AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.1.1.5

Microscopy

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**8**
Available paper years	**2018–2025**

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.

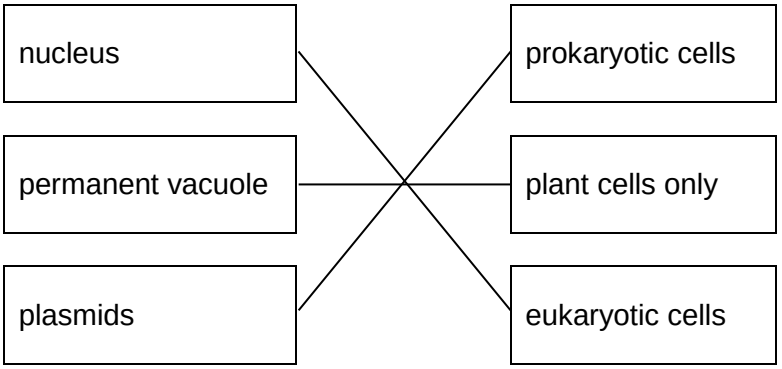
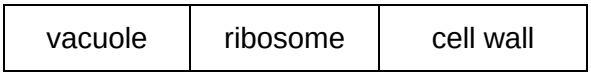
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Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.1.1.5 Microscopy

Answer 01 · Mark scheme

June 2018 | 8464/B/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	 allow **1** mark for one or two correct links		2	AO1 4.1.1.1 4.1.1.2
01.2	 tick box takes precedence if no tick is given, look at both the figure and the circling of words in the table if writing is seen on the figure and in the table both must be correct		1	AO1 4.1.1.2
01.3	turn the (fine focusing) knob until the cells are in focus	allow focus it do **not** accept increase magnification ignore decrease magnification ignore clear ignore references to resolution / illumination ignore zoom in / out	1	AO2 4.1.1.2

4.1.1.5 Microscopy

Answer 01 · Mark scheme

June 2018 | 8464/B/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(rotate the) nosepiece / objective lens	allow change the (objective / eyepiece) lens	1	AO2 4.1.1.2
	to a higher power (lens)	allow (to) increase the magnification a comparator is required ignore change / adjust the magnification allow stronger or more powerful lens ignore references to resolution / illumination unqualified ignore zoom in / out ignore references to an electron microscope	1	

4.1.1.5 Microscopy

Answer 01 · Mark scheme

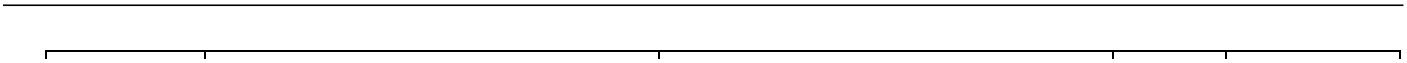
June 2018 | 8464/B/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5		an answer of 400 (×) scores **3** marks		AO2 4.1.1.2
	conversion of units: (112 mm →) 112 000 (µm) **or** (280 µm →) 0.28 (mm)		1	
	(magnification =) $\frac{112}{0.28}$ **or** (magnification =) $\frac{112\ 000}{280}$	allow **1** mark for no conversion of units 112 / 280 **or** incorrect value from step 1 correctly substituted	1	
	400 (×)	do **not** accept if units are given	1	
		if no other mark scored allow **1** mark for: magnification = $\frac{\text{size of image}}{\text{size of real object}}$ a triangle with words or letters in is insufficient, as the correct rearrangement is needed		
Total			**9**	

4.1.1.5 Microscopy

Answer 01 · Mark scheme

June 2018 | 8464/B/1H | Original Q1



4.1.1.5 Microscopy

Answer 02 · Mark scheme

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 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	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		

4.1.1.5 Microscopy

Answer 02 · 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 (which suggests) they are absorbed by active transport / uptake which requires energy from respiration 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	allow nitrate ions absorbed faster in the presence of oxygen do **not** accept energy produced / created / made	1 1 1 1	AO3 AO2 AO1 AO2 4.1.3.3 4.2.3.2

4.1.1.5 Microscopy

Answer 02 · 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**	

4.1.1.5 Microscopy

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	amylase	allow phonetic spelling allow carbohydrase do **not** accept amylose	1	AO1 4.2.2.1
02.2	small intestine		1	AO1 4.2.1 4.2.2.1
02.3	any **one** from: • greater magnification • higher resolving power	allow can see (smaller) sub-cellular structures / parts allow can see more detail (inside cells) allow reference to 3-D images	1	AO1 4.1.1.5
02.4	capillary		1	AO2 4.2.2.1 4.2.2.2
02.5	$20 = \frac{\text{image length}}{0.8}$ image length = 0.8 x 20 image length = 16 (mm)		1 1 1	AO2 4.1.1.5 RPA 1
02.6	diffusion		1	AO3 4.1.3.1
02.7	active transport	allow active uptake	1	AO3 4.1.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	any **one** from: • respiration • to form glycogen • to make amino acids / proteins	allow as an energy source do **not** accept to make / use / create / produce energy allow to make lipid / fat	1	AO1 4.4.2.1 4.4.2.3

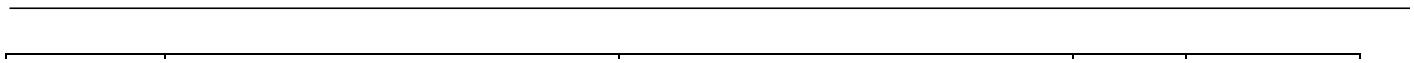
02.9	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2 4.1.1.3 4.1.3.1 4.1.3.3 4.2.2.1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • have (many) microvilli • (to) increase surface area • wall of villus only one cell thick **or** is thin • capillaries are close to surface • (so) short pathway • good blood supply • (to) transport food molecules away **or** to the body • (and) maintain a diffusion gradient • cells have many mitochondria • (where) respiration takes place • (where) energy is transferred • (as) active transport requires energy • energy is needed to absorb sugar / food / molecules For Level 2 must make links between structure and it's function		

Total		**14**

4.1.1.5 Microscopy

Answer 03 · Mark scheme

November 2020 | 8464/B/1H | Original Q2



4.1.1.5 Microscopy

Answer 04 · Mark scheme

June 2022 | 8464/B/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	both have a cell membrane both have cytoplasm		1 1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	any **one** from: • fever • abdominal / stomach cramps	ignore vomiting / sickness / diarrhoea ignore feel unwell unqualified ignore rashes allow high temperature allow sweating / chills	1	AO1 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	penicillin	allow phonetic spelling	1	AO2 4.3.1.9

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **one** from: • only a few bacteria killed so live bacteria continued to reproduce • time delay before antibiotic reached bacteria • time delay before antibiotic could kill bacteria	allow bacteria reproducing when course started allow takes time (for antibiotic) to travel through the body allow takes time (for antibiotic) to work	1	AO3 4.3.1.1 4.3.1.3 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	there were fewer toxins in the body than at day 0		1	AO2 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	to reduce / prevent resistant strains / bacteria developing **or** to reduce / prevent antibiotic resistance (in bacteria)	ignore references to bacteria becoming immune allow because they will get better without taking any antibiotics ignore body will fight the infection unqualified allow some infections are caused by viruses allow because they have been told not to by NHS / NICE	1	AO1 4.3.1.8

4.1.1.5 Microscopy

Answer 04 · Mark scheme

June 2022 | 8464/B/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	B		1	AO2 4.2.2.3 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	D		1	AO2 4.2.2.3

Total Question 1		**9**

4.1.1.5 Microscopy

Answer 05 · Mark scheme

June 2023 | 8464/B/1H | Original Q2

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO2 AO1
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	

	Indicative content Method 1 • place ruler on (microscope) stage • focus on (scale on) ruler • measure diameter / width of field of view • in millimetres • replace ruler with slide • focus on cells • use same magnification • estimate / count number of cells that fit (lengthwise) across field of view • (to calculate mean length of onion cells): divide diameter / width of field of view by (estimated) number of cells **or** divide diameter / width of field of view by 3 cells Method 2 • focus on cells • note magnification • take a photograph of the image • calculate a mean: ○ measure length of several cells (3 or more) cells on the photograph ○ add all image lengths together and divide total by number of cells (to calculate mean cell image length) OR ○ measure the length of one cell ○ calculate the real size ○ repeat for other cells (3 or more) ○ calculate the mean real size • (mean) size of real cell = (mean cell) image size / magnification General points • focus under low power first • using focusing knob • then focus at ×100 magnification • reference to how total magnification is calculated • equation: (mean) size of real cell = (mean cell) image size / magnification For **Level 2** attempt at a method to measure cells plus an indication of how to calculate mean length For **Level 3** suitable method and calculation of mean length		4.1.1.2 4.1.1.5 RPA1

Total Question 2	**6**

4.1.1.5 Microscopy

Answer 06 · Mark scheme

June 2023 | 8464/B/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	FSH and LH		1	AO1 4.5.3.5 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	ovary / ovaries		1	AO1 4.5.3.5 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	any **one** from: • to be able to select / check egg(s) • to select / check sperm sample for live sperm • to see injection / guiding sperm to egg(s) • to see if the egg has been fertilised • to select / check (developing) embryo(s)	allow to count the eggs (collected) allow to grade the embryos ignore egg(s) / embryo(s) / sperm are too small to be seen without a microscope unqualified	1	AO3 4.5.3.5

4.1.1.5 Microscopy

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(hormones / FSH / LH used in IVF) cause an increase in progesterone **and** oestrogen		1	AO1
	progesterone / oestrogen maintain uterus lining	allow oestrogen / progesterone causes thickening of uterus lining	1	AO1
	(uterus) lining is prepared / ready for embryo to be inserted / implanted	allow the (uterus) lining is prepared / ready for implantation	1	AO2 4.5.3.5 4.5.3.3

4.1.1.5 Microscopy

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$\left(\frac{135}{450}\right) = 0.3$ 3 : 7 alternative method 1: $\frac{135}{45} : \frac{315}{45}$ **or** $\frac{135}{45} : \frac{450 - 135}{45}$ (1) 3 : 7 (1) alternative method 2: evidence of dividing both sides of 135 : 315 by 5 **and** by 9 (1) 3 : 7 (1)	allow $\left(\frac{450 - 135}{450}\right) = 0.7$ if **no** other mark awarded allow **1** mark for 27 : 63 **or** 9 : 21 **or** 15 : 35 **or** 3 : 10	1 1	AO2 4.5.3.5

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	any **one** from: • age • obesity / fitness / BMI / diet • (the original) reason for infertility • allow the number of eggs collected • the number of embryos implanted	 allow menopause allow body mass **/** weight allow a named reason for infertility / miscarriage eg endometriosis ignore infertility unqualified	1	AO3 4.5.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	any **two** from: • (physical / emotional) stress of operations • success rate is low • multiple births are a risk to mother **/** baby • (ethical concern regarding) embryos are created but not used	 allow physical / emotional stress of named part of IVF process eg infection from surgery ignore side effects unqualified allow (may) take many months / years (to be successful) allow may need several / many attempts allow multiple births more likely ignore unethical unqualified	2	AO3 4.5.3.5

Total Question 5	11

4.1.1.5 Microscopy

Answer 07 · Mark scheme

June 2024 | 8464/B/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	*microscope:* electron (microscope) **and** *reason:* (has a) high resolution / magnification		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	any **three** from: (prokaryotic cell):	allow converse for eukaryotic cell if clearly stated	3	AO1 4.1.1.1 4.1.1.2
	• does not have a nucleus **or** DNA is free in the cytoplasm **or** genetic material is free in cytoplasm	ignore genetic information		
	• does not have mitochondria	if no other mark awarded, allow prokaryotic cell has no membrane-bound organelles		
	• has a single loop of DNA **or** has a single strand of DNA	ignore genetic information		
	• (has) plasmids	allow (small) rings of DNA		
	• (is) smaller	allow bacteria have smaller ribosomes		

4.1.1.5 Microscopy

Answer 07 · Mark scheme

June 2024 | 8464/B/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow correct calculations in cm or mm		AO2 4.1.1.5
	measurement of cell 36 (mm)	allow in the range of 35 to 37 (mm) allow in the range 3.5 to 3.7 (cm)	1	
	conversion 36 × 1000 = 36 000 (μm)		1	
	real size of cell (30 × 1.5) = 45 (μm)		1	
	substitution magnification = $\frac{36\,000}{45}$		1	
	800	do **not** accept if unit given	1	
		if no other mark awarded allow **1** mark for: magnification = $\frac{\text{image size}}{\text{real size}}$ or correct rearrangement		

Total Question 5	9

4.1.1.5 Microscopy

Answer 08 · Mark scheme

June 2025 | 8464/B/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	any **one** from: • high resolution • high magnification • 3D image • cilia can be seen in detail	 allow a high level of detail ignore subcellular structures can be seen	1	AO3 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	move / transport egg / embryo / ovum / mucus	ignore move / transport dust / bacteria / pathogens / sperm	1	AO2 4.1.1.3 4.3.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	*recall of equation* magnification = $\frac{\text{size of image}}{\text{size of real object}}$	ignore use of equation triangle	1	AO1
	rearrangement of equation size of real object = $\frac{\text{size of image}}{\text{magnification}}$		1	AO2
	substitution $\frac{6}{1.5 \times 10^3}$	allow $\frac{6}{1500}$ allow substitution of incorrectly converted value	1	AO2
	0.004 (mm)	allow answer using incorrectly converted value	1	AO2
	conversion 4 (µm)	allow conversion to µm at any stage	1	AO2 4.1.1.5

4.1.1.5 Microscopy

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	less oxygen (is transported) to cells / tissues / organs / muscles	allow less oxyhaemoglobin transported	1	AO2 4.2.2.3 4.4.2.1 4.4.2.2
	(so) anaerobic respiration produces lactic acid	ignore less aerobic respiration ignore reference to energy	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	*total amount of red blood cells* $(5 \times 10^5 \times 100\,000 =)$ $50\,000\,000\,000$	allow 5×10^{10}	1	AO2 4.2.2.3
	percentage calculation $\frac{50\,000\,000\,000}{100} \times 35$	allow $\frac{5 \times 10^{10}}{100} \times 35$ allow $5 \times 10^{10} \times 0.35$ allow a correctly calculated percentage calculation from an incorrectly calculated number of red blood cells	1	
	$17\,500\,000\,000$		1	
	standard form 1.75×10^{10}	allow correct standard form from an incorrectly calculated number of red blood cells	1	
		alternative route $\frac{35}{100} \times 100\,000 = 35\,000$ (1) $35\,000 \times 500\,000$ (1) $17\,500\,000\,000$ (1) 1.75×10^{10} (1)		

4.1.1.5 Microscopy

Answer 08 · Mark scheme

June 2025 | 8464/B/1H | Original Q6

Question	Answers	Mark	AO / Spec. Ref.
06.6	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO2
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO3
	No relevant content	0	4.1.2.3 4.2.2.3

Indicative content

Advantages of blood from stem cells:

- reduces the need for volunteer blood donors
- **only** a small sample of blood is required (to produce the necessary blood cells)
- can produce a large(r) quantity of red blood cells
- (blood cells are all new) so last longer in the patient
- no rejection **or** no need to tissue match
- no ethical objection to receiving blood (because it is from the patient)
- we can produce blood that is a rare / specific blood group / type
- less / no risk of infection (from contaminated blood)

- whole blood donation takes more time / processing to separate the blood into its parts

Disadvantages of blood from stem cells:

- a blood donation is still required
- not tried and tested **or** it is a (relatively) new technology
- white blood cells, plasma and platelets are not collected
- cannot use for other purposes as only red blood cells collected

Costs:

- red blood cells from donation are cheaper than blood from stem cells
- red blood cells from whole donation costs 61 / 62 pence per cm^3
  or
  red blood cells from whole donation costs £6.15 per 10 cm^3
- red blood cells from stem cells cost £1.50 per cm^3

- lab grown blood is 2 / 3 times more expensive than whole blood donation
- (470 cm^3 of red blood cells) from stem cells cost £705
- (211.5 cm^3 of red blood cells) from stem cells cost £317.25
- 211.5 cm^3 of red blood cells from whole donation costs £130

For **Level 3**, advantages and disadvantages for a treatment are needed **and** a reference to costs.
For **Level 2**, advantages / disadvantages for a treatment are needed **and** a reference to costs.
For **Level 1**, relevant points are made.

Total Question 6	**19**

4.1.1.5 Microscopy

Answer 01 · Examiner comments

June 2018 | 8464/B/1H | Original Q1

Question 1 (standard demand)

01.1 Students demonstrated a good understanding of prokaryotic and eukaryotic cells. 87% of students achieved two marks. To gain both marks all three structures had to be correctly linked to the type of cell where each structure is found.

When only one mark was awarded it was usually for identifying the nucleus as being found in eukaryotic cells.

01.2 Students demonstrated a good understanding of cell structure. 80% of students were awarded the mark for identifying the vacuole, ribosome and cell wall in the plant cell.

Students were asked to tick one box, but some labelled the diagram, whilst others circled the names of the structures in the table.

01.3 27% of students achieved this mark. The cells on slide A appeared large, but blurred. The required response was a reference to focusing the image.

Many students referred to zooming in or out, to altering the magnification or using an electron microscope. All of these were ignored. However, if they said increase the magnification this was incorrect and negated a correct answer of focusing the image.

01.4 The cells on slide B appeared small but in focus. The required response was a description of how to obtain a larger image. There were two marks available for this question.

- One was for reference to changing the lens.
- One was for stating that the new lens would have a higher power or magnification.

45% of students obtained a mark. Where a mark was awarded it was usually for saying increase the magnification.

Changing or using a better magnification was insufficient. Many students referred to zooming in or out or said use an electron microscope, both of which were ignored.

4.1.1.5 Microscopy

Answer 01 · Examiner comments June 2018 | 8464/B/1H | Original Q1

01.5 There were three marks available for this question.

- The first mark was for conversion of units. Many students did not attempt a conversion but could still go on to achieve two marks. A range of different errors were made which included multiplying or dividing by 10, 100 or 10 000, rather than by 1000. Some did not appreciate that a micrometre is smaller than a millimetre.
- The second mark was for correctly substituting into the rearranged equation to calculate magnification. This mark was allowed even if their initial conversion was incorrect.
- The final mark was for an answer of 400. Some students added a unit to their answer and this negated the mark.

33% of students achieved all three marks, and 33% achieved two marks. 24% of students scored zero. This was often for 280 ÷ 112 = 2.5

4.1.1.5 Microscopy

Answer 02 · 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.

4.1.1.5 Microscopy

Answer 02 · Examiner comments

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.

4.1.1.5 Microscopy

Answer 02 · Examiner comments

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

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.

4.1.1.5 Microscopy

Answer 04 · Examiner comments

June 2022 | 8464/B/1H | Original Q1

Question 1 (standard demand)

01.1 66% of students scored both marks for identifying the cell membrane and cytoplasm as structures that are found in both bacterial and animal cells.

01.2 One symptom of salmonella food poisoning was asked for, with students instructed not to refer to vomiting and diarrhoea. 60% of the students were awarded the mark, usually for stomach ache or fever. Many described fever as having a high temperature or sweating, which were allowed.

01.3 64% of students knew that penicillin was the first antibiotic developed. A wide range of phonetic spellings were accepted. The most common incorrect answers were the names of well-known painkillers.

01.4 Fewer than half of the students scored this mark. Most correct responses referred to a time delay before the antibiotics became effective, or started working. A few students said the bacteria would be reproducing or multiplying. There was some confusion with antibodies, and incorrect references to bacteria fighting the antibiotics, or antibiotics fighting bacteria.

01.5 Two-thirds of students knew that a child will start to feel better after taking antibiotics for a few days because there will be fewer toxins in the body. Most other students thought the child had become resistant to the bacteria.

01.6 31% of students scored the mark, usually for saying overuse of antibiotics could result in antibiotic resistance. Alternatively, they scored the mark for the idea that the person would get better without taking any antibiotics, which was allowed.

Quite a lot of students said the patient or the antibiotic would become resistant, which was incorrect. A common mistake was to confuse immunity with resistance.

Answer 04 · Examiner comments

June 2022 | 8464/B/1H | Original Q1

01.7 A third of students correctly identified the drawing of the white blood cell as the cell that produces antibodies. More than half of the students thought the red blood cell produced antibodies; potentially as a result of students being unfamiliar with drawings of blood components.

01.8 63% of students identified platelets as the part of the blood that starts the clotting process. Few selected plasma as their answer.

4.1.1.5 Microscopy

Answer 05 · Examiner comments June 2023 | 8464/B/1H | Original Q2

Question 2

Question 2 was common to both tiers and was set at standard demand.

The question asked students to describe how a microscope, a transparent ruler and a prepared slide of onion cells could be used to estimate the mean length of onion cells on the slide. Many students described how to prepare the slide, which did not gain credit as the students were told that they were provided with this.
Students were not expected to know how to use an eyepiece graticule and stage micrometer. Full marks could be obtained from either of the methods detailed on the mark scheme.

On the Higher tier almost a third of students gave responses that were Level 2 or above, although very few were in Level 3. This was often because they mixed up the two methods, so the key steps were not logically sequenced. A common mistake was to describe how to measure the cells with a ruler using the microscope, but then they divided the measurement by 100.
In order to move into Level 2 an attempt at a method to measure the size of the cells was required, as well as a reference to how to calculate a mean. The latter was often not addressed, so more than a third of students only scored 2 marks.

Answer 06 · Examiner comments June 2023 | 8464/B/2H | Original Q5

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

05.1 Nearly two-thirds of students could identify the hormones that are given to women having IVF treatment.

05.2 Most students could state ovary / ovaries as the target organ of the hormones used in IVF.

05.3 Students found this question challenging. Many simply stated that egg / sperm are too small to see without a microscope, which was insufficient to answer the question.

Students could refer to any relevant stage in the process of IVF, as illustrated by the list of bullet points on the mark scheme.

One common misconception was that microscopes are needed to view hormones.

05.4 Students could write follicle stimulating hormone for FSH and luteinising hormone for LH. Students gave lots of detail on the general roles of FSH and LH that are irrelevant to the question.

Many students did not answer the question in terms of IVF, but could still gain marks.

In marking point 2, ‘womb’ was taken as equivalent to ‘uterus’. ‘Building up’ (of the uterus lining) is equivalent to ‘thickening’. Endometrium was an acceptable alternative to lining (that is beyond the specification). Note that the list rule was applied if additional hormones were referred to here.

For marking point 3, ‘the lining is prepared for pregnancy’ was common, but insufficient, because this did not add to the information given in the question.

05.5 The correct answer without any working received full marks. If the correct answer was given with working then examiners checked the working to see that it is logical before awarding full marks.

The correct answer did not have to be on the answer line but anything that has been given on the final answer line will always take precedence. Students sometimes displayed the alternative method 2 in a slightly different way, such as dividing both sides of the ratio by 5, then by 3 and then by 3 again.

Answer 06 · Examiner comments

There was a fall back mark if students did not complete their simplification of the ratio but got part way through the process. Alternatively, the fall back mark was given for a ratio of 3:10, which indicated students misinterpreted the table but simplified that ratio correctly.

If the ratio was given the incorrect way round, no mark was awarded.

05.6 The most commonly awarded marks were for age (bullet point 1) or for smoking, obesity or alcohol as named reasons for infertility (bullet point 2). There were many insufficient vague references to health or lifestyle which were not creditworthy. Other commonly seen insufficient answers included hormone levels or the levels of named hormones such as FSH as well as statements about the condition or health of the uterus.

Bullet points 4 or 5 were very rarely awarded. When students did attempt these marking points they often referred to the amount of eggs without suggesting it was the number collected that was important or suggesting it was eggs or fertilised eggs that were implanted rather than embryos.

05.7 For bullet point 1 there were many vague statements about stress, it being emotional or harmful without saying how or why it was stressful, emotional or potentially harmful. References to the risks of surgery were seen very rarely.

Bullet point 2 was the most commonly awarded marking point although many students were not awarded this marking point as they made vague references to the idea that it might not work rather than emphasising the low success rate.

There were many references to multiple births or twins, which were not creditworthy as they failed to qualify the reference with the idea of the risks associated with multiple births or that IVF made multiple births more likely.

0 5 . 7 Give **two** arguments against the use of IVF treatment.

Do **not** refer to cost or to religion in your answer.

[2 marks]

1 It ~~can~~ can be emotionally and physically stressful for the women

2 IVF treatment doesn't always work

This response did not gain any marks. The first reference is too vague to award bullet point 1. The reference to IVF treatment not always working could apply to any conception and therefore needed to be qualified, such as 'low chance of working'. Some students quoted their ratio from question **05.5** to support this response.

There were many references to the process of IVF being unethical or unnatural without saying what made it unethical but on many occasions students went further and explained it was unethical as it might lead to the destruction of a potential life.

Other insufficient answers referred to the embryo or egg not being able to consent or the misconception that IVF allows parents to choose characteristics or will lead to designer babies.

4.1.1.5 Microscopy

Answer 07 · Examiner comments

Question 5 (standard/high & high demand)

05.1 This question required students to make the link between the size of bacteria and the requirement for a high magnification or resolution. Therefore, an electron microscope is needed. Many students referred to an 'electronic microscope', which was insufficient. References to black and white images were also insufficient. 40% of students correctly linked electron microscope and the reason why it was used.

05.2 Just under a quarter of students understood this concept well and gained all 3 marks. A common mistake was to confuse a single loop of DNA with rings of DNA called plasmids.

05.3 This proved to be a very challenging question, with students often unable to work the calculation through and making mistakes at many of the different stages: 41% of students were only awarded 1 mark. Many students did not realise they needed to measure the diagram of a cell using a ruler, instead giving the image size as 30 mm. Many managed to calculate the real size as 45 µm; however, many were weak in correctly converting the units with frequent mistakes in converting 45 µm in 45 nm. Some students did not seem to think about whether their final answer made mathematical sense, giving a result that was unreasonably large or small.

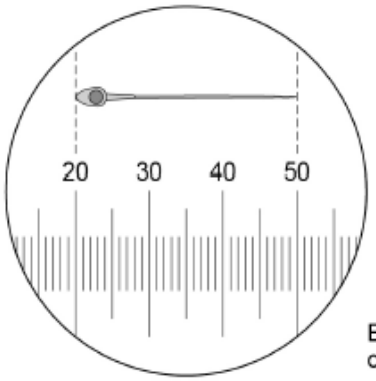
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4.1.1.5 Microscopy

Answer 07 · Examiner comments June 2024 | 8464/B/1H | Original Q5

0 5 . 3 **Figure 4** shows a special slide used to determine the size of a cell viewed using a microscope.

Figure 4



Each small division on the scale is 1.5 µm

Calculate the magnification of the cell shown in **Figure 4**.

[5 marks]

Calculate the magnification of the cell shown in **Figure 4**.

[5 marks]

magnification = image size / actual size

30 ÷ 1000 = 0.03

magnification = 3.6 / 0.03 = 120

Magnification = x 120

This was a common response, with a correct equation given for the fallback mark. The student has correctly measured the cell size at 3.6 cm and this is still awarded even if it is marked on the diagram.

The student cannot correctly work out the actual size of the cell instead giving 30 µm. They also incorrectly divide the 30 µm by 1000 giving an incorrect actual size. Although they correctly substitute in their numbers these are too far from the correct calculation to be awarded anything other than 1 mark for measuring the size of the cell correctly.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments June 2025 | 8464/B/1H | Original Q6

evaluate' were often interpreted as 'state' or 'describe', leading to students missing out on marks. Question **06.6** was a notable example of this.

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Answer 08 · Examiner comments

Question 1 (Standard demand)

01.1 This question was generally well answered. A significant proportion of students (48%) achieved both marking points, demonstrating strong understanding of the topic. Many responses showed accurate labelling and good recall of the key blood vessels associated with the heart.

Where only one mark was awarded, this was most commonly for the correct identification of the vena cava.

01.2 61% of students gained the mark for this question.

01.3 This question was generally well answered, with most students recognising the involvement of respiration. However, many did not explain that more energy was required, and the misconception that energy is 'produced' rather than 'released' in the mitochondria was common.

Only a small proportion demonstrated understanding that the heart muscle needs to contract, with few using this precise term. Confusion between the processes of respiration and breathing was common.

Overall, 35% of students achieved two or more marks, while only 7% gained full marks. Most gained partial credit for identifying respiration but struggled to explain how energy is used by the heart.

01.4 This question was well answered, with 71% of students gaining at least one mark. Tiredness and chest pain were the most frequently identified symptoms.

Some responses repeated the same idea using different wording, for example 'heart attack' and 'blood clot'. Terms such as 'heart murmur' or 'palpitations' were credited as irregular heartbeat, while 'heartburn' was not.
Descriptions of increased breathing rate were often too vague, and few students mentioned pale skin.

01.5 This question was generally well answered, with over 80% of students gaining at least one mark. Many correctly identified infection or rejection as valid risks, while fewer mentioned the risk from anaesthetic.

Weaker responses often rephrased the question, giving vague statements such as 'there is a risk from surgery', which were not creditworthy. Some students speculated about long-term outcomes, for example 'the heart tissue not growing' or 'the patch being too small'. These were outside the scope of the question and not accepted.

Answers referring to bleeding had to make clear that it resulted from the operation and involved a significant loss of blood, with terms such as 'heavy blood loss' being credited. General references to 'risk of disease' were also not sufficient.

Descriptions such as the heart being punctured or stopping were credited as examples of damage to the heart, but unqualified terms like 'harming the heart' or 'death' were not.

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Answer 08 · Examiner comments

Question 2 (Standard demand)

02.1 This question was very well answered, with 95% of students correctly identifying touch or direct contact as a method of transmission. Many also referred accurately to coughing, sneezing, or droplets, which were credited.

Vague examples like hugging or playing together were not creditworthy, as they did not clearly imply skin-to-skin contact. In contrast, examples such as kissing, high fives, or transmission via contaminated surfaces like shared towels were accepted.

02.2 This question was very accessible, with many students correctly stating that antibiotics are used to treat bacterial infections.

A common misconception was the claim that chickenpox is not a virus, revealing a misunderstanding of the nature of the disease. References to 'it' were interpreted as referring to chickenpox and were credited where appropriate.

02.3 Many students correctly referred to dead pathogens, which was creditworthy. However, vague answers such as 'dead cells', 'dead disease', or 'dead chickenpox' were not accepted, as students needed to identify that it was the pathogen, not the disease itself, used in the vaccine.

Unqualified statements such as 'a small amount' were insufficient unless clearly linked to the dead pathogen or the antigen. Terms such as 'inert' or 'dormant' were accepted as synonymous with inactive when applied correctly to the pathogen.

02.4 This question was generally well answered, with 87% of students gaining at least two marks. Many demonstrated a clear understanding of the concepts being assessed.

Errors most often arose from repeating the same idea using different wording, for example stating that the drug was tested 'to check for toxicity' and 'to check for side effects'. These were treated as equivalent and not credited twice. References to allergic reactions were also accepted as side effects, and statements such as 'to check it doesn't kill the person' were credited as showing awareness of the ultimate risk.

Terms such as 'efficient' and 'effective' were accepted as equivalent to efficacy. However, references to 'reliability' or 'accuracy' were not sufficient, as they do not directly address whether the drug works as intended. Overall, this was an accessible question, though more precise language would have improved some responses.

02.5 This extended response question was assessed holistically. Many students demonstrated a clear understanding of the primary immune response, often describing in detail how white blood cells produce specific antibodies. These responses typically met the criteria for Level 2, with 50% of students achieving this level.

Fewer students were able to describe the secondary immune response in sufficient detail to reach Level 3, with only 10% achieving this. Stronger answers successfully linked features such as the faster production of antibodies and the role of memory cells in enabling a quicker, more effective response. High-level responses also referred to the production of complementary antibodies and explained how this led to a rapid destruction of pathogens. Statements such as antibodies being 'produced sooner' were creditworthy, while vague phrases such as pathogens being 'fought off quickly' were not.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments

The function of white blood cells was generally well understood, and many students correctly described antibody production. However, credit for specificity required clarity that the antibodies produced were complementary or specific to the pathogen or its antigens. Simply stating that antibodies were produced was insufficient.

Confusion between antigens and antibodies was common and often affected the accuracy of responses. Overall, while the primary response was well described by most students, a lack of detail about the secondary immune response prevented many from progressing beyond Level 2. This question highlighted that the secondary immune response remains an area of weakness for many.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments June 2025 | 8464/B/1H | Original Q6

0 2 . 5 Explain how a vaccine for chickenpox gives immunity against the disease.

You should refer to how the body responds to:

- the vaccine
- chickenpox pathogens that enter the body after vaccination.

[6 marks]

A Chickenpox vaccine contains a dead or inert pathogen. This is then injected into the patients bloodstream. This causes the immune system to react to the new foreign pathogens. Lympho-cytes (white blood cells) ~~target~~ produce antibodies which are specific to the antigens on the surface of the pathogen and then memory cells remember what antibodies to produce for the particular antigens of the bacteria. Thus, if you are actually injected you can produce antibodies quicker and kill the pathogens

Extra Space

This response was awarded 4 marks but had the potential to reach 6 with slightly more detail. The initial explanation of what a vaccine is was ignored, as this was assessed in a previous question.
The student correctly states that white blood cells produce antibodies, which satisfies the requirements for Level 2 and earns 3 marks. They further add that the antibodies are specific to the antigens—this additional piece of indicative content increases the mark within Level 2.

Credit is given for the mention of memory cells, and the student continues by stating that antibodies are produced more quickly upon infection. While this begins to reference the secondary response, it lacks a second linked idea, such as explaining that pathogens are destroyed more rapidly. Had this been included, the response could have progressed into Level 3, with up to 6 marks awarded.

This example reflects a common pattern seen on the Higher Tier, students providing accurate information but not developing it fully enough to access the Level 3 marks.

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Answer 08 · Examiner comments

June 2025 | 8464/B/1H | Original Q6

Question 3 (High demand)

03.1 58% of students were awarded the mark for this question.

03.2 This question differentiated well between students of varying ability. Most were able to gain the first two marks by correctly selecting two distances from the graph that doubled and applying the inverse square law. A small number of students selected distances that did not double, such as 10 cm and 60 cm, which prevented them from achieving the calculation marks.

A few students used the incorrect formula 1/d rather than $1/d^2$, resulting in no credit. Others referred to the rate of oxygen production rather than calculating light intensity, which was also not credited. However, the majority used the correct formula and expressed their answers in an acceptable form.

Stronger answers correctly stated that light intensity 'decreases by a factor of four' or an equivalent phrase. Many, however, gave only vague statements such as 'light intensity decreases as distance increases', which were insufficient. A small number incorrectly stated that intensity 'reduced by 25%'.

03.3 This question was generally well answered, with 54% of students achieving at least one mark. Many correctly described that an increase in temperature leads to a higher rate of photosynthesis or faster oxygen production. Responses referring to the 'rate of bubble production' were credited, as the bubbles were identified as oxygen in the figure. However, answers that only mentioned an increase in oxygen volume or used vague terms such as 'rate of reaction' without linking this to photosynthesis were not sufficient.

Although many students described an 'increase of energy', It was often unclear what had more energy and vague statements about an energy increase for 'the plant' were not creditworthy. The idea of *more frequent* collisions was generally not well described. Responses that referred only to collisions, without further qualification did not gain credit.

Overall, most students gained at least one mark. However, only a minority demonstrated the particle-level understanding required to achieve full marks.

03.4 This question was challenging, with only 37% of students gaining at least one mark. References to other limiting factors, such as carbon dioxide, were not credited.

Many students correctly stated that high temperatures lead to less oxygen production, but only those who linked this to enzyme denaturation gained full marks. Responses that referred vaguely to cells or pondweed being denatured were not accepted.

Incorrect answers often suggested that oxygen production would increase or remain unchanged. Some students gave irrelevant points about experiment accuracy, which were not creditworthy.

Overall, while many achieved partial marks, few used precise biological terminology or explained the cause-and-effect relationship needed for full credit.

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Answer 08 · Examiner comments

June 2025 | 8464/B/1H | Original Q6

Question 4 (Standard and High demand)

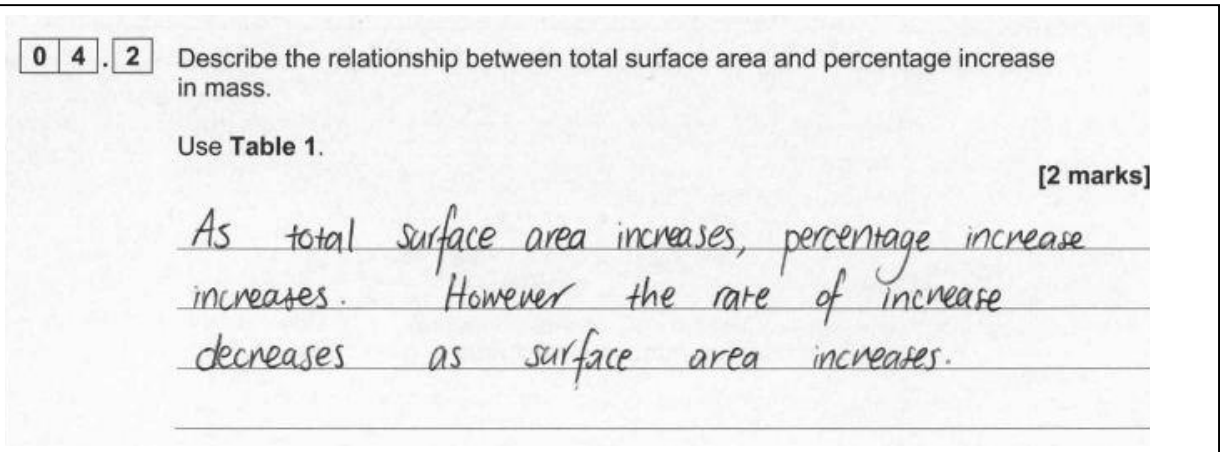
04.1 To gain credit, students needed to state that the potato pieces had different *starting* masses, making answers such as 'they have different mass', insufficient.

References to precision, accuracy, or comparability were not credited unless clearly linked to the variation in starting mass. Few students fully explained why using percentage change is more valid, with many giving vague responses such as 'more accurate' or 'more reliable'.

Some incorrectly attributed the use of percentage change to differences in surface area, which was not relevant. Others noted that it made results 'easier to compare', but did not go on to explain why.

04.2 This question was well answered, with 86% of students correctly identifying a positive correlation, stating that as surface area increases, the percentage increase in mass also increases.

A common error was the incorrect use of the term 'directly proportional', which was not credited as the relationship was not linear. Only 3% of students demonstrated higher-level understanding by noting that the rate of increase slowed, showing awareness of the diminishing trend in the data.



0 4 . 2 Describe the relationship between total surface area and percentage increase in mass.

Use **Table 1**.

[2 marks]

As total surface area increases, percentage increase increases. However the rate of increase decreases as surface area increases.

This is a rare response that was awarded 2 marks. The student successfully describes a decreasing rate, which meets the criteria for marking point 2. This level of detail and understanding was not commonly seen, as many students did not refer to the full pattern shown in the table.

04.3 To gain credit, students needed to state both the direction of water movement and name the process as osmosis. While most correctly identified osmosis, many omitted the direction of movement.

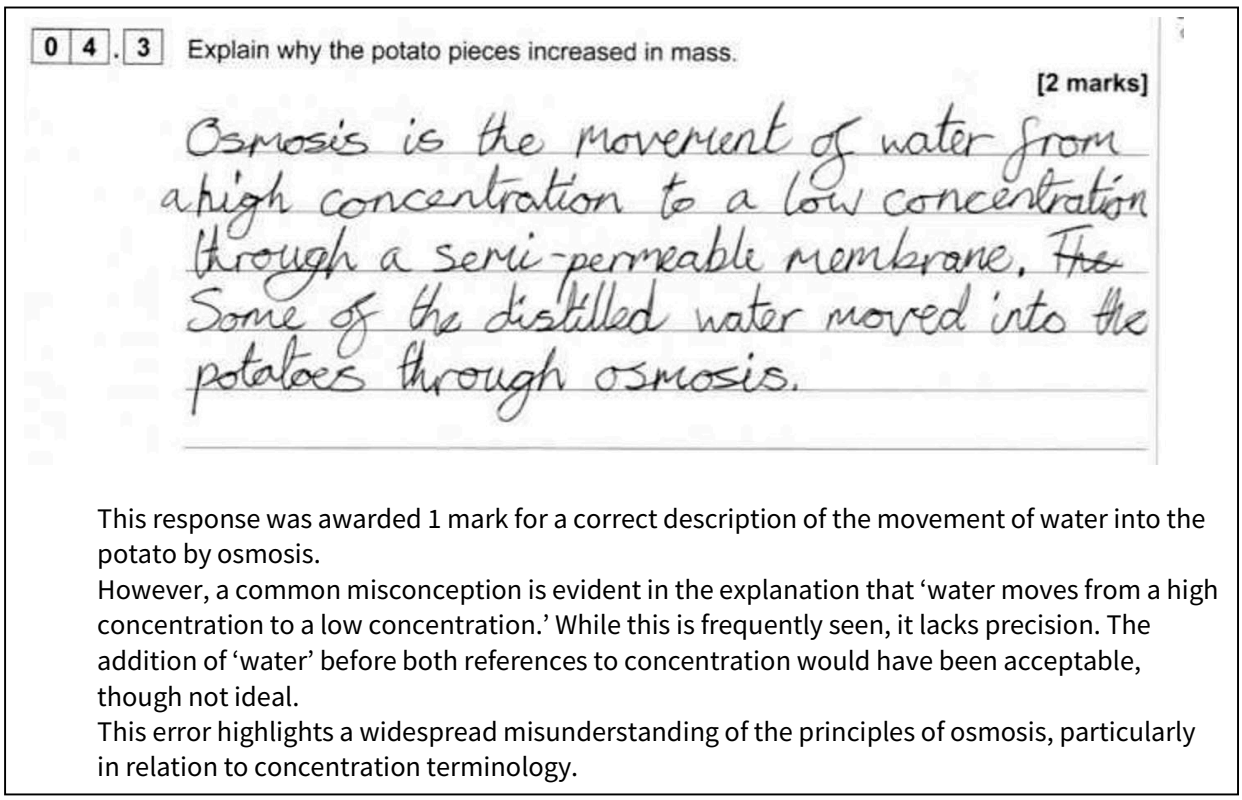
Explanations were credited if they described water moving from a high to low concentration of water, although this less precise wording often caused confusion. The preferred description was water moving from a dilute solution to a more concentrated solution across a partially permeable membrane. Statements referring to movement from low to high solute concentration were also accepted.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments June 2025 | 8464/B/1H | Original Q6

Confusion about concentration remained common, with many students not distinguishing between water and solute concentration. Although most could name osmosis, unclear explanations of the gradient and movement direction often prevented full marks.



0 4 . 3 Explain why the potato pieces increased in mass.

[2 marks]

Osmosis is the movement of water from a high concentration to a low concentration through a semi-permeable membrane. ~~The~~ Some of the distilled water moved into the potatoes through osmosis.

This response was awarded 1 mark for a correct description of the movement of water into the potato by osmosis.
However, a common misconception is evident in the explanation that 'water moves from a high concentration to a low concentration.' While this is frequently seen, it lacks precision. The addition of 'water' before both references to concentration would have been acceptable, though not ideal.
This error highlights a widespread misunderstanding of the principles of osmosis, particularly in relation to concentration terminology.

04.4 This question was particularly challenging, with only 4% of students gaining any marks. It required application of knowledge about osmosis in a broader context.

Few students recognised that all potato pieces would eventually reach the same percentage change in mass after 24 hours. Many incorrectly stated that the pieces would have the same mass, showing misunderstanding of what percentage change represents.

Credit was also given for identifying that it is the potato *cells*, not the whole pieces or the potato, that becomes turgid.

Common misconceptions included the belief that concentrations would equalise, and osmosis would stop, that percentage change would increase indefinitely, or that cells would burst. The role of the cell wall in preventing bursting was rarely acknowledged.

Overall, this question highlighted significant gaps in students' understanding of osmosis, particularly in distinguishing between plant tissues and plant cells.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments June 2025 | 8464/B/1H | Original Q6

04.5 This question was poorly answered, with only 8% of students meeting both criteria. Many responses lacked precision and failed to clearly describe how the method should be adapted. Few students stated that the independent variable should be different concentrations of salt solution. References to at least three concentrations and the use of units such as g/dm^3 clarified that solutions, not masses of salt, were being tested. Vague statements such as 'add some salt to water' were not credited. Many students also failed to recognise that surface area needed to be replaced as the independent variable, often attempting to include both variables in the same method.

For controlling surface area, responses needed to state that all potato pieces should have the same surface area and not just the 'same size' or 'same shape' which were too vague. Students could also gain credit by stating that the cylinders should not be cut further or should be cut into the same number of pieces, as this implied control of surface area. Very few students addressed this point at all.

Overall, most responses demonstrated confusion around the concept of concentration and lacked the clarity required to access the marks.

Describe how the student could change the method to investigate the effect of salt concentration on potato tissue.

[2 marks]

Cut 5 cylinders from one potato. Do not cut into different number of pices. Put each cylinder into different beaker containing solution of salt in distilled water with different concentrations: 0, 0.2, 0.4, 0.6, 0.8

This is a rare example of a 2-mark response. The student correctly refers to not cutting the pieces of potato, which demonstrates an understanding of the need to control the size and surface area of the samples. They also clearly state that different concentrations of salt solution were used, which shows an awareness of how to create the range of conditions needed to observe a pattern in mass change.

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Answer 08 · Examiner comments

Question 5 (Standard and High demand)

05.1 49% of students gained 1 mark on this question. 34% gained full marks for this question.

05.2 This question proved challenging, with 63% of students failing to achieve the mark. While many correctly identified the palisade layer, a wide range of incorrect responses was seen.

Common errors included confusing the palisade tissue with the upper epidermis, spongy mesophyll, or simply writing 'mesophyll', which was too vague to credit. Other incorrect answers suggested other plant tissues and sub-cellular structures.

Overall, the question highlighted that while some students had a good grasp of leaf anatomy, many lacked precise knowledge of the location and function of palisade tissue.

05.3 This question was challenging, with 62% of students failing to achieve any marks. It required understanding of the adaptations of palisade mesophyll tissue and how these relate to its role in photosynthesis. While some students identified one appropriate adaptation or function, few provided the full explanation needed for both marks.

Many students correctly stated that the cells contain many chloroplasts or a large amount of chlorophyll. However, common errors included mentioning a 'large surface area', omitting the quantifier 'many', or failing to link the adaptation to its function. Responses such as 'contains chloroplasts for photosynthesis' were too vague, whereas answers specifying that the many chloroplasts absorb light for photosynthesis were awarded full credit.

Some students incorrectly described the position of the palisade cells at the top of the leaf or referred to unrelated processes such as water absorption or gas exchange. Confusion between palisade and spongy mesophyll tissues was also frequent.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments

June 2025 | 8464/B/1H | Original Q6

0 5 . 3 Explain how tissue **A** is adapted to its function.

[2 marks]

has many chloroplasts and so many chlorophyll so photosynthesis can take place ~~at a higher~~

0 5 . 3 Explain how tissue **A** is adapted to its function.

[2 marks]

contains lots of chloroplast wich contains chlorophyll to absorb the light thats why its on the top side of the leaf as thats where there is the highest light intensity

Two examples of responses that were both limited to 1 mark.

In the first example, the student is awarded for correctly stating that the cell contains many chloroplasts. However, further credit is not gained, as the response only references photosynthesis and does not specifically mention the absorption of light—an essential part of that marking point.

In the second example, the student is again awarded marking point 1 for correctly identifying the presence of many chloroplasts. This time, the student does mention light absorption but does not go on to link this to the process of photosynthesis.

In both cases, the students demonstrated partial understanding but did not provide enough detail to access full marks. This pattern was common across responses, where students often gave either the function (photosynthesis) or the mechanism (light absorption), but not both.

05.4 This question was challenging, with many students demonstrating only partial understanding. While 77% gained at least one mark, only 26% achieved three or more. Few were able to provide a full, coherent sequence of the pathway of water.

Most students gained credit for stating that water enters the root hair cells from the soil. However, answers that referred only to 'roots' or incorrectly described the process as active transport were not credited.

Fewer students successfully described water moving up the xylem, as many omitted the direction of flow or confused the xylem with the phloem, sometimes incorrectly referring to translocation instead of transpiration.

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Answer 08 · Examiner comments

References to water moving to the leaves were rare, with many responses diverting into discussions of photosynthesis, which was not relevant to the mark scheme.

Only a small number of students mentioned stomata or described their role in water leaving the leaf. Evaporation or transpiration as the final stage of water loss was more commonly stated, although it had to be correctly located to gain credit.

Overall, while the early and final stages of the process were better understood, students often lacked the precision and sequencing needed for full marks. This question highlighted persistent misconceptions about water transport and the role of specific plant structures.

Question 6 (High demand)

06.1 61% of students gained the mark for this question.

06.2 This question required students to apply their knowledge of ciliated cells in a new context. To gain credit, answers needed to describe the movement caused by the cilia (e.g. push, sweep, waft, pass through) and correctly identify what was being moved (e.g. egg, ovum, fertilised egg, or embryo). Phrases such as 'pass the egg through' were accepted, and incorrect references to the egg's destination were ignored. References to sperm were not credited.

Many students struggled, often confusing the roles of cilia and mucus. A common error was stating that cilia trap bacteria or pathogens, a function associated with mucus in the respiratory system rather than the oviduct.

06.3 Students generally performed well on this question, with 47% achieving full marks. Most were able to recall and correctly rearrange the equation, demonstrating strong mathematical skills.

The most common error was incorrect conversion from millimetres to micrometres, which prevented many from gaining the conversion mark. Some students also substituted values incorrectly, leading to an incorrect final answer.

Overall, performance was good, and many students showed confidence with both standard form and the calculation process. Clear working remains important, as it allows credit to be given for correct steps even when the final answer is incorrect. Students should also cross out incorrect attempts to make their reasoning clear.

06.4 This question proved difficult for many students, as it required clear application of knowledge about oxygen transport and respiration.

Many recognised that anaemia reduces oxygen transport but often used vague phrasing such as 'less oxygen is taken to the body', which was not credited. To gain the mark, answers needed to specify that oxygen was not reaching cells, muscles, or another specific destination. Irrelevant organs, such as the liver, and absolute statements like '*no* oxygen is taken to the cells' were not accepted.

Fewer students successfully identified the shift to anaerobic respiration and the associated production of lactic acid. Responses that referred only to 'less energy' or 'less aerobic respiration' were insufficient, and mentioning anaerobic respiration without lactic acid was also insufficient.

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4.1.1.5 Microscopy

Answer 08 · Examiner comments June 2025 | 8464/B/1H | Original Q6

Overall, while many students understood the initial effect of reduced oxygen transport, few linked this to the physiological consequences of anaerobic respiration, revealing gaps in applying respiration knowledge in unfamiliar contexts.

0 6 . 4 Explain why a person with anaemia is likely to experience muscle fatigue.

[2 marks]

Because red blood cells carry oxygen around the body so if there aren't enough of them, the muscles don't have enough oxygen to respire meaning less energy.

This response was awarded 1 mark. The student correctly identifies that less oxygen reaches the muscles. A more general statement such as 'less oxygen to the body' would not have been sufficient at this level.
However, the student does not mention anaerobic respiration or the production of lactic acid, both of which were required to achieve further credit. This reflects a common issue where students recognise the reduction in oxygen delivery but do not link it to the consequences on respiration.

06.5 This question was generally well answered, with 67% of students gaining full marks. Many demonstrated strong mathematical skills and successfully applied standard form.

The most common errors were in the percentage calculation, which led to incorrect final answers despite correct method or structure. Magnitude errors, often caused by misplacing zeros, were also frequent.
Students who made calculation errors but correctly expressed their answer in standard form were often able to gain partial credit.

06.6 Most students (83%) accessed Level 1 by identifying relevant points, 47% reached Level 2, but only 1% achieved Level 3. The question highlighted weaknesses in data interpretation, comparative reasoning, and structuring evaluations.

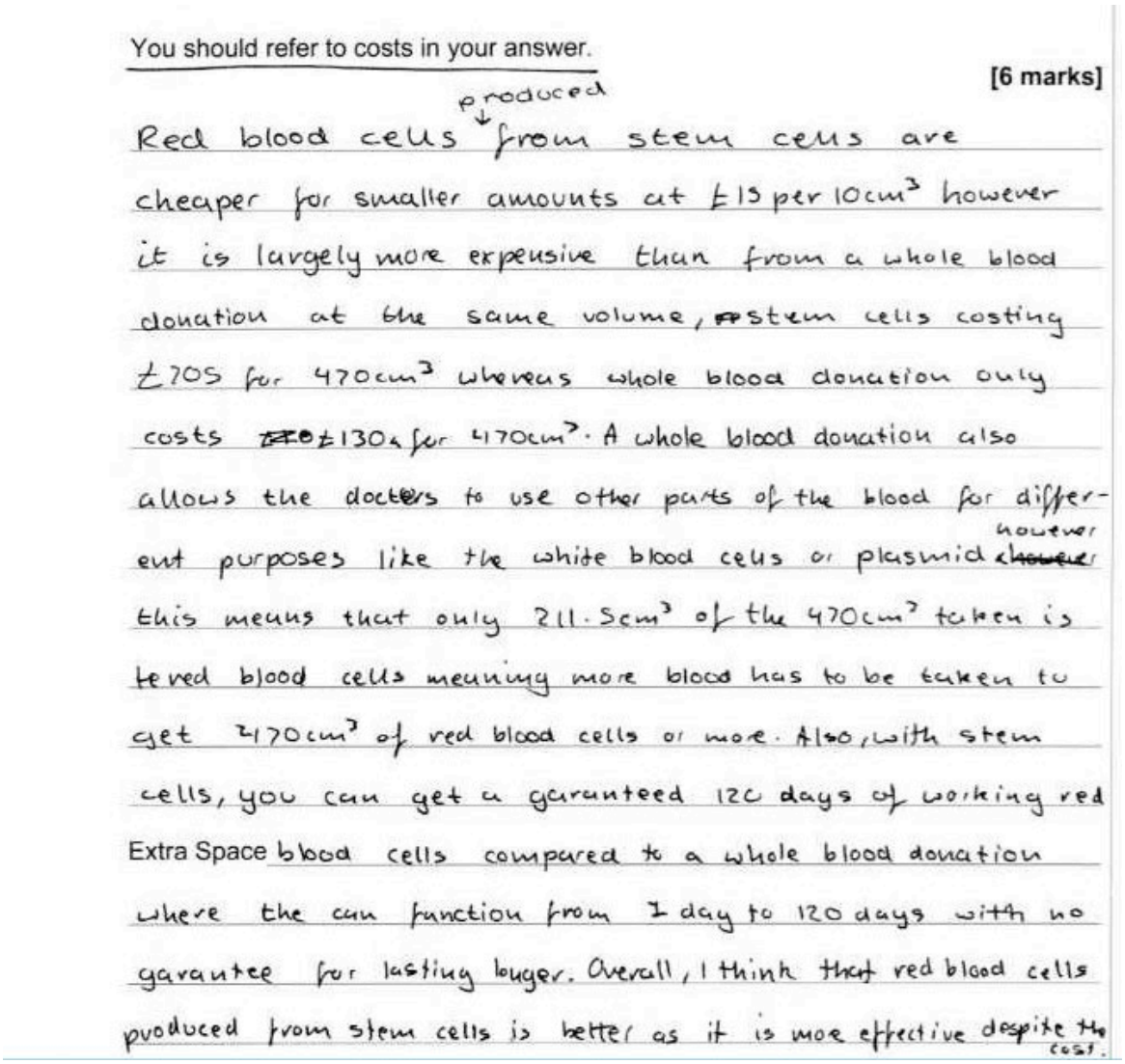
Many students correctly identified advantages of stem cell-derived red blood cells, including longer shelf life, smaller sample requirements, and lower risk of infection. Some gained credit by framing these as disadvantages of whole blood donation. However, many answers simply re-stated information from the table without comparison or explanation.

Disadvantages of stem cells were rarely mentioned. While cost was often noted, few students developed this point or compared it effectively with the lower cost of whole blood donation. Misconceptions were common, particularly references to ethical concerns about embryonic stem cells, which were not relevant in this context. Few students recognised benefits such as reduced risk of rejection or potential advantages for patients with rare blood types.

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4.1.1.5 Microscopy

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You should refer to costs in your answer. **[6 marks]**

Red blood cells produced from stem cells are cheaper for smaller amounts at £15 per 10cm³ however it is largely more expensive than from a whole blood donation at the same volume, ~~a~~ stem cells costing £705 for 470cm³ whereas whole blood donation only costs ~~£0~~ £130 for 470cm³. A whole blood donation also allows the doctors to use other parts of the blood for different purposes like the white blood cells or plasmid ~~however~~ however this means that only 211.5cm³ of the 470cm³ taken is red blood cells meaning more blood has to be taken to get 470cm³ of red blood cells or more. Also, with stem cells, you can get a garanteed 120 days of working red blood cells compared to a whole blood donation where the can function from 1 day to 120 days with no garantee for lasting longer. Overall, I think that red blood cells produced from stem cells is better as it is more effective despite the cost.

Extra Space

This is a rare example of a response that was awarded 5 marks.

The student correctly states that red blood cells produced from stem cells are more expensive and identifies the specific cost as £705, meeting two of the cost-related points.

They then note that whole blood donation includes other components, such as white blood cells, and despite the incorrect reference to plasma, this is accepted as being in line with the indicative content principles. The student also explains that these additional components can be used for different purposes. This was sufficient to award credit relating to the advantages of whole blood donation.

The response continues with an extended discussion about the lifespan of different types of blood cells. Although somewhat lengthy, the student eventually makes the point that red blood cells derived from stem cells last longer—earning credit for an advantage of stem cell blood.

In total, this response gained credit for cost-related points, advantages of whole blood donation, and an advantage of stem cell blood. Had the student included a further distinct advantage of stem cell blood, they would have been awarded the full 6 marks.

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Cost evaluation was key to higher marks. Many students performed calculations correctly, allowing progression beyond Level 1, but errors occurred when comparing unequal volumes. Correct intermediary calculations were still credited.

Overall, while most students identified some valid points, only a very small proportion produced well-developed evaluations supported by data analysis.

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4.1.1.5 Microscopy

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Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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