AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.1.3

Cell specialisation

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**7**
Available paper years	**2021–2025**

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.

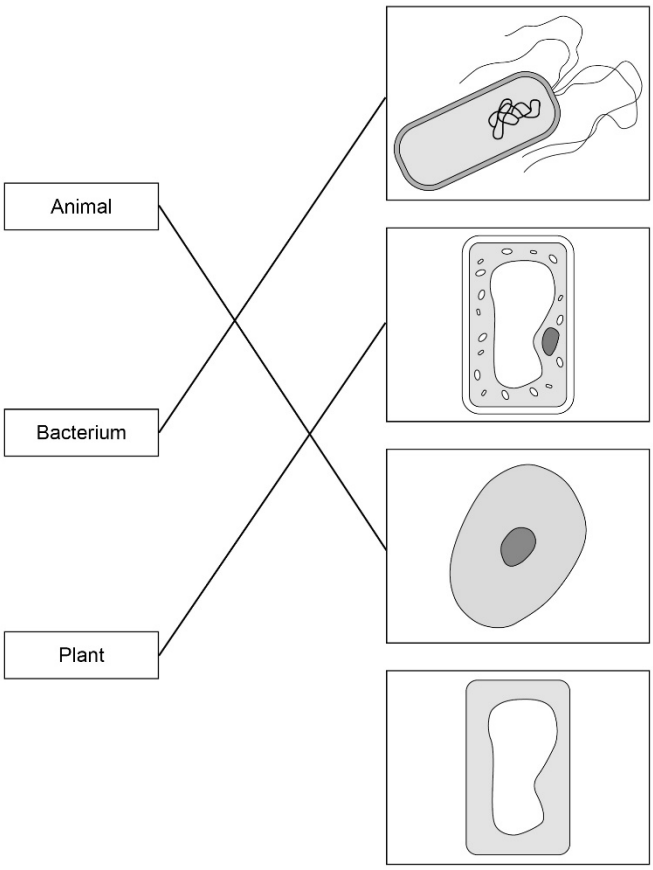
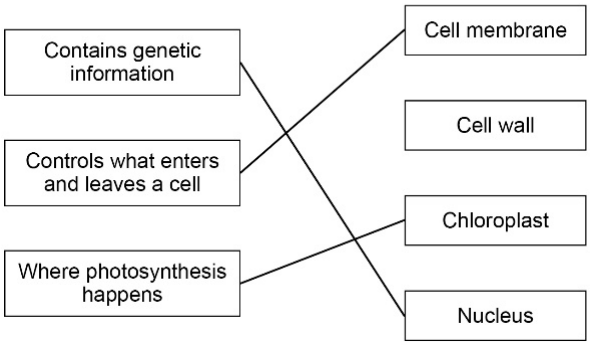
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Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme

November 2021 | 8464/B/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	 do **not** accept more than one line from a box on the left		1 1 1	AO1 4.1.1.1 4.1.1.2
01.2	 do **not** accept more than one line from a box on the left		1 1 1	AO1 4.1.1.2 4.1.2.1 4.1.3.1 4.4.1.1

4.1.1.3 Cell specialisation

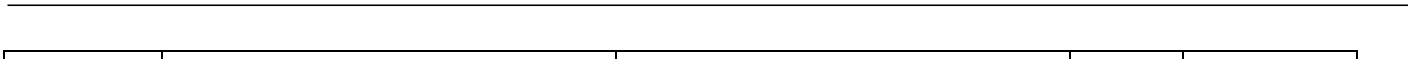
Answer 01 · Mark scheme

01.3	urea glycogen starch cellulose	must be in this order	1 1 1 1	AO1 4.1.1.2 4.4.1.3 4.4.2.3
01.4	any **one** from: • (to cause) movement • to contract / shorten	 allow example of movement ignore to relax / expand ignore references to strength / energy / power	1	AO1 4.1.1.3 4.4.2.2
01.5	(many) mitochondria to transfer / release (a lot of) energy	 allow (mitochondria) for respiration do **not** accept to produce / make / create energy ignore reference to the shape / strength of the cells	1 1	AO2 4.1.1.2 4.1.1.3 4.4.2.1
01.6	$\frac{2}{0.05}$ (×) 40	 do **not** accept if a unit is given	1 1	AO2 4.1.1.5 RPA 1
Total			**15**	

4.1.1.3 Cell specialisation

Answer 01 · Mark scheme

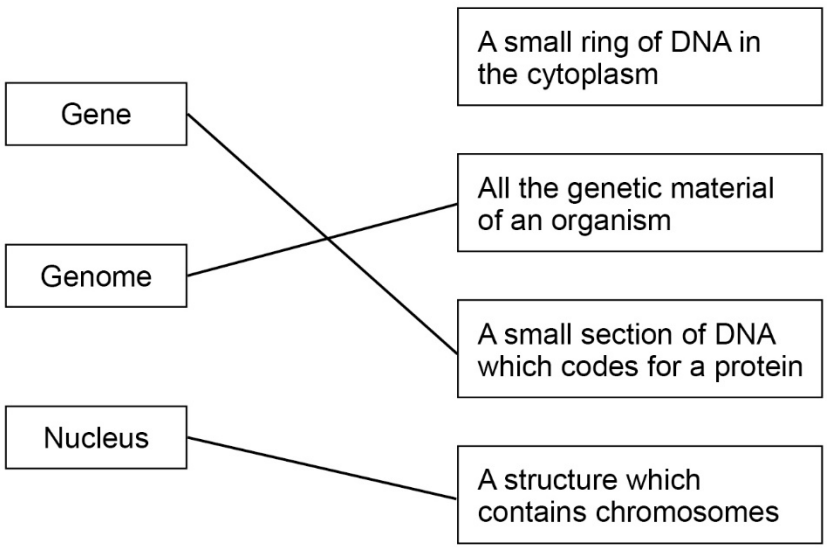
November 2021 | 8464/B/1F | Original Q1



4.1.1.3 Cell specialisation

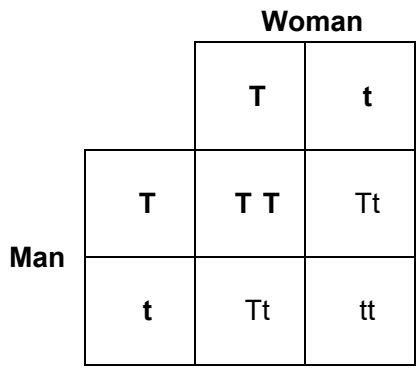
Answer 02 · Mark scheme

November 2021 | 8464/B/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	23		1	AO1 4.6.1.2
01.2	 additional line from a box on the left negates the mark for that box		1 1 1	AO1 4.6.1.4 4.6.1.3
01.3	any **one** from: • to survive • so you do not eat the plants • to stop you being harmed / poisoned	allow to protect them allow stop you getting ill / dying	1	AO2 4.7.1.4
01.4	heterozygous		1	AO2 4.6.1.4
01.5	tt	allow homozygous recessive	1	AO2 4.6.1.4

4.1.1.3 Cell specialisation

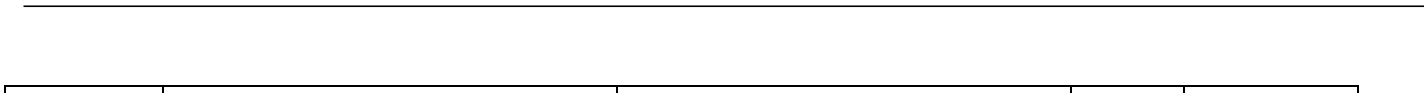
Answer 02 · Mark scheme

01.6		allow 1 or 2 genotypes correct for **1** mark	2	AO2 4.6.1.4
01.7	75%	allow **only** a probability consistent with student's derivation if no answer to question **01.6** allow 75%	1	AO3 4.6.1.4
Total			**10**	

4.1.1.3 Cell specialisation

Answer 02 · Mark scheme

November 2021 | 8464/B/2F | Original Q1



4.1.1.3 Cell specialisation

Answer 03 · Mark scheme

June 2022 | 8464/B/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	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.
06.2	differentiation	ignore specialisation	1	AO1 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	4	allow 15	1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	46	allow 23 pairs (of chromosomes)	1	AO2 4.1.2.1 4.1.2.2

4.1.1.3 Cell specialisation

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	**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	

4.1.1.3 Cell specialisation

Answer 03 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
06.6	**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	

	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 03 · Mark scheme

June 2022 | 8464/B/1F | Original Q6

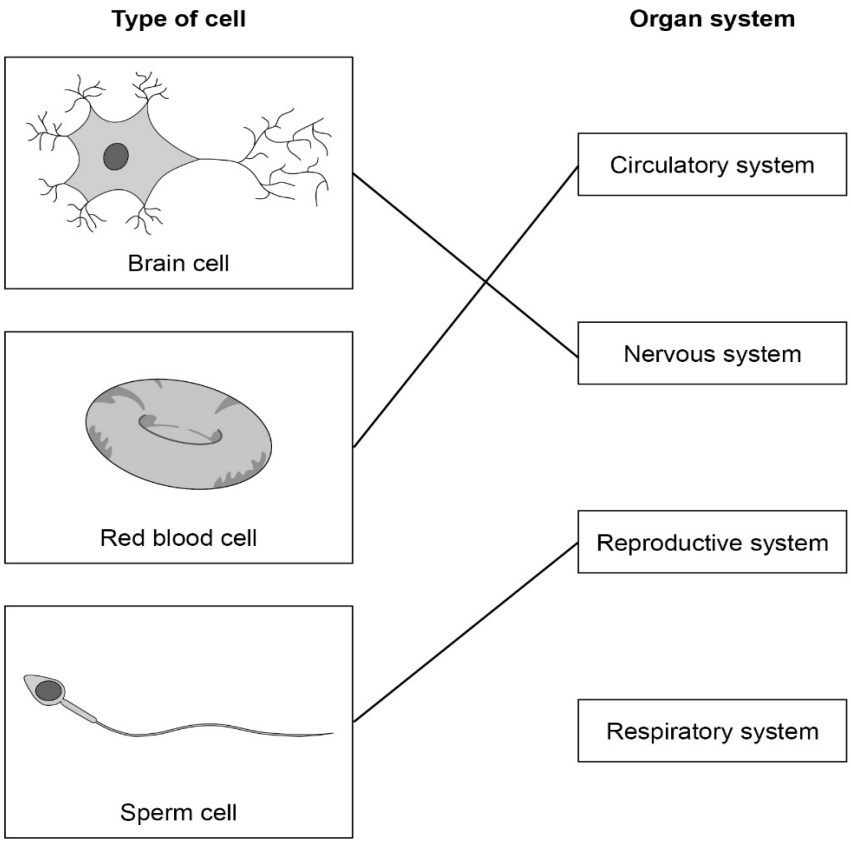
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	repair of tissues **or** replacement of cells	ignore growth allow repair of organs ignore repair of cells allow replacement of tissues ignore replacement of organs	1	AO1 4.1.1.4

Total Question 6		**14**

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme June 2023 | 8464/B/1F | 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	AO2 4.1.1.3 4.2.1 4.2.2.2 4..2.2.3

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

June 2023 | 8464/B/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	has a tail	allow has flagellum	1	AO1 4.1.1.2
	(so) it can swim	allow so it can move / travel	1	4.1.1.3
	OR			
	has (many) mitochondria (1)			
	to transfer / release / energy (for sperm to swim) (1)	allow for energy do **not** accept energy is made / produced / created		
	OR			
	has enzyme(s) (1)			
	to penetrate into the egg (1)			
	OR			
	is streamlined (1)			
	to swim faster (1)			
	OR			
	has 23 chromosomes (1)			
	to produce 46 chromosomes in fertilised cell (1)			
		allow a correct adaptation (1) and linked explanation (1)		

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

June 2023 | 8464/B/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	any **one** from: (cell in **Figure 1**) does **not** have • a (cell) wall • a (large) vacuole • chloroplasts	 ignore chlorophyll	1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	cell membrane		1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	diffusion Reason: concentration (of oxygen) is greater outside the cell **or** concentration (of oxygen) is lower inside the cell	 allow (oxygen moves) from a high concentration to a low concentration allow there is more (oxygen) outside the cell (than inside the cell) allow there is less (oxygen) inside the cell (than outside the cell) ignore oxygen moves along a concentration gradient	1 1	AO3 AO2 4.1.3.1

4.1.1.3 Cell specialisation

Answer 04 · Mark scheme

June 2023 | 8464/B/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	any **two** from: • glucose / sugar • water • amino acids • fatty acids • glycerol • mineral ions	ignore oxygen allow H_2O allow minerals / salts / vitamins / hormones allow named ion / mineral / vitamin / hormone ignore carbon dioxide ignore urea	2	AO2 4.1.3.1 4.2.2.1 4.2.2.3 4.4.2.1 4.4.2.3

Total Question 1	11

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

June 2023 | 8464/B/2F | Original Q6

Question 6

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	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.
06.3	heterozygous	ignore dominant / recessive	1	AO2 4.6.1.4

4.1.1.3 Cell specialisation

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(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 05 · Mark scheme

June 2023 | 8464/B/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	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 6	11

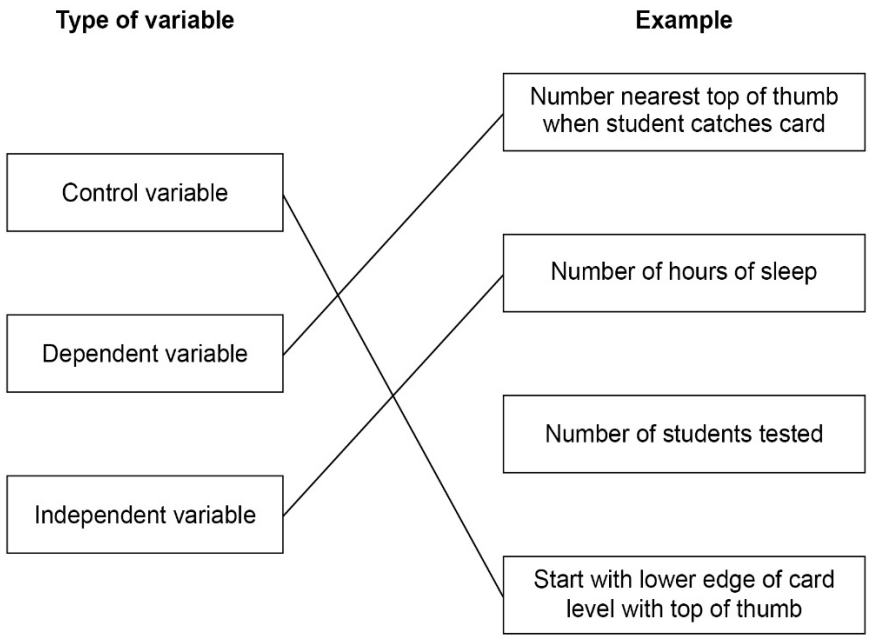
4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

June 2024 | 8464/B/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **one** from: • (react in order) to brake / steer • avoid accidents / collision / people / cars / objects	allow for safety	1	AO2 4.5.2

Question	Answers	Mark	AO / Spec. Ref.
03.2	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	students may catch the card between scores		1	AO3 4.5.2 RPA6

4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	plot at 8.5 hours and reaction score 3	allow a tolerance of ±½ small square	1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	7.5 (hours)	allow 7 ½ (hours) allow 7 hours and 30 minutes allow 7:30 allow answer on **Figure 6** if no answer on line do **not** accept 7.3	1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	reaction time stayed the same		1	AO3 4.5.2 RPA6

4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	any **two** from: • repeat (card drop) for each student • repeat on different days • repeat on larger number of students • repeat with wider range of sleep times • control / same age • control / same sex • control / same food / drink / caffeine / drugs (before test) • control distance between thumb and forefinger • control / same practice • remove distractions • use computer / phone reaction timer • have more divisions on the card • record sleep time in smaller intervals	if none of these awarded allow **1** mark for repeat unqualified allow control / same gender allow remove gaps between (reaction) scores for **2** marks allow repeat for each student and calculate a mean for **2** marks allow repeat on different days and calculate a mean	2	AO3 4.5.2 RPA6

4.1.1.3 Cell specialisation

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	long (cell)		1	AO1 4.5.2
	to transport / carry the information / impulse(s) / signal	allow to transport / carry electrical messages ignore to carry messages unqualified	1	
	from CNS / coordinator / spinal cord / brain to muscle(s) / effector		1	
	alternative approach 1: (many) branches (1)	allow (many) dendrites		
	to transport / carry the information / impulse(s) / signal (1)	allow to transport / carry electrical messages ignore to carry messages unqualified		
	to many / several muscle cells (1)			
	alternative approach 2: attach to muscle cells (1)			
	to transport / carry the information / impulse(s) / signal (to muscle) (1)			
	for muscle contraction (1)			
	alternative approach 3: many mitochondria (1)			
	to respire (1)	allow to release energy do **not** accept energy produced / made / created		
	to assist / allow the information / impulse / signal to travel (1)	allow to assist / allow the transport / carriage of electrical messages		

4.1.1.3 Cell specialisation

	alternative approach 4: insulation **or** fatty sheath (1) to transport / carry the information / impulse(s) / signal (1) (along the neurone) faster (1)	 allow to transport / carry electrical messages ignore to carry messages unqualified **alternative approach 5:** allow narrow (1) so many (neurones) can fit in a small space (1)		

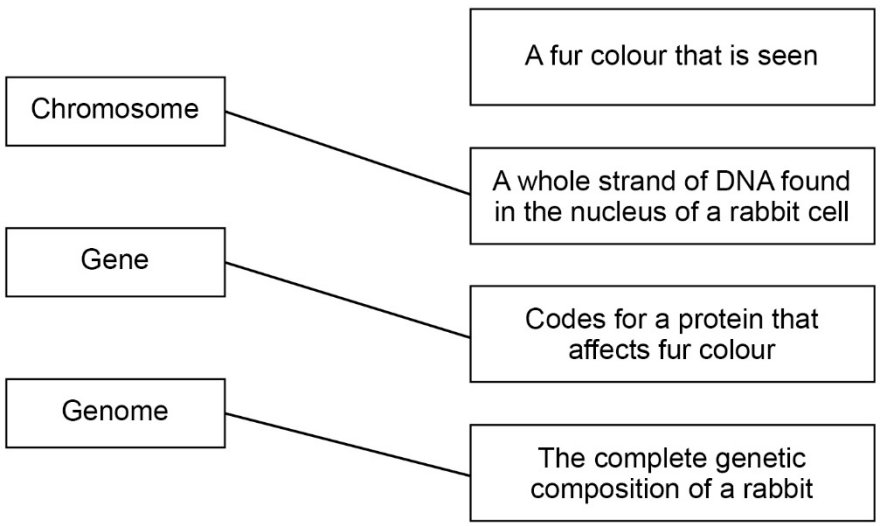
Total Question 3	**13**

4.1.1.3 Cell specialisation

Answer 07 · Mark scheme

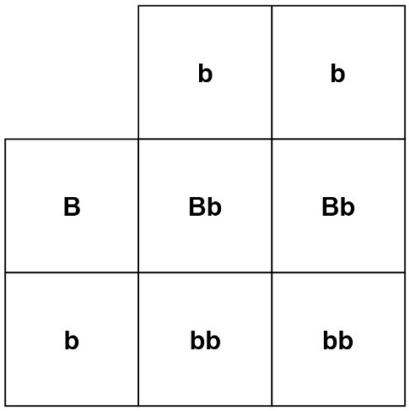
June 2025 | 8464/B/2F | Original Q5

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

4.1.1.3 Cell specialisation

Answer 07 · Mark scheme

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

4.1.1.3 Cell specialisation

Answer 07 · 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

4.1.1.3 Cell specialisation

Answer 07 · Mark scheme

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**

4.1.1.3 Cell specialisation

Answer 01 · Examiner comments November 2021 | 8464/B/1F | Original Q1

Question 1 (low & standard demand)

This question was about cells and cell structure. More than half of the students identified the drawings of animal, bacterial and plant cells. Most students could identify the drawing of a bacterial cell. Knowledge of the function of cell structures was variable, but most students knew that the nucleus contains genetic information and many knew that photosynthesis happens in chloroplasts. There was some confusion between the function of the cell membrane and cell wall.

01.3 was about chemicals in cells. Most students knew that cellulose strengthens plant cell walls and many knew that urea is excreted by animals and starch is stored in plant cells. Knowledge of glycogen was set at a higher demand, and few knew that it is stored in animal cells.

In **01.4**, many thought the function of a muscle cell is for strength, which was ignored. A reference to movement or contraction was needed. Approximately a quarter of students scored a mark for saying that muscle cells have many mitochondria, but a weak expression of language in reference to energy meant that very few students gained both marks for **01.5**. Energy being produced, made or created is never credited and students should be encouraged to say that energy is transferred.

Over half of the students gained both marks for calculating the correct magnification. If units were added to the answer this prevented students gaining one mark. Common mistakes included incorrectly substituting into the equation, or multiplying their answer by a factor of 10.

Answer 02 · Examiner comments November 2021 | 8464/B/2F | Original Q1

Question 1 (low demand)

This question assessed the genetics section of the specification. Nearly all students could recall or calculate the number of chromosomes in a sperm cell when told the number of chromosomes in a human body cell. **01.2** was more challenging with few students being able to correctly link the words ‘gene’, ‘genome’ and ‘nucleus’ with the meaning of that word. Of these, nucleus was the most common correct response.

Most students knew the term heterozygous, but few could give the genotype in **01.5**. Many students correctly completed the Punnett square, however interpreting this to give the correct probability was more difficult, with an answer of 50% frequently seen.

4.1.1.3 Cell specialisation

Answer 03 · Examiner comments

June 2022 | 8464/B/1F | Original Q6

Question 6 (standard demand)

06.1 A quarter of the students put gene, chromosome, nucleus and cell in order of increasing size.

06.2 Fewer than a tenth of students gave the correct answer, differentiation. Some said specialisation, whilst most students thought the process was mitosis or cell division.

06.3 19% of students correctly calculated the number of cell divisions to form a 16-cell embryo.

06.4 41% of students knew that the cells of a human embryo have 46 chromosomes.

06.5 23% of the students scored any marks for this question. Most of these 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 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.

4.1.1.3 Cell specialisation

Answer 03 · Examiner comments

June 2022 | 8464/B/1F | Original Q6

06.6 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. This was rarely seen, where a quarter of students scored three marks. Similar proportions scored two marks and one mark, amounting to 81% scoring at least a single mark.

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.

06.7 8% of students scored this mark. The question asked for one way that mitosis is important in fully grown animals; so saying 'to grow' was not credited. Some students said for growth and repair, which was insufficient.

Replacement of cells or tissues was required. Repair of tissues, organs or wounds all gained credit. Repair of damaged cells is incorrect.

Many students said mitosis is needed for reproduction, or development of an embryo, both of which were ignored.

4.1.1.3 Cell specialisation

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 04 · Examiner comments June 2023 | 8464/B/1F | Original Q1

Question 1

01.1 Students had to link different types of cell to the organ system in which they are found. Almost all students scored at least 1 mark. Linking the sperm cell to the reproductive system being the most common correct response. Almost two thirds scored full marks, and over a quarter scored 2 marks. Common errors were to link the red blood cell with the respiratory system, or the brain cell to the circulatory system.

01.2 The question was answered well, with almost three quarters of students scoring both marks. Most students said the sperm cell has a tail so it can swim, and some said the cell has mitochondria to provide energy. A few students gave two adaptations, but did not explain the use of either, so were only awarded the first marking point.

01.3 Over half of the students scored the mark, usually for saying that the cell in the figure was not a plant cell because it did not have a cell wall, or it did not have a vacuole. Fewer students said the cell did not have chloroplasts.
There were many references to the oxygen molecules, or to the shape of the cell, which were ignored. Some said the cell was not a plant cell because it did not have ribosomes or mitochondria. Others said it did not have a nucleus. All these were incorrect.

01.4 Four fifths of students correctly identified the cell membrane as the structure that controls the movement of substances into and out of a cell.

01.5 Students had to interpret a diagram showing oxygen molecules in and around a cell to decide by which process the oxygen would enter the cell. Half the students correctly concluded that the oxygen would enter the cell by diffusion. Half of these also scored the second mark for explaining this was because the concentration of oxygen was higher outside the cell than inside the cell. Some students confused the process with osmosis. The marking points were independent, so a few students gained a mark for a correct explanation relating to the concentrations of oxygen inside and outside the cell, but had given an incorrect process.

01.6 Only a tenth of students correctly named two substances that move into most cells in the body from the blood. Half of the students named at least one substance. The most common correct substances given were glucose, sugar and water. Parts of the blood were very common answers which did not gain credit, as well as oxygen and carbon dioxide which were ignored.

4.1.1.3 Cell specialisation

Answer 05 · Examiner comments

June 2023 | 8464/B/2F | Original Q6

Question 6 (Standard demand)

06.1 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 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.

06.2 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 and 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. There is no expectation for teachers to teach this idea.

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 fallback mark for 'mutations'. This mark was awarded only if no other mark was given.

4.1.1.3 Cell specialisation

Answer 05 · Examiner comments June 2023 | 8464/B/2F | Original Q6

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.

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

06.4 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.

06.5 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 05 · Examiner comments June 2023 | 8464/B/2F | Original Q6

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 06 · Examiner comments

Question 3 (low & standard demand)

03.1 Most students could suggest why fast reactions are important for car drivers.

Responses that restated the question, such as 'fast reactions are important', or 'to be alert' were not sufficient. Some students misinterpreted the question and explained how they could get to where they were going faster by driving quickly, which was incorrect.

03.2 The most common error was to confuse the independent and dependent variable.

03.3 Most students could identify that it was a problem that the student may catch the card between scores.

03.4 Most students could plot the point correctly.

03.5 Many students could give the mode. Some students attempted calculations in the answer space, which were not needed to answer the question. In most cases, these students were attempting to calculate the mean or median.

03.6 Approximately half of the students selected the correct response that reaction time stayed the same.

03.7 Many students gave the idea of repeats, or using a wider range of different sleep times.

In most cases, incorrect responses were suggesting other independent variables that could be changed, such a drinking different caffeine drinks before the test. Other students incorrectly stated that all the students should sleep for the same length of time or that a stopwatch should be used.

03.8 Few students could state an adaptation of the motor neurone cell. The most common correct answers were 'long' or 'attached to muscle cells'. Explanations of the adaptation were very rare.

A frequently seen misconception was that the muscle contracts and then a signal is passed to the motor neurone. Few students referred correctly to an impulse.

Misconceptions that were frequently seen included:

- neurones transport energy
- the motor neurone tells muscle/brain what to do
- the motor neurone sends messages
- the cell can move
- the cell has a large surface area
- the cell pulls the muscle
- the cell has a tail/arm/leg/stem.

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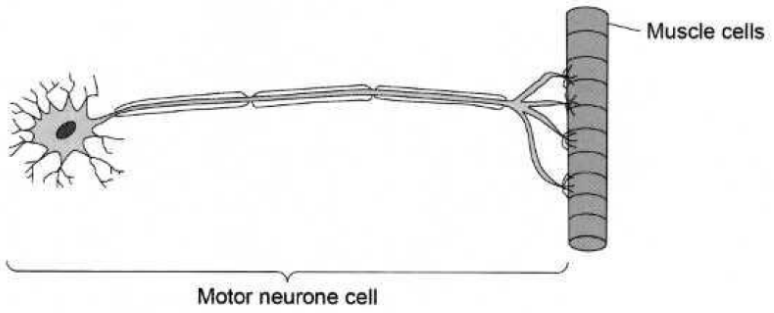
4.1.1.3 Cell specialisation

Answer 06 · Examiner comments June 2024 | 8464/B/2F | Original Q3

0 3 . 8 Motor neurones are involved in reactions.

Figure 7 shows a motor neurone.

Figure 7



Explain **one** way the motor neurone cell is adapted for its function.

[3 marks]

Motor neurone cells are long in length so that messages being sent around the body can happen quickly and efficiently. There length means they can travel longer distances so messages to the CNS can happen as fast as possible.

The student gained 1 mark for 'long'. The misconception here, that the motor neurone is sending impulses, was frequently seen. In this instance, the student also refers to 'impulses' as 'messages', which is insufficient. The misconception that the impulse is travelling from the muscle, as demonstrated here, was also common.

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Answer 07 · 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 eggs 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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4.1.1.3 Cell specialisation

Answer 07 · 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.