AQA GCSE Biology | 8461

SPECIFICATION POINT 4.2.2.3

Blood

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**25**
Available paper years	**2008–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

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

4.2.2.3 Blood

Answer 01 · Mark scheme

June 2008 | BLY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	antibiotics	**2**
	B	painkillers	**4**
	C	antibodies	**3**
	D	vaccines	**1**

4.2.2.3 Blood

Answer 02 · Mark scheme

June 2008 | BLY3H | Original Q5 | Legacy

question	answers	extra information	mark
5(a)(i)	protein is large (molecule) / too big to pass through filter		1
5(a)(ii)	glucose is present in the filtrate **or** 0.8 in filtrate	ignore units	1
	no glucose is present in the urine **or** 0 in urine		1
5(a)(iii)	active transport – up / against (concentration) gradient **or** from low to high (concentration)	it = active transport throughout	1
	uses energy / ATP	accept needs specific carrier / specific protein (in cell membrane) for **1** mark	1
5(b)	<u>water</u> <u>re</u>absorption / taken out **or** water taken into blood / body	other substances cancel mark	1
Total			**6**

4.2.2.3 Blood

Answer 02 · Mark scheme

June 2008 | BLY3H | Original Q5 | Legacy

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: June 2008

4.2.2.3 Blood

Answer 03 · Mark scheme

question	answers	extra information	mark
2(a)	antibodies	allow antitoxins / memory cells do **not** allow antigens	1
	immune	ignore protection allow resistant	1
2(b)(i)	fell		1
	numerical qualification to zero / nothing / by 100%	allow stopped in 1995	1
2(b)(ii)	(no) % vaccination fell **or** when no vaccination	ignore circle	1
	but autism numbers did not fall / stayed high / increased **or** '(yes) might support it if time lag between vaccination and autism symptoms' / 'time lag for diagnosis' (1) 6 year time lag quantified (1)		1
Total			**6**

4.2.2.3 Blood

Answer 03 · Mark scheme

COMPONENT NUMBER: BLY1H

COMPONENT NAME: Science B / Biology

STATUS: Final

DATE: January 2009

4.2.2.3 Blood

Answer 04 · Mark scheme

January 2009 | BLY2H | Original Q2 | Legacy

question	answers	extra information	mark
2(a)(i)	pancreas	allow phonetic spelling	1
2(a)(ii)	glucose into cells / liver / muscles	allow any named organ / cell allow turned into / stored as glycogen **but** do **not** allow hybrid spellings for glycogen allow increases respiration allow stored as / turned into fat	1
2(b)(i)	reference to "98.6% of all people who used Diacure reported an improvement in their condition."	allow claim **1** / **1** / the first one	1
2(b)(ii)	(only) 30 patients **or** not enough / not many patients	allow only one trial **or** only done once **or** not repeated ignore bias	1
2(b)(iii)	little effect / difference suggest drug is not effective (in long term)	allow no effect allow only drops by 4 (±1) allow wouldn't persuade people to take it	1 1
2(b)(iv)	avoid bias / owtte	eg company could change / ignore results / might lie ignore fair / accurate / reliable / valid	1
Total			**7**

4.2.2.3 Blood

Answer 04 · Mark scheme

COMPONENT NUMBER: BLY2H

COMPONENT NAME: Additional Science / Biology

STATUS: Final

DATE: January 2009

4.2.2.3 Blood

Answer 05 · Mark scheme

January 2009 | BLY3H | Original Q7 | Legacy

question	answers	extra information	mark
7(a)(i)	**A**		1
7(a)(ii)	(protein) molecule is large cannot pass through filter	ignore letters (protein is) too big to get through the filter = **2** marks	1 1
7(b)	**B** is taken back into the blood **or B** is reabsorbed reabsorbed completely **or** reabsorbed after filtration		1 1
7(c)	RBC is too big to pass through filter Haemoglobin is inside red blood cells **or** haemoglobin released when red blood cell bursts Haemoglobin is small enough to pass through filter **or** haemoglobin diameter < pore diameter		1 1 1
Total			**8**

4.2.2.3 Blood

Answer 05 · Mark scheme January 2009 | BLY3H | Original Q7 | Legacy

COMPONENT NUMBER: BLY3H

COMPONENT NAME: Biology

STATUS: Final

DATE: January 2009

Answer 06 · Mark scheme November 2009 | BLY1AP | Original Q2 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 07 · Mark scheme November 2009 | BLY1AP | Original Q8 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 08 · Mark scheme March 2010 | BLY1AP | Original Q3 | Legacy

Three	**3**	**4**	**4**	**1**

4.2.2.3 Blood

Answer 09 · Mark scheme

March 2010 | BLY1AP | Original Q9 | Legacy

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

4.2.2.3 Blood

Answer 10 · Mark scheme

January 2011 | BLY3H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	A		1
7(a)(ii)	(protein molecule is) too large to pass through the filter / cannot pass through the filter		1
7(b)	RBC is too big to / cannot pass through filter haemoglobin released when RBC bursts **or** haemoglobin inside RBC in a healthy person haemoglobin is small enough to / can pass through filter **or** haemoglobin diameter < pore diameter **or** haemoglobin only 5.5 nanometres		1 1 1
Total			**5**

4.2.2.3 Blood

Answer 11 · Mark scheme

June 2011 | BLY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3	(wbc) ingest / digest pathogens / bacteria / viruses	allow eat germs ignore swallow germs ignore ingest the disease ignore attack / kill the disease	1
	(wbc) produce antibodies		1
	(wbc) produce antitoxins		1
	any **one** from: • (antibodies) destroy or kill pathogens / bacteria / viruses / germs • (antitoxins) counteract / destroy /neutralise toxins / poisons • reasonable reference to memory cells **or** rapid production of antibodies upon re-infection	 ignore destroy / kill disease ignore attack / fight pathogens ignore attack / killing toxins	1
Total			**4**

4.2.2.3 Blood

Answer 11 · Mark scheme

June 2011 | BLY1H | Original Q3 | Legacy

BLY1H

4.2.2.3 Blood

Answer 12 · Mark scheme

June 2011 | BLY3H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	(protein molecules too) big **or** larger than pore size	allow cannot fit through the pores / hole / gaps	1
2(b)(i)	diffusion		1
2(b)(ii)	high to low concentration **or** high concentration in blood, low concentration in dialysis fluid **or** down concentration gradient **or** correct use of numbers	ignore along gradient / across gradient allow there is none in dialysis fluid	1
2(c)	any value between 3.15 and 3.25 (inclusive)		1
2(d)(i)	any **two** from: • kidney works all the time **or** dialysis works for short time **or** dialysis needs regular trips to hospital / regular treatment / long term treatment • kidney maintains correct concentration all the time **or** no build-up as between dialysis sessions • no need to regulate diet **or** correct example – eg low salt / low protein / low fluid intake as with dialysis • cheaper in the long term	ignore enables an active life accept kidney transplant is one off treatment	2

Question 2 continues on the next page

Question 2 continued

question	answers	extra information	mark
2(d)(ii)	any **two** from: • rejection / described **or** need to use immunosuppressants **or** need to take drugs for life • susceptible to other infections • hazards of operation / anaesthetic • shortage of donors / match • high initial cost	allow may need later replacement	2
Total			**8**

4.2.2.3 Blood

Answer 12 · Mark scheme

June 2011 | BLY3H | Original Q2 | Legacy

BLY3H

4.2.2.3 Blood

Answer 13 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)(i)	any **one** from: • (produce) toxins / poisons • (cause) damage to cells	 kill / destroy cells allow kills white blood cells	1
6(a)(ii)	produce antitoxins engulf / ingest / digest pathogens / viruses / bacteria / microorganisms	 accept phagocytosis or description ignore eat / consume / absorb for engulf ignore references to memory cells	1 1
6(b)(i)	dead / inactive / weakened (measles) pathogen / virus	accept idea of antigen / protein ignore bacteria	1 1
6(b)(ii)	(after infection) rise begins sooner / less lag time steeper / faster rise (in number) longer lasting **or** doesn't drop so quickly	accept converse if clearly referring to before vaccination idea of staying high for longer ignore reference to higher starting point	 1 1 1
6(b)(iii)	antibodies are specific or needs different antibodies	accept antigens are different **or** white blood cells do not recognise virus	1
6(c)	reduces spread of infection / less likely to get an epidemic	 accept idea of eradicating measles	1
Total			**10**

4.2.2.3 Blood

Answer 13 · Mark scheme January 2013 | BL1HP | Original Q6 | Legacy

BL1HP

Answer 14 · Mark scheme June 2014 | BL3HP | Original Q4 | Legacy

4(a)(i)	defence against **or** destroy pathogens / bacteria / viruses / microorganisms	do **not** allow 'destroy disease' accept engulf pathogen / bacteria / viruses / microorganism accept phagocytosis accept produce antibodies / antitoxins allow immune response	1	AO1 3.2.2d
4(a)(ii)	they are small fragments of cells		1	AO1 3.2.2e
4(b)	liver kidney(s)	in this order only	1 1	AO1 3.2.2b
4(c)	any **two** from: • that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells • whether it is a long lasting material / doesn't decompose / corrode / inert • if it is strong (to withstand pressure) • it will open at the right pressure • that it doesn't cause clotting • that it doesn't leak **or** it prevents backflow • non toxic	ignore correct size	2	AO3 3.2
Total			6	

4.2.2.3 Blood

Answer 14 · Mark scheme

June 2014 | BL3HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.2.2.3 Blood

Answer 15 · Mark scheme

June 2015 | BL3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	any **two** from: • carbon dioxide / CO_2 • urea • protein • water / H_2O • hormones / insulin	ignore food / waste / alcohol / drugs / enzymes ignore glucose and oxygen allow **two** correct hormones for 2 marks allow **two** correct food components for 2 marks allow antibodies allow antitoxins	2	AO1 321a,322b /c,331a
2(b)(i)	plasma platelets		1 1	AO1 322a
2(b)(ii)	(cardiac) muscle	allow muscular	1	AO1 321b

Question	Answers	Extra Information	Mark	AO / Spec. Ref
2(c)			6	AO3 32, 321f

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is a description of at least one advantage of the cow tissue valve **or** a description of at least one disadvantage of the cow tissue valve.	There is a description of at least one advantage of the cow tissue valve **and** at least one disadvantage of the cow tissue valve.	There is a description of the advantages and disadvantages of the cow tissue valve **or** a description of several advantages of the cow tissue valve and at least one disadvantage.

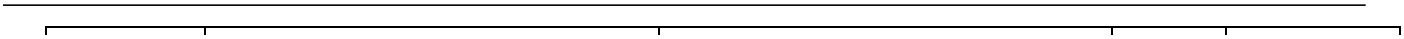
examples of the points made in the response	extra information
Advantages of cow tissue valve: • abundant supply of cows • so shorter waiting time • no need for tissue typing • quicker operation • less invasive **or** shorter recovery time • cheaper operation costs • less operation / anaesthetic risks	ignore information copied directly from the table without value added ignore can take many years to find a suitable human donor
Disadvantages of cow tissue valve: • made from cow so possible objections on religious grounds • new procedure so could be unknown risks • risks of using a stent eg. blood clots, stent breaking or valve tearing • not proven as a long term treatment • may be rejected	ignore ethical arguments allow possible transfer of disease from cow

Total		11

4.2.2.3 Blood

Answer 15 · Mark scheme

June 2015 | BL3HP | Original Q2 | Legacy



4.2.2.3 Blood

Answer 16 · Mark scheme

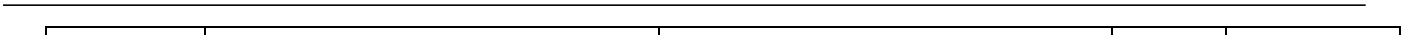
June 2017 | BL3HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	sugar / glucose / carbohydrate	allow correctly named sugars	1	AO1 3.1.1d/e
6(b)(i)	3:1	do **not** allow 1:3 ignore 112:38 / 56:19 allow 2.95:1 allow 2.9:1	1	AO2 3.1.1e
6(b)(ii)	concentration is (slightly) lower than the blood **or** concentration is 20 units less (than blood) the ratio of sodium (ions) to potassium (ions) is close to 2:1	 allow has high levels of sugar / substance X to keep blood sugar levels stable **or** for (more) energy	1 1	AO3 3.1.1e
6(b)(iii)	cells shrivel **/** shrink (because) cells lose water due to osmosis (of water) **or** diffusion (of water)	ignore reference to flaccid / plasmolysed allow crenated allow because there is a higher concentration <u>of water</u> in cells (compared to the sports drink)	1 1 1	AO2/3 3.1.1b
Total			7	

4.2.2.3 Blood

Answer 16 · Mark scheme

June 2017 | BL3HP | Original Q6 | Legacy



4.2.2.3 Blood

Answer 17 · Mark scheme

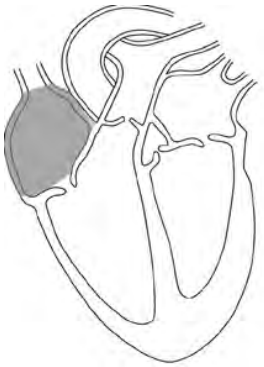
June 2018 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: • carbon dioxide • water • glucose • amino acids • lactic acid	allow proteins / hormones / antibodies / vitamins / minerals / ions / fatty acids / glycerol ignore sugar / enzymes / nutrients / waste	2	AO1 4.2.2.3
03.2	more haemoglobin (therefore) more oxygen can be carried / transported (for) more (aerobic) respiration of muscle (cells) **or** more energy released for muscle (cells)	**max 2** marks if 'more' is not given allow less anaerobic respiration / lactic acid / oxygen debt / fatigue in muscle (cells) ie addition of 'debt do **not** accept energy produced	1 1 1	AO1 4.2.2.3 4.4.2.2 AO2 4.2.2.3 4.4.2.2 AO1 4.2.2.3 4.4.2.2
03.3	pulmonary artery vena cava		1 1	AO1 4.2.2.2
03.4	B		1	AO1 4.2.2.2

4.2.2.3 Blood

Answer 17 · Mark scheme

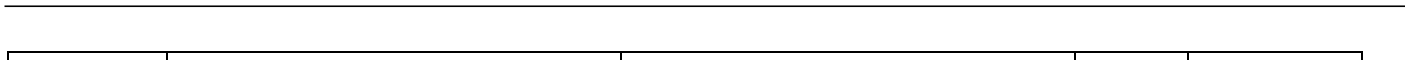
June 2018 | 8461/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	any **three** from: • arteries have a thick**er** layer of muscle (tissue) **or** veins have a thinn**er** layer of muscle (tissue) • arteries have a thick**er** layer of elastic tissue **or** veins have a thinn**er** layer of elastic tissue • arteries have a narrow**er** lumen **or** veins have a wid**er** lumen • arteries do not have valves **and** veins have valves	if neither marking points 1 or 2 awarded, allow arteries have a thick wall **and** veins have a thin wall **or** arteries have a thick**er** wall **or** veins have a thinn**er** wall for **1** mark do **not** accept 'cell wall' allow descriptions of 'lumen' allow **only** veins have valves	3	AO1 4.2.2.2
03.6	allow an X drawn anywhere in grey shaded area below: 	if a large X is drawn, award the mark if the intersection touches the grey area if a label line is used, award marks if the end of the label line touches the grey area allow label 'pacemaker' ignore label 'right atrium'	1	AO1 4.2.2.2
03.7	an irregular heart beat	allow arrhythmia allow fibrillation ignore heart failure do **not** accept cardiovascular disease / heart murmur	1	AO1 4.2.2.2
Total			**13**	

4.2.2.3 Blood

Answer 17 · Mark scheme

June 2018 | 8461/1H | Original Q3



4.2.2.3 Blood

Answer 18 · Mark scheme November 2021 | 8461/1H | Original Q1

01.1	any **two** from: • (microscope) slide • cover slip • dye / stain • (mounted) needle • pipette / dropper • scalpel • forceps / tweezers	allow named dye / stain ignore water ignore knife allow swab (to collect cells)	2	AO1 4.1.1.5 RPA1
01.2	eyepiece / lens	do **not** accept objective lens	1	AO1 4.1.1.5 RPA1
01.3	to focus (the image / cells)	allow to make the cells / image clear(er) allow to improve resolution (of the image) ignore to move the stage up / down do **not** accept reference to magnification	1	AO1 4.1.1.5 RPA1
01.4	any **one** from: • no cells in the field of view • slide not in the correct position • mirror not in correct position • (objective) lens not clicked into place **or** (objective) lens dirty • (student is) looking at a (large) air bubble • (the microscope is) not focussed	allow light / microscope not switched on / plugged in allow student did not stain the cells allow idea of magnification not being high enough	1	AO3 4.1.1.5 RPA1

01.5	**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	AO2
	Level 1: Relevant features are identified and differences noted.	1–3	AO1
	No relevant content	0	
	Indicative Content **Differences:** • red blood cell has no nucleus **or** plant cell has a nucleus • red blood cell has no cell wall **or** plant cell has a cell wall • red blood cell is a biconcave disc **or** there are many different shapes of plant cell • red blood cell contains haemoglobin **or** plant cells do not contain haemoglobin • red blood cells do not contain chlorophyll **or** plant cells (may) contain chlorophyll • red blood cell has no chloroplasts **or** plant cell has chloroplasts • red blood cell has no (permanent) vacuole **or** plant cell has (permanent) vacuole • red blood cells are (much) smaller than plant cells **Similarities:** both have: • cytoplasm • cell membrane • pigments (although they are different) ignore references to mitochondria and ribosomes for **Level 2**, consideration of both red blood cells and plant cells is required.		4.1.1.2 4.2.2.3

01.6	water enters (the cells) by osmosis / diffusion	allow water enters **and** the cell starts to swell ignore explanations of osmosis	1	AO2
	plant cell has a cell wall (which prevents it from bursting)	allow red blood cell has no cell wall (so it swells and bursts)	1	AO1 4.1.3.2 4.1.1.2
Total			**13**	

4.2.2.3 Blood

Answer 18 · Mark scheme

November 2021 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.2.2.3 Blood

Answer 19 · Mark scheme

November 2021 | 8461/1H | Original Q7

07.1	cells grow / divide abnormally / uncontrollably	ignore mutation	1	AO1 4.2.2.7

07.2	has spread to other parts / organs of the body **or** has spread to the liver / lung **or** has formed a secondary tumour	allow tumour has metastasised	1	AO2 4.2.2.7

07.3	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.2.2.3 4.3.1.6 4.4.2.1 4.4.2.2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content.	0	
	Indicative content: *Tiredness* • fewer red blood cells • so less haemoglobin • so less oxygen transported around the body • so less (aerobic) respiration can take place • so more anaerobic respiration takes place • less energy released for metabolic processes **or** less energy released so organs cannot function as well • lactic acid produced (during anaerobic respiration) causes muscle fatigue *Frequent infections* • fewer white blood cells / phagocytes / lymphocytes • so fewer antibodies produced **or** less phagocytosis • so fewer pathogens / bacteria / viruses killed *Bleeding* • fewer platelets • so blood does not clot as easily For **Level 3**, reference to all three symptoms must be made.		

07.4	anti-B antibodies in patient / receiver / recipient will bind to type B antigens on person's / donor's red blood cells		1	AO3
	(so) red blood cells clump together and are wider than capillaries **or** (so) red blood cells clump together and block capillaries	allow (so) red blood cells clump together and capillaries burst	1	AO3
	(so) cells have reduced supply of oxygen / glucose **or** (so) cells can't respire	ignore references to energy if no other mark awarded allow antibodies from patient and antigens from donor are matching / complementary shapes for **1** mark	1	AO2 4.2.2.3 4.3.1.6
07.5	no antigens (on type O red blood cells)		1	AO3 4.2.2.3 4.3.1.6
	(so) antibodies cannot bind (to the antigens / red blood cells)	allow no clumping (of red blood cells)	1	
07.6	hepatitis C infection		1	AO3 4.2.2.3 4.3.1.1
07.7	no / less bile reaches the small intestine	ignore less / no bile produced	1	AO3
	(so) less / no emulsification of fat	allow correct description of emulsification do **not** accept reference to chemical digestion	1	AO1
	(so) smaller surface area for lipase to break down fat		1	AO1
	pH of small intestine is not neutralised / alkaline	allow pH of small intestine is acid / low	1	AO2
	(so) lipase is not at its optimum pH to break down fat	pH (of small intestine) is not suitable for lipase to break down fat	1	AO2 4.2.2.1
Total			**19**	

4.2.2.3 Blood

Answer 20 · Mark scheme

November 2021 | 8461/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	mutation means less oxygen for (aerobic) respiration	allow haemoglobin **or** red blood cell carries oxygen for (aerobic) respiration do **not** accept no oxygen for respiration	1	AO2 4.6 4.6.1.5 4.2.2.3
08.2	4 ÷ 17 0.235(29...)	allow 4:13 allow 0.24 **or** 24% allow ratio 1 : 3.25	1 1	AO2 4.6.1.5 4.2.2.3
08.3	father / **8**'s gametes correct: $H^A + H^A$ mother / **9**'s gametes correct: $H^A + H^S$ correct derivation of offspring genotypes: H^AH^A H^AH^A H^AH^S H^AH^S correct phenotype for each derived genotype 0.25 / ¼ / 25% / 1 in 4 / 1:3	allow **1** mark for both sets of gametes if parents not identified allow correctly derived offspring genotypes from incorrect parental gametes allow **only** a probability consistent with student's derivations	1 1 1 1 1	AO2 AO2 AO2 AO2 AO3 4.6.1.6 4.6.1.7 4.6.1.8

4.2.2.3 Blood

Answer 20 · Mark scheme

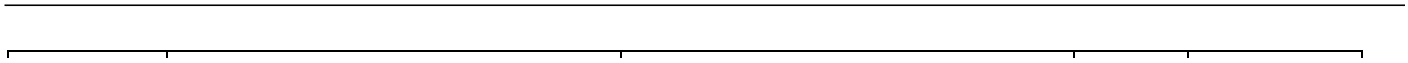
November 2021 | 8461/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **three** from: *points for:* • H^AH^S do not get malaria • H^AH^S survive sickle cell anaemia *points against:* • H^AH^A may die from malaria • H^SH^S may become (severely) ill with sickle cell anaemia • Judgement: if parents H^AH^S then some offspring survive both malaria and sickle cell anaemia **or** if parents H^AH^S then some offspring may become (severely) ill with malaria and some become (severely) ill with sickle cell anaemia	to gain full marks both point(s) for and point(s) against must be given	3	AO3 4.6.2.1
Total			**11**	

4.2.2.3 Blood

Answer 20 · Mark scheme

November 2021 | 8461/2H | Original Q8



4.2.2.3 Blood

Answer 21 · Mark scheme

June 2023 | 8461/1H | Original Q5

Question 5

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

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

4.2.2.3 Blood

Answer 21 · Mark scheme

June 2023 | 8461/1H | Original Q5

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

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

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

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

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

Total Question 5	15

4.2.2.3 Blood

Answer 22 · Mark scheme

June 2024 | 8461/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.1	penicillin	allow other named antibiotics ignore penicillium	1	AO1 4.3.1.3 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.2	the bacterium is killed (by antibiotic **C**)	allow there is a zone of inhibition (around antibiotic **C**)	1	AO2 4.3.1.8 4.1.1.6 RPA2
	if the bacterium was resistant, bacteria would be right up to the (edge of the) antibiotic disc	allow resistance means that the bacterium is not killed (by antibiotic(s)) allow if the bacterium was resistant there would be no zone of inhibition ignore no white area	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.3	any **two** from: • current / available antibiotics do not kill (certain) bacteria • diseases become more common **or** there will be some diseases that cannot be cured / treated • new antibiotics need to be developed which takes time / money	allow current / available antibiotics have no effect on (certain) bacteria ignore more people become ill allow some diseases become more difficult to treat	2	AO2 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.4	viruses **only** exist / reproduce inside (living) cells	allow viruses **need** (living) cells to exist / reproduce allow viruses exist / reproduce inside (living) cells **and** agar is not made of cells ignore names of cell types	1	AO2 4.3.1.8 4.3.1.1

4.2.2.3 Blood

Answer 22 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.5	(these) drugs (can) damage (body) cells / tissues **or** it is hard to get (these) drugs into (living) cells	allow viruses often / frequently mutate (giving resistance to these drugs)	1	AO1 4.3.1.8

Question	Answers	Extra information	Mark	AO / Spec Ref.
06.6	AIDS		1	AO1 4.3.1.2

Total Question 6	8

4.2.2.3 Blood

Answer 23 · Mark scheme

June 2025 | 8461/1H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.1	(to) transport / carry hormones / antibodies / proteins / ions / enzymes / urea / glucose / carbon dioxide	allow (to) transport / carry other correctly named substances allow (to) transport / carry platelets ignore nutrients / waste / oxygen	1	AO1 4.2.2.3

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.2	*recall of equation* magnification = $\frac{\text{size of image}}{\text{size of real object}}$	allow magnification = $\frac{\text{diameter of image}}{\text{diameter of real object}}$ ignore use of equation triangle	1	AO1
	rearrangement of equation size of real object = $\frac{\text{size of image}}{\text{magnification}}$	allow diameter of real object = $\frac{\text{diameter of image}}{\text{magnification}}$	1	AO2
	substitution $\frac{6.3}{7200}$	allow substitution of incorrectly converted value	1	AO2
	0.000875 (cm)	allow answer using incorrectly converted value	1	AO2
	conversion 8.75 (µm)	allow 8.8 (µm) allow conversion to µm at any stage ignore further rounding	1	AO2 4.1.1.5

4.2.2.3 Blood

Answer 23 · Mark scheme

June 2025 | 8461/1H | Original Q5

Question	Answers	Mark	AO / Spec Ref.
05.3	<table><tr><th>Pressure of blood travelling through vessel in arbitrary units</th><th>Blood vessel in Figure X</th></tr><tr><td></td><td></td></tr><tr><td>5</td><td>A</td></tr><tr><td>18</td><td>B</td></tr><tr><td>120</td><td>C</td></tr></table> allow **1** mark for 1 or 2 correct answers ignore names of blood vessels	2	AO3 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.4	pulmonary vein		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.5	thick elastic / muscle (layer)	ignore thick wall unqualified do **not** accept reference to cell walls ignore has no valves	1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.6	less energy released / transferred (per molecule of glucose)	allow more molecules of glucose need to be broken down to release / transfer equivalent energy do **not** accept less energy produced / made / created do **not** accept no energy released do **not** accept less energy released for respiration	1	AO1 4.4.2.1
	(due to) incomplete breakdown / oxidation of glucose	allow glucose **only** broken down to lactic acid	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.7	(the athlete has an) <u>oxygen debt</u> (so more) oxygen is required to oxidise lactic acid	allow the lactic acid concentration is high allow (so more) oxygen is required to remove lactic acid allow (so more) oxygen is required to break down lactic acid ignore reference to oxygen being used to convert lactic acid back to glucose (in the liver) ignore reference to liver as the site of lactic acid oxidation	1 1	AO2 4.4.2.1 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.8	(there is) more haemoglobin so more oxygen (carried **/** bound) (athlete can do) more <u>aerobic</u> respiration to transfer / release (more) energy **or** (athlete can do) more <u>aerobic</u> respiration so less muscle fatigue / cramp	allow more oxyhaemoglobin (is formed) allow (athlete will do) less <u>anaerobic</u> respiration which transfers / releases less energy allow (athlete will do) less <u>anaerobic</u> respiration which would (otherwise) result in muscle fatigue / cramp do **not** accept (athlete can do) more anaerobic respiration do **not** accept energy produced / made / created do **not** accept energy released for respiration	1 1	AO2 4.4.2.1 4.2.2.3

Total Question 5	16

Answer 24 · Mark scheme

June 2025 | 8461/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.1	(stem cells) can differentiate into any type of cell	allow (stem cells) can differentiate into liver cells ignore specialisation	1	AO1 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.2	any **one** from: • (it is) destroying a (potential) life / embryo • embryo cannot give consent • (against) religious / cultural / personal beliefs	allow the embryo does not have a choice allow against (someone's) faith ignore against God's will ignore religion unqualified	1	AO2 4.1.3.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.3	**A** = lymphocyte (specific to the antigen) **B** = tumour (cell) **C** = hybridoma	ignore white blood cell allow myeloma allow other specific types of tumour (cell) ignore cancer (cell)	1 1 1	AO2 4.3.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.4	(the mouse is) injected with (liver) antigens	allow (by) injecting (the mouse) with liver cells do **not** accept (by) injecting (the mouse) with a pathogen	1	AO2 4.3.2.1

4.2.2.3 Blood

Answer 24 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.5	monoclonal antibodies bind to (liver) antigens / cells	allow drug sticks to (liver) antigens / cells	1	AO2 4.2.2.3 4.3.1.6
	(because) monoclonal antibodies are complementary (in shape) to (liver) antigen	allow description of complementarity ignore reference to specificity do **not** accept (because) monoclonal antibodies are the same shape as (liver) antigen	1	4.3.2.1 4.3.3.2
	(so) antibodies released by white blood cells cannot bind to (liver) antigens / cells	allow (so) antibodies released by lymphocytes cannot bind to (liver) antigens / cells allow (so) phagocytes are unable to identify / detect cells to engulf do **not** accept (so) antibodies released by phagocytes cannot bind to liver antigens / cells	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.6	any **one** from: • tests to detect pathogens	allow COVID tests **or** lateral flow tests **or** LFTs	1	AO1 4.3.2.2
	• tests to detect hormones / chemicals / drugs • to locate / identify (specific) molecules in a cell / tissue • to locate / detect cancer (cells) • to deliver (toxic) chemicals / drugs to cells	allow chemotherapy / immunotherapy allow to treat named disease ignore to diagnose / treat disease unqualified		

Question	Answers	Extra information	Mark	AO / Spec Ref.
07.7	gall bladder		1	AO1 4.2.2.1

4.2.2.3 Blood

Answer 24 · Mark scheme

Question	Answers	Mark	AO / Spec Ref.
07.8	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3-4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2	AO1
	No relevant content.	0	4.2.2.1
	Indicative content • less / no bile produced (by liver) so less / no emulsification of fats o (so) fats not made into small(er) droplets o (so) surface area (of fat) not increased o (so) lipase cannot digest fat as quickly / much (due to smaller surface area) • less / no bile produced (by liver) so acid not neutralised o (because) bile is alkaline o (so) lipase **or** small intestine not at optimum pH o (so) lipase denatures o (so) lipase cannot digest fat as quickly / much (due to reduced / incorrect pH) For **Level 3**, there must be consideration of the effect on lipase activity and on both emulsification **and** the effects of pH.		

Total Question 7	17

Answer 25 · Mark scheme

June 2025 | 8461/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1		allow converse allow answers in terms of likelihood of having / getting (Type 2) diabetes		AO3 4.5.3.2
	(percentage of people with Type 2) diabetes increases with age	allow more old people have (Type 2) diabetes	1	
	(percentage of people with Type 2) diabetes increases with increased (body) mass / weight	allow more obese people have (Type 2) diabetes allow (percentage of people with type 2) diabetes increases with obesity	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	7.65%		1	AO3 4.3.1.9 4.5.3.2

Question	Answers	Mark	AO / Spec. Ref.
09.3	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.3.1.9 4.5.3.2
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	

	Indicative content allow 'investigation 1' for drug **A** and 'investigation 2' for drug **B** throughout **Methods** *Methods are not comparable because:* • different methods are used to administer the drugs - injection (drug **A**) and pill (drug **B**) **or** drug **A** acts more quickly (than drug **B**) • dosage for drug **A** and drug **B** might differ (as dosage is not stated) • drug **A** and drug **B** are tested for different time periods **or B** is given for a longer period (24 weeks) (than **A** - 12 weeks) • placebo / control only included when testing drug **B** • only drug **B** has intermediate readings **or** fewer readings were taken when testing drug **A** • different sample sizes were used **or** greater sample size used when testing drug **B** (**A** = 175, **B** = 631 / 1261) • different scientists carried out each investigation • no double-blind trial for drug **A** *Methods may be similar because:* • neither drug trial was double-blind • quantitative tests in both trials • (relatively) large sample size used for both drugs **Usefulness of drug A and drug B** allow 'blood glucose' for Hb-G throughout o both lower Hb-G (levels) o both lower Hb-G to similar levels o drug **A** reduced Hb-G more than drug **B** o neither drug reduced Hb-G to an acceptable value (<7%) o Hb-G increases after 18 weeks with drug **B** o no information on side effects for either drug o no information on the trend for drug **A** For **Level 1**, details about the method **or** usefulness of the drugs must be given. For **Level 3**, details about the method **and** usefulness of the drugs must be given.		

Total Question 9	**9**

4.2.2.3 Blood

Answer 17 · Examiner comments

June 2018 | 8461/1H | Original Q3

Question 3 (standard & standard / high demand)

03.1 72% of students achieved at least one of these marks and many gained both, commonly giving two out of carbon dioxide, water and glucose. However, many students did not distinguish between substances, as required by the question, and various blood cell types were given, which were not acceptable.

03.2 There were two common omissions in answers. Firstly, many students omitted any reference to haemoglobin. Secondly many students did not link the increased oxygen supply to muscle cells, which would be needed by the athlete; and instead just indicated increased oxygen in the body, generally.

A significant minority of students referred to energy being made, created or produced, which will always disqualify otherwise correct answers.

4.2.2.3 Blood

Answer 17 · Examiner comments

03.3 The most common error was to identify the pulmonary vein, rather than the pulmonary artery as carrying deoxygenated blood. Most students achieved at least one mark by identifying vena cava.

03.4 The correct answer 'B' was most commonly given, but the other two alternatives were occasionally seen.

03.5 This question asked for a comparison between an artery and a vein. Many students wrote about arteries and veins but did not make clear comparisons between them. Most marks were awarded for the alternate answer describing the walls of arteries as being thick(er) and the thin(ner) walls of veins. Very few students referred to the relative thicknesses of the elastic or muscle layers of the vessels.

Students who did not achieve marks often correctly stated that veins contain valves but made no further comparative statement about the lack of them in arteries. The difference in the size of the respective lumens was expressed in numerous ways; however thick or thin were terms not accepted as they don't describe the relative size of the lumens themselves.

This question would lend itself to a tabulated response thus ensuring a comparison for all answers was given but very few students took this route. Some students lost marks by referring to the cell walls of blood vessels which is clearly incorrect.

03.6 Most students added an X to the figure, but relatively few students (34%) achieved the mark. It appeared that despite efforts to clearly indicate where questions are being asked or instructions given, some students only respond when there are lines to write answers on.

03.7 There were many references to indeterminate cardiovascular diseases, with relatively few students (34%) knowing what a pacemaker is used to treat.

4.2.2.3 Blood

Answer 18 · Examiner comments

November 2021 | 8461/1H | Original Q1

Question 1 (standard demand)

A lack of correct terminology was seen throughout Question 1. Many students were confused over the apparatus used in the Required Practical Activity (RPA) assessed in **01.1** and the RPA on microbial growth. Unrelated equipment given as an answer included a spatula, microwave and petri dish and a number of students gave answers such as microscope, stage and objective lens, indicating that they had not read the question correctly.

Commonly, weak descriptions of the idea of focussing were given in **01.3**, with many students referring incorrectly to magnification, or more commonly, 'zoom'.

In **01.5**, most students were able to state some of the structures of a red blood cell and a plant cell, and some students were able to make comparisons between the two. Few students included similarities in their comparisons and several were confused about the different blood components, stating that red blood cells contain platelets, plasma and nuclei.

Confusion about the function of the cell wall was seen in **01.6**. Many students thought that the cell wall stops the movement of water into the cell and hence, this is the reason why the cell placed in water did not burst. Several students also thought that the plant cell already had lots of water inside of it and so would not take any additional water in, and therefore, would not burst.

4.2.2.3 Blood

Answer 19 · Examiner comments

November 2021 | 8461/1H | Original Q7

Question 7 (standard, standard/high & high demand)

In **07.4** and **07.5**, many students had not read the stem of the question in detail and therefore gave ideas about the donor transferring antibodies to the patient. In **07.5**, several students stated that the red blood cells do not have a specific antigen 'shape' so therefore all of the antibodies can fit and bind.

In **07.7**, most students were able to describe the function of bile as an emulsifier, and many students gave long explanations of how bile works, however, they did not link this to a lack of bile and why this would cause difficulty digesting fat.

This question highlighted several misconceptions in this area. Some students thought that fat, lipase or food molecules pass through the bile duct and that big molecules of fat would not fit past the blockage. Some students stated that bile is an enzyme and were confused over the difference between lipase and bile, often thinking that they are one in the same.

Concluding Remarks

The standard of responses seen in this paper was lower than in previous years. Students generally scored well on simple recall of knowledge questions (AO1) and questions on the topic of cell structure were generally well answered. Some students were able to apply their knowledge effectively in straightforward questions (AO2), but many found application of knowledge to new situations more difficult. There was indication that many students had not carried out the Required Practical Activities assessed throughout the paper. Many student's understanding of the structure and function of plant tissues was limited and a lack of clear knowledge meant that some students did not articulate themselves well throughout the paper. Generally, students scored well on the mathematical skills, however, a lack of precision when reading data from graphs was common.

4.2.2.3 Blood

Answer 19 · Examiner comments

Mark Ranges and Award of Grades

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

4.2.2.3 Blood

Answer 20 · Examiner comments November 2021 | 8461/2H | Original Q8

Question 8 (standard/high & high demand)

This question was about the inheritance of sickle cell anaemia and its effects. Answers to **08.1** were generally insufficient. Many students knew that a mutation in the haemoglobin gene could result in less oxygen being transported around the body (although some stated this would 'affect' the amount of oxygen), but hardly any went on to explain that this would mean a lower level of respiration.

Calculations in **08.2** were weak. Some students did not count the number of normal and sickled cells in Figure 13. Many did not understand the difference between the ratio 4:13 and the fraction $\frac{4}{13}$. Many did not go on to convert the correct fraction $\frac{4}{17}$ to a decimal (0.24) or to a percentage (24%). Some students, having worked out a percentage, did not include the % symbol in their answer, thus giving an incorrect proportion of '24'. Thus few students scored both marks.

08.3 was a construction of a Punnett square to determine the probability that certain parents from the family pedigree diagram would produce a child with sickle cell trait, followed by multiplication by ½ to find the probability that this child would be female. A very small proportion of students was completely successful. Errors included assigning the same genotype to parents who had different phenotypes, not stating which gametes came from which parent, not identifying the phenotypes of the offspring genotypes and not dividing the probability from the Punnett square by 2 to allow for the biological sex specified in the question. A few students showed the offspring as being haploid even though each was derived from two haploid gametes.

In **08.4**, students had difficulty in applying information from various other parts of question 8 to evaluate the scientist's statement about the advantage of having the H^S allele in countries where malaria occurs. Around 96% of studebts did not discuss the effects of sickle cell anaemia and malaria on people of different stated genotype and thus scored no marks.

Answer 21 · Examiner comments June 2023 | 8461/1H | Original Q5

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

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

4.2.2.3 Blood

Answer 21 · Examiner comments

June 2023 | 8461/1H | Original Q5

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

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

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

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

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

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

4.2.2.3 Blood

Answer 22 · Examiner comments

June 2024 | 8461/1H | Original Q6

Question 6 (standard, standard/high demand and high demand)

06.1 83% of students were able to name an appropriate antibiotic. Commonly seen incorrect answers included aspirin, ibuprofen and paracetamol.

06.2 65% of students scored one mark on this question, with the majority achieving the first marking point. 6% of students scored two marks.

The vast majority of responses referenced a zone of inhibition, rather than a description of an area where the bacteria had been killed, both of which were creditworthy. However, references to a 'clear' or 'white' area were not. A number of students missed out on the mark, however, for offering vague references to bacteria 'not growing' rather than describing the effect the antibiotic had on them. For marking point 2, the majority of students went on to simply repeat what they had said for marking point 1 in a different way; that because the bacteria were killed, or because there was a zone of inhibition, they cannot be resistant, rather than what would happen if the bacteria *were* resistant. Frequently, reference to the antibiotic being resistant was seen.

06.3 74% of students scored zero marks on this question, largely due to not accurately articulating their ideas. The most commonly seen response related to marking point 3, regarding the difficulty of developing new antibiotics in terms of cost or time, with nearly a quarter of students achieving one mark. Some students began a sentence about the difficulty of developing new antibiotics, but offered no further clarification and therefore could not be awarded a mark. For marking point 2, many students began to try to express the idea that diseases would become more common and/or diseases would be more difficult to treat. However, they struggled to articulate themselves in a way that was creditworthy, with the emphasis on (individual) illnesses or infection, rather than diseases generally.

06.4 36% of students were awarded the mark in this question. The majority of students were aware that viruses only exist inside living cells although many had difficulty expressing this clearly enough to gain the mark. The most commonly seen correct response referred to viruses needing cells to reproduce, rather than viruses *only* reproducing inside cells.

06.5 43% of students achieved the mark in this question. A significant number of students understood that drugs used to destroy viruses would also damage the body cells, with vastly fewer recognising that it was hard to get these drugs into cells. Those who did not gain credit for this idea often stated that 'antibiotics only kill bacteria', 'viruses are small, so are difficult to find' or 'it is hard/expensive to research and develop new drugs'.

Those student who referenced mutation usually did not gain credit because they described viruses mutating 'more' or 'faster', rather than frequently. Often, students used the term 'they' in their answer as referring to 'the drugs', when in fact 'they', in the context of the question, refers to 'the scientists'. Students should be encouraged to look at the subject of the question before answering in terms of 'they' or 'it' for example, or better still, not use such terms in their answer.

06.6 84% of students correctly identified AIDS as a viral disease that damages white blood cells.

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4.2.2.3 Blood

Answer 23 · Examiner comments

June 2025 | 8461/1H | Original Q5

Question 5 (standard/high demand and high demand)

05.1 This question was generally well answered with 63% of students achieving the mark. Some students gave vague answers such as 'nutrients', 'waste' or 'carbohydrates', which were not credited due to a lack of specificity. These responses suggested a partial understanding but missed the precision required by the mark scheme. It was surprising to see a large number of students describing blood clotting, possibly confusing the word 'plasma' with 'platelets.

05.2 This question required students to recall and apply the magnification formula, including rearranging it, substituting values and performing unit conversions. Most students were able to correctly recall the full magnification equation rather than relying on symbols or triangle methods, which were not creditworthy. However, a common source of error was an incorrect rearrangement of the equation when solving for actual size. Additionally, a significant number of students struggled with unit conversion. While many recognised that 1 mm = 1000 µm, they often overlooked the need to first convert from centimetres to millimetres, leading to errors in the final answer. Despite this, many students made a good attempt (59% gained full marks and a further 32% achieved 4 marks), and it was encouraging to see clear working and structure in students' responses. Students should be reminded not to round their answers to calculation questions too early on in their working; as a number of students did so in this question, leading to an incorrect final answer.

05.3 Students were presented with a diagram of the heart showing four labelled blood vessels and were required to match labels to a pressure value. Most students were able to correctly identify that blood leaves the heart at high pressure and returns at lower pressure. Some also recognised that pressure in the pulmonary circulation is lower than in the systemic circulation. Where students had a secure understanding of the circulatory system, they were able to apply this knowledge effectively to select the correct values, with 66% achieving full marks, and 22% achieving 1 mark.

4.2.2.3 Blood

Answer 23 · Examiner comments

June 2025 | 8461/1H | Original Q5

05.4 68% of students were able to identify vessel D as the pulmonary vein, suggesting a strong familiarity with the structure and function of the heart. Where errors occurred, they were often due to confusing the pulmonary vein with the aorta, with errors in both the side of the heart and the direction of blood flow.

05.5 This was a generally well-answered question, with 62% of students correctly describing artery walls as thick, muscular and / or elastic. A small number of students referred instead to the size of the lumen or the pressure of the blood, which did not gain credit as the question asked specifically about the structure of the wall.

05.6 63% of students scored no marks in this question, with the majority misunderstanding what was being asked of them, often describing the disadvantages of anaerobic respiration, rather than the efficiency. Therefore, those students who only referred to the production of lactic acid and its effects did not answer the question and so could not gain credit for this knowledge. Students who went into all the detail they knew regarding the comparison of aerobic and anaerobic respiration frequently gained the first mark (26%), as irrelevant information was ignored. Only 10% of students were able to access the second mark, realising that the word 'only', was critical to this approach. A number of students continue to refer to energy production or generation and some other common misconceptions seen included:

- aerobic respiration being quicker than anaerobic
- anaerobic respiration using more energy than aerobic
- removal of lactic acid requiring energy (and so anaerobic respiration being less efficient).

05.7 Most students who gained the first mark in this question did so by referring to 'oxygen debt'. 45% of students achieved 1 mark. Describing the presence of lactic acid in the blood was insufficient for this mark, as the figure shows there was always some lactic acid present. A number of students could link the concept of oxygen debt to this question but gave further explanatory detail showing that they did not understand what it meant, for example, incorrect ideas such as 'oxygen was used in the oxygen debt', 'the body needs an oxygen debt' and 'the oxygen debt is still required'. 34% of students scored full marks with the second marking point being more difficult to access for many, with some of these displaying a misunderstanding of the concepts described in the specification; in that oxygen is used to 'remove' or 'break down' lactic acid but is not used directly to rebuild lactic acid into glucose. A number of published texts only add to the confusion around this concept; the conversion of lactic acid back to glucose is an oxidation reaction (loss of electrons), but it does not require oxygen directly. Vague descriptions such as 'oxygen flushing out the lactic acid', 'limiting the effects of lactic acid' or 'neutralising the lactic acid' were insufficient. Some students thought that the body needed to aerobically respire in order to break down the lactic acid.

05.8 The answers from many students (58%) lacked the detail required to gain either mark, although it was clear that many of these students understood the overall advantage to some athletes of having a high number of red blood cells. Those students who did not gain credit often referred to the increased number of red blood cells being able to

4.2.2.3 Blood

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carry more oxygen to the muscles in order for more respiration to take place to release energy.
These students had omitted reference to haemoglobin (for MP1) or to 'aerobic' or 'anaerobic' respiration (for MP2) and should be reminded to include all the relevant detail they have learned when answering any question.
Fewer students than in the past, now refer incorrectly to energy being 'produced' or to energy being used 'for' respiration, although a significant minority still do. Some students also think that oxygen binds to red blood cells to form haemoglobin.

4.2.2.3 Blood

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Question 7 (standard, standard/high demand and high demand)

07.1 Nearly 60% of students were able to use the correct terminology to achieve the mark in this question. Common incorrect answers included referring to the process of differentiation as 'specialisation' or describing undifferentiated cells turning into specialised cells.

07.2 47% of students achieved the mark in this question, with the most common correct answer being the idea of embryos or a potential life being destroyed or killed. A smaller proportion of students achieved credit for the idea that embryos are unable to give consent but very few were able to articulate ideas about beliefs clearly enough to be awarded the third bullet point in the mark scheme. Incorrect responses were often less biological or were emotive in nature e.g. 'it's murder', 'a baby is killed', 'embryos are a potential life', and 'it would have grown into a baby', that did not answer the question.

07.3 62% of students scored full marks in this question, with a further 17% scoring 2 marks, and 9% scoring 1 mark. The majority were able to identify and spell hybridoma (for MP3) correctly, but credit could not be awarded for reference to cancer, rather than tumour cell (for MP2), and white blood cell rather than lymphocyte (for MP1). A small number of students incorrectly named cell A as 'spleen cell' and cell B as a dead or weakened pathogen.

07.4 42% of students scored the mark for this question with most referring to injection of antigens rather than liver cells. Incorrect answers were almost always related to injecting the mouse with a pathogen or disease, confusing this context with that of vaccination against infectious disease.

07.5 Around 30% of students scored a mark on this question with only 11% scoring 2 marks and 1% scoring full marks. MP1 was most frequently scored, with the statement that monoclonal antibodies bind to antigens (on liver cells). A common incorrect response was that the monoclonal antibody would bind to white blood cells to stop them rejecting the liver cells. MP3 was scored infrequently, mostly with the idea that antibodies made by the patient's white blood cells would be blocked from binding to the liver antigens, after MP1 had already been scored. A few students did correctly describe that phagocytes could not detect the liver cells as the monoclonal antibodies

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were bound to the antigens on their surface. MP2 was very rarely scored. Whilst most students had attempted this question using some correct terminology, the responses were often confused and either showed that the information provided in the stem of the question had not been used, or that the student had misunderstood the nature of the monoclonal antibody treatment for liver disease. It was very common to see the idea that if the monoclonal antibody was bound to the liver cell antigens, that the white blood cells would not produce antibodies at all.

07.6 This question was well-answered by most students with 67% scoring the mark. A range of answers was seen, although responses relating to cancer detection and treatment were most common. Drug and COVID testing were also seen frequently. Most incorrect answers were due to students not fully qualifying their responses for example 'treat diseases' or 'fighting cancer'.

07.8 This was a levelled response question about the function of the liver during liver failure. The majority of students attempted the question, but 43% of students achieved no marks. Level 2 responses were the most common with 24% of students achieving marks. 11% of students achieved Level 3 and 20% Level 1. The majority of Level 2 responses that did not match the criteria for Level 3, were due to an omission to refer to the role of lipase, or to distinguish that the rate of breakdown of fats would be slow*er* with liver disease. In addition, students were limited to Level 2 if they only described the effect on emulsification **or** on the neutralisation of acid.

In Level 1, the majority of students did not develop their answers, scoring 1 mark for reference to the effect on emulsification and neutralisation, but with no further detail, or scoring 2 marks for a linked idea about either emulsification or neutralisation. Common misconceptions included lipase being made in the stomach, fat *molecules* being broken down by the process of emulsification (rather than by lipase action), the liver producing lipase and bile neutralising acid in the stomach. Other incorrect answers included the idea that there would be no digestion of fat without bile, that lipase is found within bile, that bile is an enzyme and that lipase engulfs fats. The context of many students' responses related to the usual role of bile in a healthy liver, whilst mentioning less bile production in patients with liver disease. Some students scored no marks for this approach as they did not reference the disease causing less bile production, or said that the patient had *difficulty* producing bile, which was not creditworthy. Occasionally, some students did not mention bile at all, despite it being in the stem of the question. A few students thought that the diseased liver would stop producing enzymes or lipase which is why digestion of fat was difficult.

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Question 9 (Standard, Standard/high and High demand)

09.1

This question required students to provide two conclusions about the percentage of people with Type 2 diabetes, from data provided in the form of a bar chart. Two thirds of students scored 2 marks on this question.

Referring to 'diabetes' was sufficient for credit to be awarded, although 'it' was insufficiently clear without some qualification. Any student referring to Type 1 diabetes could not gain credit, but this was extremely rare.

Most students gained at least one mark, with nearly all describing the effect of age on the prevalence of Type 2 diabetes. This could be phrased in terms of an overall trend or a

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description of one or other end of the age range. Some students referred to both ends of the age range as their two conclusions but could only be awarded one mark.

Descriptions of the effect of body weight on the prevalence of diabetes proved to be a little more problematic, with some suggesting that 'overweight people' have the highest percentage of diabetes; unfortunately, these students had not used the key sufficiently well, as 'overweight' was the middle category of body weight. Hence, students who described one or other end of the body weight scale were most successful, with answers such as 'diabetes is more common in obese people'.

Some students were confused by the information and wrote about the effect of age on body weight, 'people get more obese as they get older', which was not supported by the information and gained no credit. Other students attempted to describe both trends in one statement, often not clearly describing either trend.

09.2

Two thirds of students correctly identified the mean percentage of Hb-G after 12 weeks as being 7.65%

09.3

Around a third of students did not gain any marks in this extended response question. For credit, students were required to analyse information about two clinical studies on diabetes treatments. Students were expected to evaluate both the methods used and the effectiveness of the treatments in detail to be awarded a mark in Level 3 – achieved by just 20% of students.

The high demand of this question meant that a single statement for each of the usefulness of the drugs and the methods used was insufficient to access the lower mark in Level 1.

Many students did attempt to compare the usefulness of the drugs, with answers such as 'both drugs lower Hb-G levels', which even if seen in reference to the two drugs in statements well apart in the response, were still credited. Furthermore, a correct comparison of the relative impact of the two drugs in lowering Hb-G levels could gain credit for both drugs lowering Hb-G levels and for drug A having a greater effectiveness in this respect. However, many students referred only to the drugs 'changing Hb-G levels' or even for 'drug A changing Hb-G levels more than drug B' and could not gain credit for either of these statements.

In terms of comparing the methods used in the investigations, many students simply restated the methods or suggested alternative methods, such as 'investigation 1 should have used a placebo' which was not a clear comparison of the methods and gained no credit.

Some students were confused by the numbers of patients involved in Investigation 2, believing that only 1 patient had taken the drug, and 630 patients had been given the placebo.

Students should practise questions of this type in their studies and revision, as the command word 'evaluate' was not well understood in many cases. This requires students to make comparisons; in this case of the two investigations.

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Mark Ranges and Award of Grades

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