AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.6.1.6

Sex determination

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**3**
Available paper years	**2019–2025**

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.

4.6.1.6 Sex determination

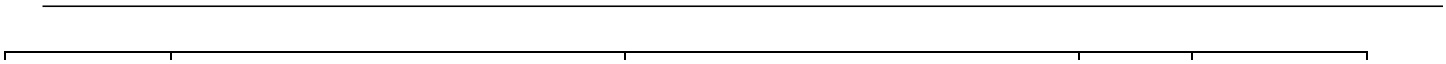
Answer 01 · Mark scheme June 2019 | 8464/B/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	mutation		1	AO1 4.6.2.1
04.2	any **three** from: • choose the cats with the blue tail • breed these cats together • choose offspring with blue tails and breed these together • repeat until all cats have blue tails	allow choose the cats with the desired characteristic allow breed for several generations	3	AO1 AO2 4.6.2.3
04.3	they are rare / beautiful / expensive	allow description e.g. the breeder will make (more) profit	1	AO3 4.6.2.3
04.4	they are produced by inbreeding		1	AO2 4.6.2.3
04.5	(male cat) XY **or** YX (female cat) XX	both required for the mark allow lower case letters	1	AO1 4.6.1.6
04.6	<table><tr><td></td><td>(X)</td><td>(X)</td></tr><tr><td>(X)</td><td>XX</td><td>XX</td></tr><tr><td>(Y)</td><td>XY</td><td>XY</td></tr></table>	allow 2 **or** 3 derivation squares correct for **1** mark	2	AO2 4.6.1.6
04.7	random (if X or Y goes into each sperm)	allow it is a chance event allow it is only a probability	1	AO3 4.6.1.6
Total			**10**	

4.6.1.6 Sex determination

Answer 01 · Mark scheme

June 2019 | 8464/B/2F | Original Q4



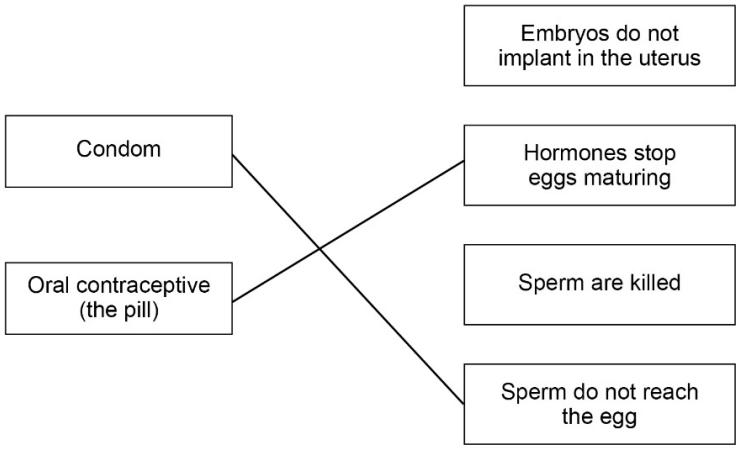
4.6.1.6 Sex determination

Answer 02 · Mark scheme

November 2020 | 8464/B/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	gametes are formed sperm and egg fuse		1 1	AO1 4.6.1.1
01.2	Y gamete for father Mother: X, X Father: X — XX, XX; Y — XY, XY	all derivations correct = 2 marks 1 or 2 correct = 1 mark allow correct derivations from incorrect gamete	1 2	AO2 4.6.1.6
01.3	rings drawn around all XY	allow one ring drawn around both XY ignore ring drawn around father's genotype ecf any letter for Y, except X	1	AO2 4.6.1.6
01.4	Hormone: Oestrogen, Testosterone Change that hormone causes at puberty: Breasts develop, Skin turns lighter, Voice becomes deeper, Wisdom teeth appear If more than one line from a hormone no mark for that hormone		1 1	AO2 4.5.3.3

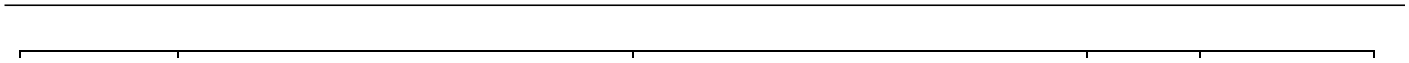
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01.5	**Method of contraception** / **How the method prevents pregnancy**  If more than one line from a method of contraception no mark for that method		1 1	AO1 4.5.3.4
01.6	advantage – any **one** from: • very reliable • easy to take • do not have to rely on partner • helps to treat acne or period pain disadvantage – any **one** from: • may cause side effects • may affect her fertility later • have to remember to take it (every day) • does not protect against STIs	ignore you do not get pregnant allow described eg headaches, nausea, putting on weight allow you have to take it every day	1 1	AO3 4.5.3.4
Total			**12**	

4.6.1.6 Sex determination

Answer 02 · Mark scheme

November 2020 | 8464/B/2F | Original Q1

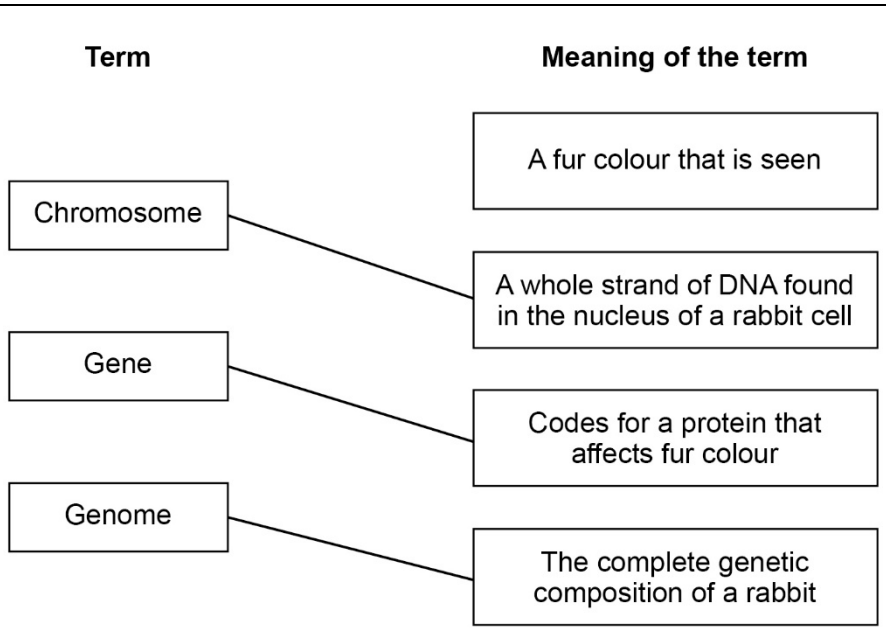


4.6.1.6 Sex determination

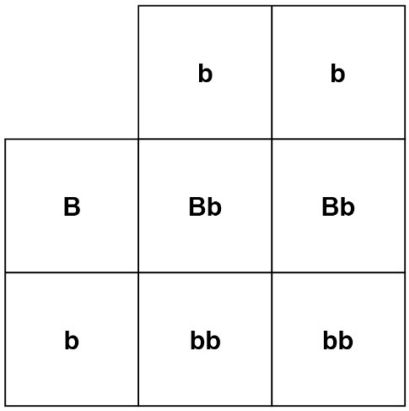
Answer 03 · Mark scheme

June 2025 | 8464/B/2F | Original Q5

Question 5

Question	Answers	Mark	AO / Spec. Ref.
05.1	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.6.1.3 4.6.1.4

4.6.1.6 Sex determination

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2				
	gametes correct	allow in either position in Punnett square	1	AO2
	offspring genotypes correctly derived	allow correct derivation of offspring genotypes from incorrect gametes allow 3 correctly derived offspring genotypes for **1** mark	2	AO2
	any **bb** offspring identified as having white fur		1	AO2
	0.5	probability must match offspring genotypes if given allow 50% **or** 1 in 2 **or** 1:1 **or** $\frac{1}{2}$ do **not** accept 1:2	1	AO3 4.6.1.4

4.6.1.6 Sex determination

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow gamete(s) **or** sex cells for sperm throughout		
	sperm have one of each chromosome (pair)	allow sperm have one **set** of chromosomes / genes allow sperm (only) have one allele for each gene allow sperm are haploid allow sperm have half the (number / amount of) chromosomes (compared with a body cell) allow sperm have 23 / 22 chromosomes ignore sperm have one allele ignore sperm have half the DNA / genes	1	AO2
	sperm are produced by meiosis **or** body cells have two of each chromosome	allow body cells have pairs of chromosomes allow body cells are diploid allow body cells have 46 / 44 chromosomes allow **B** and **b** are (alleles) on 2 chromosomes (of the same pair)	1	AO1 4.6.1.1 4.6.1.2 4.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	44	allow 22 pairs	1	AO2 4.6.1.6

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	has two X (chromosomes)	allow XX allow the rabbit is not XY allow the rabbit does not have a Y (chromosome) allow the rabbit only has X (chromosomes) allow both (X) sex chromosomes are the same size	1	AO1 4.6.1.6

Total Question 5	**12**

Answer 03 · Examiner comments

June 2025 | 8464/B/2F | Original Q5

Question 5 (Standard demand)

05.1 The most common incorrect answer was a gene linked to 'a fur colour that is seen'. Students seemed to have a better understanding of the meaning of the term genome.

05.2 45% of students on Foundation tier gained 4 or more marks.

Those students who were able to put the gametes given in the question stem correctly into the Punnet square generally also achieved 2 marks for the correct derivations. Many students failed to identify the offspring that would have white fur and consequently could not be awarded marking point 4. However, the probability mark was often seen and was awarded if it was correct for the student's derivations.

Some students used the Punnet square incorrectly, with gametes given on the outside of the square and more than four derivations.
The most common error was students using both parent genotypes as Bb.

A number of 50/50 answers were seen despite this being highlighted in previous examiner reports as not being an equivalent probability to 0.5 or 50:50. Some students incorrectly gave the probability as 50, rather than 50% and therefore could not be awarded marking point 5.

05.3 This proved a very challenging question with relatively few students gaining a mark. Commonly, students tried to answer in terms of dominant and recessive alleles or genotypes, described the inheritance of alleles from parents, or described the different roles of sperm cells and body cells. Very few made any reference to chromosomes, and even fewer mentioned meiosis.

A frequently seen misconception was that 'sperm contain half a chromosome', illustrating that some students struggle with the abstract concepts relating to this part of the specification. Incorrect use of terminology was frequent, such as 'body cells are heterozygous, but sperm cells are homozygous'. Another frequent misconception was the idea that body cells contain maternal and paternal genes or chromosomes, but that sperm cells only contain paternal genes or chromosomes.

0 5 . 3 A male rabbit is heterozygous for fur colour.

The rabbit's body cells have the genotype **Bb**.

One of the sperm cells from the rabbit has the allele **b**.

Explain why the alleles in the rabbit's body cells and the allele in the sperm cell are different.

[2 marks]

The sperm cell has half of the rabbits DNA and when combines with the other half that is in a female rabbits eggy it creats a whole cell

This student has given a common response that could not be awarded either mark. 'Half of the rabbits DNA' is insufficiently clear as to which 'half' is in the sperm cell, therefore is not equivalent to marking point 1.

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4.6.1.6 Sex determination

Answer 03 · Examiner comments June 2025 | 8464/B/2F | Original Q5

05.4 A small proportion of students correctly gave an answer of 44, and very few gave the correct equivalent answer of 22 pairs. The most common incorrect answers were 21, 22 and 42, although those also frequently seen included 1, 2, 11, 23 and 46.

05.5 This question asked for evidence from the figure that the rabbit was female. This was answered well with many students stating that there were 2 X chromosomes. A few students did not gain the mark because they stated '2 X genes' or '2 X alleles'. Some students recognised the absence of the Y chromosome which also gained the mark.