO1 4.2.2.1 4.6.1.5
08.5	produces (some) offspring with high-fat milk **or** not all offspring have low-fat milk	ignore reference to alleles	1	AO3 4.6.1.6
08.6	takes less time (to obtain results) **or** more offspring at the same time	allow other sensible suggestion – eg allows screening **or** allow cow 7 to continue to produce eggs **or** avoid injury to cow 7 during mating or giving birth	1	AO3 4.5.3.6

4.6.1.1 Sexual and asexual reproduction

Answer 31 · Mark scheme

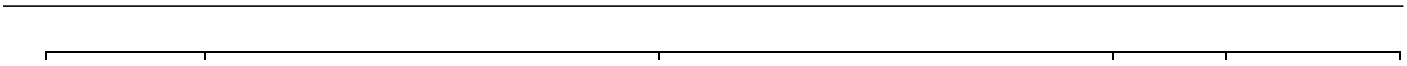
June 2018 | 8461/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7		**max 3** marks if own symbols used with no key **max 3** marks if alternative diagram to Punnett square used		AO2 4.6.1.6
	male gametes correct: d (and d)		1	
	female gametes correct: D and d	allow **1** mark if gametes are correct but gender not identified	1	
	correct derivation of offspring genotypes from given gametes	allow 2 × 2 **or** 2 × 1 derivation	1	
	Dd identified as low-fat **and** dd identified as high-fat in offspring	if DD offspring are produced, must also identify as low-fat	1	
08.8	find female with low(est) fat in milk **and** high(est) milk yield	allow choose from 7, 9, 12, 13 which has the highest yield	1	AO3 4.6.2.3
	find male whose female offspring have high(est) milk yield **and** low(est) fat in milk **or**	allow choose from 16 or 18 whose female offspring has the highest yield	1	AO3 4.6.2.3
	find female with lowest fat in milk **or** cow 13 (1) **or** find male whose female offspring have high(est) milk yield (1)	allow female with high(est) milk yield allow male whose female offspring have lowest fat in milk / male 16		
	cross the best (for both features) female with the best male		1	AO2 4.6.2.3
	select best offspring (for both features) from each generation and repeat for several generations		1	AO2 4.6.2.3
Total			**16**	

4.6.1.1 Sexual and asexual reproduction

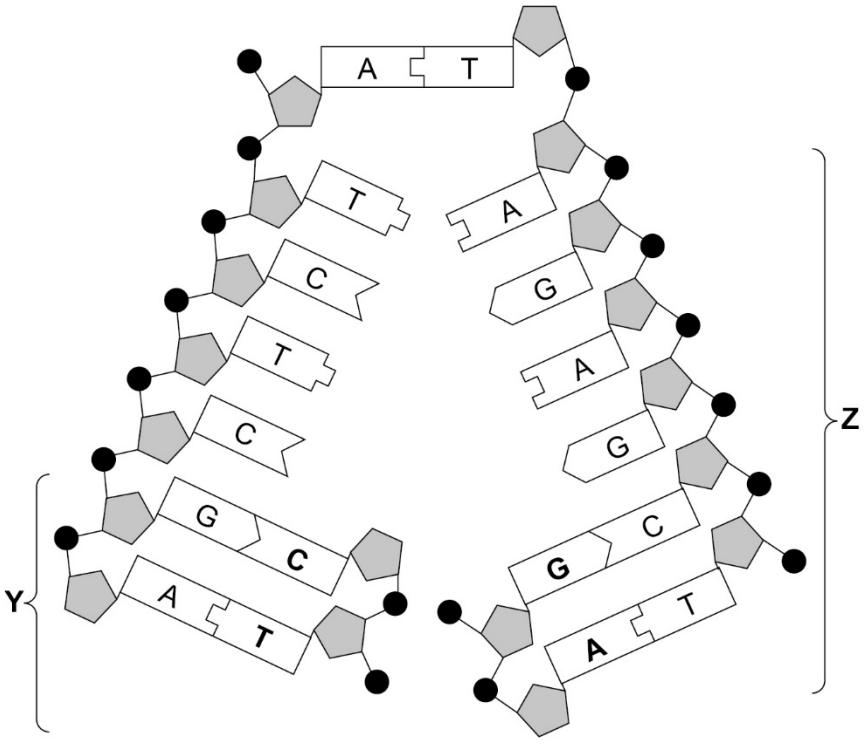
Answer 31 · Mark scheme

June 2018 | 8461/2H | Original Q8



4.6.1.1 Sexual and asexual reproduction

Answer 32 · 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

4.6.1.1 Sexual and asexual reproduction

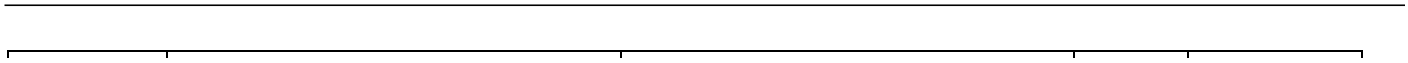
Answer 32 · Mark scheme

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**	

4.6.1.1 Sexual and asexual reproduction

Answer 32 · Mark scheme

November 2021 | 8461/2H | Original Q1



4.6.1.1 Sexual and asexual reproduction

Answer 33 · 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

4.6.1.1 Sexual and asexual reproduction

Answer 33 · 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		

4.6.1.1 Sexual and asexual reproduction

Answer 33 · 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

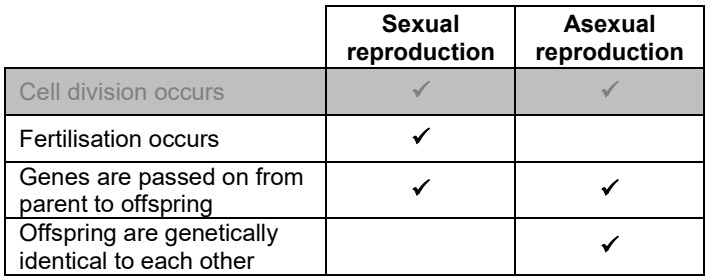
Total Question 4		**14**

4.6.1.1 Sexual and asexual reproduction

Answer 34 · Mark scheme

June 2022 | 8461/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1		allow **1** mark for 1 or 2 correct rows ignore 'x' in blank boxes	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		✓

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

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	5 hours 6 hours		1 1	AO2 4.6.1.2

4.6.1.1 Sexual and asexual reproduction

Answer 34 · Mark scheme

June 2022 | 8461/2H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	2		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	4		1	AO2 4.6.1.2

Total Question 1		**8**

4.6.1.1 Sexual and asexual reproduction

Answer 35 · Mark scheme

June 2023 | 8461/1H | Original Q5

Question 5

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

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	any **three** from: • protist / it has mitochondria • protist / it has (a) nucleus **or** protist DNA / genetic material is not free in the cytoplasm • protist / it does not have a single loop of DNA / genetic material • protist / it does not have plasmids • protist / it does not have a cell wall	allow converse for prokaryotic cells allow eukaryotic for protist if neither mark awarded, allow **1** mark for protist has membrane-bound structures ignore genetic information ignore genetic information do **not** accept eukaryotic cell does not have a cell wall allow protist / it does not have a slime capsule ignore cilia / flagellae / ribosomes ignore size / shape	3	AO2 4.1.1.1 4.3.1.5

4.6.1.1 Sexual and asexual reproduction

Answer 35 · Mark scheme

June 2023 | 8461/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.3	less oxygen carried (in blood)	allow less oxygen carried (to cells) ignore reference to number of red blood cells unqualified do **not** accept no oxygen carried	1	AO2 4.4.2.3 4.4.2.1 4.2.2.3
	less energy released from respiration	do **not** accept energy produced / made / created	1	

Question	Answers	Mark	AO / Spec Ref.
05.4	any **three** pairs from: **Sexual reproduction** / **Asexual reproduction** involves two parents / involves one parent involves gametes joining / fusing **or** involves fertilisation / involves no (fusion of) gametes **or** does not involve fertilisation there is mixing of genetic material / information **or** there is genetic variation **or** offspring are genetically different / there is no mixing of genetic material / information **or** there is no genetic variation **or** offspring are genetically identical ignore reference to clones involves (only) meiosis / involves mitosis **or** does not involve meiosis more energy required / less energy required slower / faster if no other mark awarded allow **1** mark for asexual reproduction produces many offspring pairs of answers can be in any order	3	AO1 4.6.1.1 4.1.2.2

4.6.1.1 Sexual and asexual reproduction

Answer 35 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	(no bases so) DNA replication cannot occur	allow copying / duplicating / doubling for replication ignore cannot make DNA unqualified	1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.6	(after DNA replication) one set of chromosomes is pulled to each end of the cell	allow one (member) of each pair of chromosomes is pulled to each end of the cell ignore (half the) chromosomes are pulled to each end of the cell	1	AO1 4.1.2.2
	nucleus divides	allow two (new) nuclei form	1	
	cytoplasm **or** cell membrane divides to form two cells	allow cytokinesis	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.7	having disorder **S** reduces incidence / percentage of malaria	allow having disorder **S** reduces chance of getting malaria allow having disorder **S** protects against malaria	1	AO3 4.2.2.5 4.3.1.5
	as age increases a lower percentage of children with disorder **S** get malaria until age 10, then the percentage increases	allow protection against malaria increases with (increasing) age until age 10, then it decreases	1	

Total Question 5	15

Answer 36 · Mark scheme

June 2025 | 8461/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	cell division **1**		1	AO2 4.1.2.2 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	**A** and **C**		1	AO2 4.1.2.2 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	23 **or** twenty three	do **not** accept 23 pairs	1	AO2 4.6.1.2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	5 / five **or** 6 / six	ignore reference to letters	1	AO2 4.6.1.2 4.6.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	(only) mitosis (so) **all** cells receive a copy of every allele / gene	do **not** accept meiosis / meitosis / metosis allow (so) **all** cells receive a copy of every chromosome **or** (so) **all** cells receive a copy of all the DNA **or** (so) **all** cells receive a full set of chromosomes	1 1	AO1 AO2 4.6.1.1 4.1.2.2 4.6.1.3

Answer 36 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	gametes are produced by meiosis		1	AO1
	(so) offspring have unique / different / random combinations of alleles / genes / chromosomes from each parent / gamete	allow (so) gametes fuse creating unique / different / random combinations of alleles / genes / chromosomes in offspring	1	AO2 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	any **two** from: • faster than sexual • many offspring produced to colonise local area **or** many offspring produced to out-compete other species • genetically identical offspring so well adapted to current conditions / environment • only one parent needed so no need for pollinators / bees • offspring receive water **and** sugars / minerals / ions / salts from parent • less energy / materials required as no need to produce gametes / flowers / seeds / fruits		2	AO1 4.6.1.1 4.6.1.3

4.6.1.1 Sexual and asexual reproduction

Answer 36 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	any **two** from: • new combinations of alleles gives genetic variation **or** genetic variation gives selective advantage • seeds dispersed to new / wider area so less vulnerable to habitat loss **or** seeds dispersed to new / wider area so not competing with (parent / offspring) plants for space / water / minerals • larger number of offspring produced so will increase the population quickly	allow genetic variation provides the opportunity for evolution allow genetic variation enables species to adapt to new / changed environments allow larger number of offspring produced will improve survival of the species	2	AO1 4.6.1.1 4.6.1.3 4.6.2.2 4.6.3.1

Total Question 6	12

4.6.1.1 Sexual and asexual reproduction

Answer 32 · 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).

4.6.1.1 Sexual and asexual reproduction

Answer 33 · 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.

4.6.1.1 Sexual and asexual reproduction

Answer 34 · Examiner comments June 2022 | 8461/2H | Original Q1

Question 1

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

01.1 Three-quarters 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.

01.2 Almost the same proportion knew that pollen is the male gamete formed in flowering plants. Incorrect answers included ‘anther’, ‘stamen, ‘stem’, ‘stigma’, ‘sperm’ and even ‘testis’.

01.3 -01.6 Interpretation of the graph in **Figure 4**, which showed changing amounts of DNA in a cell before, during and after meiosis, was good in questions **01.3** and **01.4** where, respectively, the correct period of DNA synthesis and the correct times of cell divisions were selected. However, only half the students chose the correct values for the amount of DNA expected in a sperm cell and in an embryo in **01.5** and **01.6**.

Answer 35 · Examiner comments June 2023 | 8461/1H | Original Q5

Question 5 (Standard, standard/high and high demand)

05.1 The majority of students answered this question correctly with just over 68% of students gaining credit. A number of students referred to ‘communicable disease’ or ‘carrier’ which were not creditworthy.

4.6.1.1 Sexual and asexual reproduction

Answer 35 · Examiner comments

June 2023 | 8461/1H | Original Q5

05.2 Students were told in the stem of the question that the malarial protist is a eukaryotic cell, and clearly most students processed this information and just under 95% of student gained some marks. Incorrect responses were seen often when students mixed up protist and prokaryote structures or had misconceptions regarding prokaryote structure suggesting a lack of cell membrane or cytoplasm.

05.3 Most students gained credit for stating that lesson oxygen could be carried by the blood, if red blood cells burst. Only around 20% of students linked this idea to respiration and energy release for the second marking point. Some students suggested that as a result 'no oxygen would be carried' which was not creditworthy. We again this year saw the usual incorrect idea of energy being produced or created which lost students this second marking point.

05.4 Over 70% of students were able to gain some marks on this question, with 8% gaining the full 3 marks available. Many students knew that sexual reproduction involved 'gametes' but they failed to include the idea of fusion and missed out on the first marking point. A pleasing number of students gave the idea of genetic variation for the second marking point, but when 'genetic' was omitted or students simply referred to 'clones' credit was not awarded. The full array of possible creditworthy ideas were seen, as well as the fallback mark.

05.5 Only around 37% of students gained this mark. Those that did not, often lacked detail in their answer. Students were required to specifically refer to DNA, and terms such as 'chromosome' or 'genetic material' were ignored. Furthermore, references to DNA 'multiplying' or 'reproducing' did not gain credit.

05.6 This was a high demand question, and in particular the first marking point proved a good discriminator with very few students referring to 'one set of chromosomes' being pulled to each end of the cell, and instead giving vague references to 'chromosomes pulling apart', or 'DNA halves' which are insufficient at this level. While the process of mitosis is undoubtedly familiar to most students, they struggled to articulate their ideas clearly in their responses. Less than 3% of students gained all 3 marks as a result. Almost 37% gained 1 mark for references either the 'nucleus dividing' or 'the cell membrane / cytoplasm dividing' to form 2 cells.

05.7 The majority of students got muddled with the data in this question or misinterpreted it due to misreading the information provided in the stem informing them that 'the incidence of malaria in children with disorder S was calculated as a percentage of the incidence in children without disorder S'. Consequently, most students concluded that that having disorder S *increased* the chances of children getting malaria and therefore only a minority gained credit, with only 1% of students gaining 2 marks. The trend was however described correctly by around 27% of students for the whole age range obtaining 1 mark.

Answer 36 · Examiner comments

June 2025 | 8461/2H | Original Q6

Question 6 (Standard, Standard/high and High demand)

06.1
Over 70% of students identified the correct cell division that represented mitosis.

06.2
Over half of students identified cells A and C as being genetically identical.

06.3
Just over 85% of students gained the marking point here, knowing that cell J had 23 chromosomes. The most common incorrect response was '23 *pairs*'.

06.4
Students appeared to struggle with the high demand of this question, with only around 15% of students gaining the mark. Knowledge of the *stages* of meiosis is not required for this specification – as such the exact point that the reduction in chromosome numbers happens is not needed, hence, it was reasonable for students to give an answer of 5 or 6 depending on their interpretation.
The most common correct answer was '6', and there was a range of incorrect responses, with '4' being the most common. Some responses gave a list of letters without a number which did not answer the question.

06.5
Students struggled to clearly explain why offspring produced using runners are genetically identical. While many students correctly identified mitosis as being involved for mark point 1, simply stating that offspring were 'clones' was not sufficient without mentioning mitosis. 30% of students gained 1 mark – overwhelmingly for mark point 1. Mark point 2 was rarely awarded due to ineffective articulation at this level of demand. Even answers containing pertinent details often struggled to fully meet the mark scheme requirements. Additionally, many students focused on describing asexual reproduction, with answers such as 'only one parent is required' or 'no gamete fusion,' rather than explaining **why** the offspring were genetically identical. Some described mitosis as producing two genetically identical cells, but this was insufficient to explain why the whole plant was genetically identical.
Despite detailed attempts by most students, only 1% of students gained both available marks.

06.6
Only 10% of students managed to gain any marks in this question. Again, features of sexual reproduction were given, with little additional detail explaining why the offspring produced using flowers, fruits and seeds are not genetical identical. To earn mark point 1, students needed to explicitly link meiosis with the production of gametes, a connection rarely seen in responses that typically mentioned one without the other. Mark point 2 proved highly demanding due to its strict detail requirements. Many good attempts were seen but

4.6.1.1 Sexual and asexual reproduction

Answer 36 · Examiner comments

unfortunately lacked the precision needed at this level of demand. A very common error was the suggestion that meiosis actually produced the flowers, fruits and seeds which is incorrect.

06.7

One fifth of students were able to describe at least one advantage of asexual reproduction to the survival of the strawberry plants. For bullet point 1, a direct comparison to sexual reproduction had to be made, but many responses did not use this comparative language. However, if awarded bullet point 1 was by far the most common correct response seen.
For bullet points 2 through to 6, a clear link to a survival advantage was required. Many responses stated that 'less energy was needed', or 'only one parent needed' but then did not link it to the appropriate survival advantage and as such could not be awarded credit.

06.8

This question was set at very high demand with only a quarter of students gaining at least 1 mark. Bullet point 1 was the most common advantage of sexual reproduction given – articulated in many ways to match the variety of options on the mark scheme. Responses such as, 'genetic variation will decrease the chance of a disease killing all the plants' was most commonly awarded – which equated to 'genetic variation gives selective advantage' gaining one mark. Several good answers were seen but sadly students had only referred to 'variation' and not 'genetic variation' and so could not be credited. In addition, some responses correctly stated that 'seed dispersal would lead to less competition' but then didn't qualify this with any of the required examples from the mark scheme and as such were not credited.