AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.1.3

Cell specialisation

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**5**
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.

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme June 2019 | 8464/B/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$50=\frac{43}{\text{size of real object}}$	an answer of 860 (µm) scores 4 marks	1	AO1 3×AO2 4.1.1.5
	(size of real object =) $\frac{43}{50}$		1	
	(size of real object =) 0.86 (mm)		1	
	(size of real object =) 860 (µm)	allow correct conversion of their calculated value	1	
		if no other marks awarded allow 1 mark for $\text{magnification}=\frac{\text{size of image}}{\text{size of real object}}$		

Question	Answers	Mark	AO / Spec. Ref.
05.2	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.1.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	AO1
	No relevant content	0	
	Indicative content • place slide on stage • use lowest power / ×4 objective lens (initially) • adjust mirror **or** switch light on so light passes through slide • move stage as close to lens as possible • slide must not touch lens • turn focussing knob so slide moves away from lens • turn focussing knob until image comes into focus • use fine focus to get clear image • change objective lens to ×10 • ×5 eyepiece and ×10 objective lenses (gives total magnification of ×50) • refocus slide using focussing knob For Level 2 reference to how to focus the slide / cells **and** achieve magnification of ×50 is required		

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme

June 2019 | 8464/B/1H | Original Q5

05.3	any **three** from: • (rate) fastest in the first 0.5 hours • (rate gradually) decreases after first 0.5 hours **or** (rate gradually) decreases throughout the investigation • rate is constant between 1.0 and 2.0 hours **or** rate is constant between 2.0 and 3.5 hours • (rate) becomes zero between 3.0 and 3.5 hours	allow 'it' for rate allow fastest rate is 120 units per hour (at start) allow mean rate over 3.5 hours is 37.14 units per hour allow (rate) is zero after 3.5 hours	3	AO3 4.1.3.3 4.2.3.2

05.4	more nitrate ions are absorbed in the presence of oxygen	allow nitrate ions absorbed faster in the presence of oxygen	1	AO3
	(which suggests) they are absorbed by active transport / uptake		1	AO2
	which requires energy from respiration	do **not** accept energy produced / created / made	1	AO1
	some nitrate ions absorbed by diffusion **or** some nitrate ions absorbed (by active transport / uptake) requiring energy from anaerobic respiration **or** some nitrate ions absorbed by active transport / uptake using oxygen already dissolved in the solution		1	AO2 4.1.3.3 4.2.3.2

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme

05.5	nitrate ions are used with glucose to form amino acids (which are) used to synthesise proteins (needed for growth)		1 1 1	AO1 4.4.1.3 4.4.2.3
Total			**18**	

4.1.1.3 Cell specialisation

Answer 02 · Mark scheme

June 2022 | 8464/B/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	gene chromosome nucleus cell	must be in this order	1	AO1 4.1.1.1 4.1.1.2 4.1.2.1

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	4	allow 15	1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	46	allow 23 pairs (of chromosomes)	1	AO2 4.1.2.1 4.1.2.2

4.1.1.3 Cell specialisation

Answer 02 · Mark scheme

June 2022 | 8464/B/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	**Stage 1** any **one** from: • (cell) growth • increase in number of sub-cellular structures • DNA replicates • chromosomes double / duplicate / replicate	allow increase in number of organelles / ribosomes / mitochondria allow genetic material for DNA allow DNA doubles / duplicates	1	AO1 4.1.2.2
	Stage 2 any **one** from: • (one set of) chromosomes pulled to each end of cell • two nuclei form	ignore mitosis occurs allow chromosomes line up across the centre of the cell allow chromosomes move to opposite ends of the cell allow nucleus divides / splits (into two)	1	
	Stage 3 any **one** from: • cytoplasm / membrane divides • two identical cells formed	allow cytokinesis	1	

Question	Answers	Mark	AO / Spec. Ref.
02.6	**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	AO3
	Level 1: Relevant features are identified and differences noted.	1–3	AO2
	No relevant content	0	

4.1.1.3 Cell specialisation

Answer 02 · Mark scheme

June 2022 | 8464/B/1H | Original Q2

	Indicative content General comparisons: • boys height at birth (slightly) greater than girls height • boys are (slightly) taller than girls up to age 11 • correct height comparisons eg boys are approximately 4 / 5 cm taller than girls up to age 11 • girls and boys are the same height at age 11 • girls are taller than boys between age 11 and age 14 • girls and boys are the same height at age 14 • boys are taller than girls above age 14 • correct height comparisons eg boys are 5 to 18 cm taller than girls above age 14 • boys (eventually) grow taller than girls • boys carry on growing for a longer time than girls • girls stop growing age 13 / 14 / 15 **and** boys stop growing age 17 / 18 Rate comparisons: • rate of growth similar up to age 10 / 11 • girls grow faster than boys between 10 / 11 and 14 allow girls have a greater increase in height between 11 and 14 • growth spurt occurs at a younger age in girls • growth spurt starts age 10 / 11 in girls **and** age 13 / 14 in boys • increased rate of growth in girls aged 10 to 13 /14 **and** in boys aged 13 to 17 / 18 Key points for Level 2 are correct reference to 0-11 year period, 11-14 period and after age 14, with at least one correct reference to rate of growth or use of correct values of height and age to illustrate rate.		4.1.2.2

4.1.1.3 Cell specialisation

Answer 02 · Mark scheme

June 2022 | 8464/B/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	repair of tissues **or** replacement of cells	ignore growth allow repair of organs ignore repair of cells allow replacement of tissues ignore replacement of organs	1	AO1 4.1.1.4

Total Question 2		**14**

4.1.1.3 Cell specialisation

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	negative feedback (control)	ignore homeostasis	1	AO2 4.5.3.6 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	A = glucagon B = insulin	both required in correct order correct or phonetic spelling only	1	AO2 4.5.3.2

4.1.1.3 Cell specialisation

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3 **indirect marking** **view with 5.2**	(when blood glucose concentration is high after a meal) insulin / B is secreted (by the pancreas) causing glucose to enter cells		1	AO2
	(glucose is) converted to glycogen in the liver / muscle (cells for storage)		1	AO1
	(this causes) blood glucose concentration to return to normal so insulin / B secretion slows / stops / decreases		1	AO2
	when blood glucose concentration is low glucagon / A is secreted (by the pancreas)		1	AO2
	(which causes) breakdown of glycogen in the liver (into glucose)	allow (which causes) breakdown of glycogen in the muscle (cells)	1	AO1
	(this causes) blood glucose concentration to return to normal so glucagon / A secretion slows / stops / decreases		1	AO2 4.5.3.2

4.1.1.3 Cell specialisation

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	FSH causes (several) ova / eggs to mature (in the ovary)	allow singular ovum / egg allow follicle for ovary	1	AO2 4.5.3.3 4.5.3.5
	(then) LH causes ovulation **or** LH causes release of the ova / eggs	allow singular ovum / egg	1	
	so more eggs / ova present therefore higher probability / chance of fertilisation **or** so more eggs / ova present therefore higher probability / chance of sperm fusing with an egg		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	collection of (mature) egg(s) from the ovary	allow follicle for ovary	1	AO1 4.5.3.5
	(which are) fertilised (in the laboratory)	do **not** accept if in fallopian tube allow egg and sperm fuse	1	
	develop into embryo(s) (in the laboratory)	allow develop / divide into small balls of cells (in the laboratory) do **not** accept foetus	1	
	embryo(s) inserted into uterus / womb		1	

4.1.1.3 Cell specialisation

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **three** from: • meiosis forms sperm **and** mitosis forms liver (cells) • two cell divisions to form sperm **and** one cell division to form liver (cells) • four genetically different sperm cells **and** two genetically identical liver cells • sperm cells have 23 chromosomes **and** liver cells have 46 chromosomes	ignore reproduction max **2** marks if reference to sperm cells dividing allow four genetically different cells formed from meiosis **and** two genetically identical cells formed from mitosis allow sperm cells have 23 chromosomes **and** liver cells have 23 pairs of chromosomes allow haploid (sperm) and diploid (liver cells)	3	AO1 4.6.1.2 4.1.2.2

Total Question 5		**18**

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

June 2023 | 8464/B/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	meiosis	allow phonetic spelling	1	AO1 4.6.1.1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	gametes / eggs / sperm are not (genetically) identical	allow gametes / eggs / sperm are (genetically) different allow cells produced by meiosis are not (genetically) identical	1	AO1 4.6.1.1 4.6.1.2
	(there is) mixing of genetic information / genes / DNA **or** genetic information / genes / DNA from two / both parents	allow genetic information / genes / DNA from each parent ignore gametes fuse unqualified ignore two parents unqualified if no other mark awarded allow **1** mark for mutations	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	heterozygous	ignore dominant / recessive	1	AO2 4.6.1.4

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(parents gamete genotypes shown) **D d** and **d d**	allow in either position in Punnett square	1	AO2
	(possible offspring genotypes correctly derived) **Dd Dd dd dd**	allow correct derivation of offspring genotypes from incorrect gametes allow 3 correct offspring genotypes for **1** mark	2	AO2
	correct identification of **Dd** offspring as having polydactyly	if derivation not correct and shows **DD** and **Dd**, both must be identified as having polydactyly	1	AO2
	probability must match derived offspring genotypes	if no derivation shown allow 0.5 **or** 50% **or** 1 in 2 **or** 1:1 **or** ½ do **not** accept 1:2 allow correct probability from incorrectly derived offspring	1	AO3 4.6.1.4 4.6.1.5

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any **two** from: • can find out if the embryo has an (inherited) disorder • can prepare for baby (with the disorder) • can decide whether to continue with the pregnancy • fewer people with (inherited) disorders over time	allow can find out if the embryo has inherited disease ignore can find out if the embryo has disease(s) allow description of preparation for the baby eg access to early treatment allow choice of (in vitro) embryos (to be implanted)	2	AO3 4.6.1.5

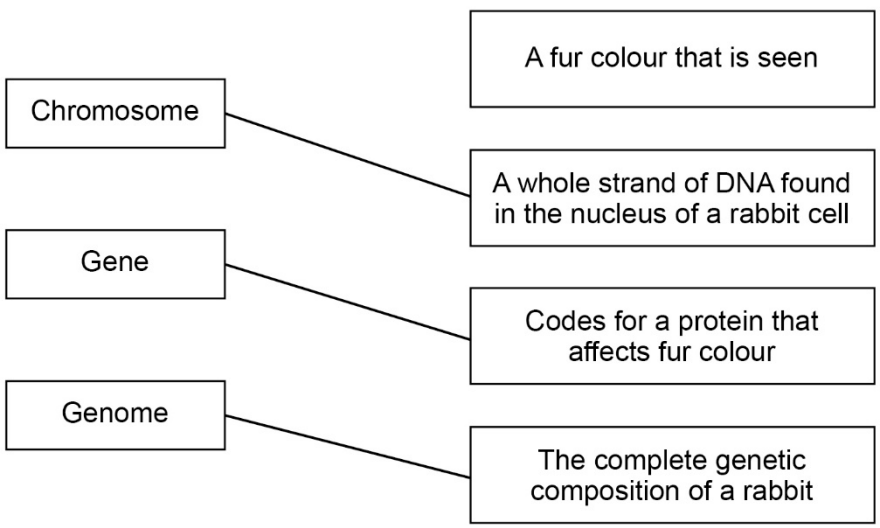
Total Question 1	11

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

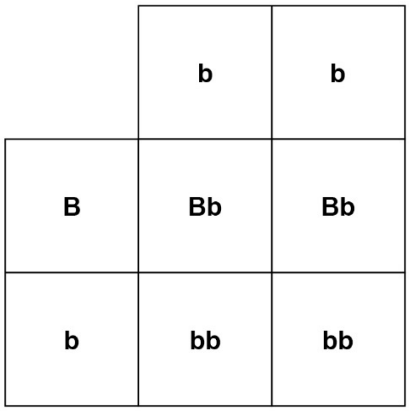
June 2025 | 8464/B/2H | Original Q1

Question 1

Question	Answers	Mark	AO / Spec. Ref.
01.1	 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

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2				
	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

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3		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.
01.4	44	allow 22 pairs	1	AO2 4.6.1.6

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	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 1	**12**

4.1.1.3 Cell specialisation

Answer 01 · Examiner comments

June 2019 | 8464/B/1H | Original Q5

Question 5 (standard, standard/high & high demand)

05.1 Around 38% of students gained full marks for calculating the length of the root hair in micrometres. Around 33% of students scored three marks because they made an error with the unit conversion. As mentioned earlier, more students are showing their working for the calculation.

The first marking point was for substitution into the equation given in the specification. The second marking point was for reorganisation of the equation to calculate the real length of the root hair. The third marking point was for correctly calculating the length in mm. The final mark was for converting this value to µm. This was an independent marking point, so a conversion of their incorrectly calculated length could gain this mark. This was often awarded. The most common errors related to incorrectly reorganising the equation, or an incorrect unit conversion.

05.2 This extended response question highlighted that many students either did not understand how to use a light microscope, or could not explain the procedure in a clear step by step way.

Some students had not read the question carefully. Instead of starting with a prepared slide, they explained how they would prepare a slide, which was not creditworthy. Knowledge of the names of the parts of a microscope was poor.

If students only said that the ×10 objective lens should be used to give a total magnification of ×50, they gained one mark. In order to access Level 2, a detailed method in a logical sequence was needed, as well as a description of how to achieve a magnification of ×50. 9% of students achieved Level 2. Many responses lacked detail, or gave confused accounts of how to focus a microscope.

05.3 This question asked students to describe the changes in the rate of absorption of ions for the seedling with no oxygen added. Many students compared the seedlings with and without oxygen, saying the rate of absorption with oxygen was faster. This is a correct statement, but does not answer the question. Others described the change in mass of the ions absorbed, rather than the rate.

A fifth of students scored one or more marks. Where one mark was awarded, it was usually for saying that the rate gradually decreased as time went by. Students always find it more difficult to interpret data when it is given in a table, rather than displayed as a graph. It might help if students sketched the data as a graph, so the changes in rate would be more obvious. Alternatively they could calculate the rate at each time point.

05.4 Around 79% of students scored one mark for saying that more nitrate ions are absorbed in the presence of oxygen. Stating that the ions were absorbed better was insufficient as at this level the idea of more or faster was required. Only a few went on to explain that this was because the ions were absorbed by active transport, which requires energy from respiration. The last marking point was rarely seen.

4.1.1.3 Cell specialisation

Answer 01 · Examiner comments

June 2019 | 8464/B/1H | Original Q5

05.5 Students found this question difficult and approximately 11% scored one or more marks. A direct description, of how nitrate ions are used to help plants grow, was required. Although nitrate ions are used to form other substances in a plant, the direct link between the formation of proteins for growth was needed.

Many students gave a description of nitrate ion uptake and transport in the plant, but this did not answer the question. Reference to active transport was often seen. Many thought that nitrate ions are transported in phloem. The use of nitrates as a food or as a source of energy was often stated. Some thought that nitrates contain glucose.

4.1.1.3 Cell specialisation

Answer 01 · Examiner comments

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Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.1.1.3 Cell specialisation

Answer 02 · Examiner comments

June 2022 | 8464/B/1H | Original Q2

Question 2 (standard demand)

02.1 54% of the students put gene, chromosome, nucleus and cell in order of increasing size.

02.2 Half of the students gave the correct answer, differentiation. Some said specialisation, whilst most students thought the process to produce specialised cells was mitosis, cell division or therapeutic cloning.

02.3 44% of the students correctly calculated the number of cell divisions to form a 16-cell embryo.

02.4 65% of students knew that the cells of a human embryo have 46 chromosomes.

02.5 A quarter of students scored full marks, with 69% scoring at least one mark. Many students scored a mark for Stage 1 by saying that the cell grows or that there is an increase in the number of sub-cellular structures. Some students thought Stage 1 was fertilisation, and they went on to describe the development of an embryo.

A mark for Stage 2 was less often awarded. Many students said mitosis happens, but as this was written on the cell cycle diagram it did not gain credit.

For Stage 3 all the changes listed on the mark scheme were seen, but many students only referred to two daughter cells forming, when reference to two identical cells was required. Reference to specialised cells being formed was seen quite a lot, and was ignored.

4.1.1.3 Cell specialisation

Answer 02 · Examiner comments

June 2022 | 8464/B/1H | Original Q2

02.6 The question asked students to compare the growth of boys with the growth of girls, using data from growth curves.

There are three main sections in the graph:

- a section from birth to age 10 or 11, where the height and growth rate of boys and girls is very similar
- a section from age 10 or 11 up to age 14, where girls grow faster than boys
- the section from 14 to 18 years, where boys continue to grow rapidly whilst girls have stopped growing.

Within each section there were several comparisons that could be made.

To score the highest marks reference to all three sections of the graph was required, in addition to at least one comparison of the rate of growth. 30% of students scored four or more marks. More than two thirds of students scored three or more marks.

As the command word was 'Compare' it was important that comparative statements about boys and girls were made. All the statements given in the indicative content are comparisons.

Many responses gave descriptions of what they had learnt about puberty and growth spurts, but if they did not match the data given in the graph they were not credited. Any data given had to be correct.

Common errors in interpreting the graph included:

- boys grow faster than girls up to age 11
- boys grow shorter, or stop growing, at age 11
- girls stop growing at age 18.

02.7 The question asked for one way that mitosis is important in fully grown animals, so saying 'to grow' was not credited. Many students said for growth and repair, which was insufficient. Repair of tissues, organs or wounds all gained credit. Many students said to repair damaged cells, which is incorrect. Replacement of cells or tissues was another acceptable response. Many said mitosis was important for reproduction, which was ignored.

4.1.1.3 Cell specialisation

Answer 03 · Examiner comments

Question 5 (standard, standard/high & high demand)

05.1 A quarter of students could identify this type of hormonal control as negative feedback. Common incorrect answers were homeostasis, diabetes and endocrine.

05.2 39% of students could interpret the figure to identify hormone A and hormone B as glucagon and insulin respectively. Both hormones were allowed to be spelt phonetically, however hybrid terms that indicated a possible confusion between glucagon and other terms such as glycogen, glucose and glycerol where not acceptable. Examples such as glycogen were seen.

Common mistakes were to confuse glucagon and insulin, or to name other hormones.

05.3 Explanations usually started with the first marking point but it was equally acceptable to start at the fourth marking point. The most frequently seen mark was for release of glucagon when blood glucose concentration is low.

Confusion was common between the terms glucagon and glycogen, plus glycerol was also regularly seen.

The third and sixth marking points were very challenging. These required an understanding of how negative feedback causes the reduction in the release of each hormone.

A fifth of students scored either three or four marks.

05.4 40% of students could identify the roles of FSH and LH. Few students gained the third marking point, to fully explain why the probability of pregnancy would be greater following FSH and LH injections.

05.5 Most students knew that IVF involves fertilisation in laboratory conditions. Some inaccuracies of language were seen, such as sperm and egg mix, with no reference to or description of fertilisation, and eggs being inserted into the body, with no reference to uterus or womb.

05.6 Students found this question challenging, with 4% achieving full marks. Confusion between meiosis and mitosis was common. Responses generally lacked the detail required for the points on the mark scheme. Some students only described one process or the other, rather than describing differences.

Responses could not gain full marks if there was an implication that sperm cells go through meiosis.

The third marking point was sometimes attempted, but not expressed clearly, such as four sperm cells are made that are different, but the two liver cells are the same. Reference to *genetically* different or *genetically* identical was required.

4.1.1.3 Cell specialisation

Answer 04 · Examiner comments

Question 1 (Standard demand)

01.1 Phonetic spelling was allowed, and variations of many phonetically correct spellings were seen. Hybrid terms between meiosis and mitosis were not credited. The list principle was applied when students stated both meiosis and mitosis. See the 'Information for examiners' on page 4 of the mark scheme for an explanation of how lists within responses are marked.

Whilst mitosis was a common error, there were many students who simply put any word that they could relate to sexual reproduction such as fertilisation, ovum, sperm, hormones.

01.2 Few students could give two reasons why sexual reproduction causes variation in the offspring. Marking point 2 was seen more frequently than marking point 1.

Responses that did not gain credit only referred to the offspring having different characteristics, such as eye colour.

For marking point 1 we were looking for the idea of variation in gametes from one parent or for the variation in gametes more generally, such as 'the genes from the egg and sperm are different'. The word genetically was bracketed, therefore is not required, but could not be contradicted, such as 'the egg and sperm look different'. We cannot put every variation of how students could phrase this in the mark scheme. For example, the mark scheme allowed 'cells produced by meiosis are not identical', so if a student wrote 'cells produced by meiosis are different' that was also worth the mark.

A few students referred to chromosomes crossing over in meiosis. This was a correct response that is beyond the specification and scored marking point 1.

We did not credit vague answers that were open to different interpretations such as:

- egg and sperm contain 50% DNA
- half is from mother, half is from father
- genetics is from mother and father
- one gene from each parent.

Errors were seen in some responses that referred to chromosomes. The response needed to be biologically correct to gain the mark. 'They get chromosomes from each parent' or 'Chromosomes mix' or '2 sets of chromosomes mix' was acceptable. However, '2 chromosomes mix' or 'pairs of chromosomes come from each parent' are incorrect. Likewise, '2 genes mix' was incorrect.

There was a fall back mark for 'mutations'. This mark was awarded only if no other mark was given.

4.1.1.3 Cell specialisation

Answer 04 · Examiner comments June 2023 | 8464/B/2H | Original Q1

0 1 . 2 Sexual reproduction produces offspring that are genetically different from each other.

Give **two** reasons why sexual reproduction causes variation in the offspring.

[2 marks]

1 The off spring is a combination of DNA from mother and father

2 The DNA taken from mother and father is not always the same

0 6 . 2 Sexual reproduction produces offspring that are genetically different from each other.

Give **two** reasons why sexual reproduction causes variation in the offspring.

[2 marks]

1 Each sperm and egg cell carry different genes.

2 Mother's and father's ~~are~~ genes are combined differently each time.

The first response (from a Higher tier paper) gave marking point 2 twice, therefore only 1 mark was awarded. The second response (from a Foundation tier paper) gave marking point 1 and marking point 2 for 2 marks.

01.3 This was very well answered. Phonetic spelling was allowed. See page 5 of the mark scheme for information on marking phonetic spelling.

01.4 On the Foundation tier, few students achieved all 5 marks, but partial credit was given frequently, such as correct derivation from incorrect gametes.

On the Higher tier, most students could complete the Punnett square and state the probability of the child having polydactyly. However, few students identified which offspring genotype would result in polydactyly. This could be indicated on any or all offspring, with a circle, line, key or label or any other clear method of identification.

01.5 Clear responses most frequently knew that embryo screening enables us to find out whether an embryo has an inherited disorder. Some confusion was seen between the term disorder and the terms diseases or disabilities.

Many responses were vague, such as ‘to see if the embryo is healthy’. Some incorrect responses incorrectly implied that embryo screening is ultrasound screening.

Very few students took the marking point 4 approach of the implications to the population over time.

4.1.1.3 Cell specialisation

Answer 04 · Examiner comments June 2023 | 8464/B/2H | Original Q1

A general misconception was that embryo screening is the same as genetic counselling, so students referred to finding out the likelihood of the embryo having an inherited disorder. The misconception that embryo screening can change DNA or treat inherited disorders was also seen.

Answer 05 · Examiner comments

June 2025 | 8464/B/2H | Original Q1

Question 1 (Standard demand)

01.1 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.

01.2 88 % of students on Higher tier gained 4 or 5 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.

01.3 This proved a challenging question with only 25% of students on Higher tier gaining one or two marks. 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. 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 occasional misconception was the idea that body cells contain maternal and paternal genes or chromosomes, but that sperm cells only contain paternal chromosomes or genes.

0 1 . 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 only contains half of the genetic material needed for an offspring. The egg will contain the other half.

This student has given a typical response that did not contain sufficient detail to gain either mark.

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4.1.1.3 Cell specialisation

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01.4 Just over 25% 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.

01.5 This question asked for evidence from the figure that the rabbit was female. This was answered very 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.