AQA GCSE Biology | 8461

SPECIFICATION POINT 4.2.2.2

The heart and blood vessels

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**16**
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.

4.2.2.2 The heart and blood vessels

Answer 01 · Mark scheme January 2008 | BLY3H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
(a)	any **three** from: • rose <u>rapidly</u> (during exercise) / use of approximate figures • then more slowly (during exercise) • to max 126 / at 5 minutes / end of exercise • <u>rapid</u> fall (during recovery) **or** use of approximate numbers • then less rapid fall / use of approximate numbers • returned to resting rate (60 bpm) by 11 minutes	accept rate (of increase) slows down	3
(b)	arteries dilate / widen	accept muscle in wall relaxes	1
(c)	any **four** from: • muscles using more energy **or** more energy released • muscles <u>respire</u> faster • supply more oxygen • supply more glucose / sugar • remove more CO_2 • remove lactic acid • remove heat / to cool	do **not** accept energy produced allow for aerobic respiration **or** to prevent anaerobic respiration 'more' needed ONCE only for full marks	4
total			8

4.2.2.2 The heart and blood vessels

Answer 01 · Mark scheme

January 2008 | BLY3H | Original Q4 | Legacy

BLY3H

4.2.2.2 The heart and blood vessels

Answer 02 · Mark scheme

June 2009 | BLY3H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	A	no mark – can be specified in reason part if B given = no marks throughout if unspecified plus two good reasons = 1 mark	
	high(er) pressure in A	allow opposite for B do not accept 'zero pressure' for B	1
	pulse / described in A	accept fluctuates / 'changes' allow reference to beats / beating ignore reference to artery pumping	1
1(b)(i)	17		1
1(b)(ii)	68	accept correct answer from candidate's (b)(i) x 4	1
1(c)(i)	oxygen / oxygenated blood	allow adrenaline ignore air	1
	glucose / sugar	extra wrong answer cancels eg sucrose / starch / glycogen / glucagon / water allow fructose as an alternative to glucose ignore energy ignore food	1

Question 1 continues on the next page…

4.2.2.2 The heart and blood vessels

Answer 02 · Mark scheme

BLY3H

Question 1 Continued

question	answers	extra information	mark
1(c)(ii)	carbon dioxide / CO_2 / lactic acid	allow CO2 / CO^2 ignore water	1
Total			**7**

4.2.2.2 The heart and blood vessels

Answer 02 · Mark scheme

June 2009 | BLY3H | Original Q1 | Legacy

BLY3H

4.2.2.2 The heart and blood vessels

Answer 03 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	B **or** D		1
1(a)(ii)	A **or** B		1
1(b)	any **four** from: • increased blood (flow) • (more) oxygen supplied **or** aerobic respiration • (more) glucose / sugar / food supplied • (higher rate of) respiration • (more) energy needed / released • (more) carbon dioxide <u>removed</u> • (muscles) doing (more) work **or** muscles contracting • remove heat / cooling • remove lactic acid **or** less lactic acid formed	more / faster must be implied at least once for full marks ignore reference to breathing allow less anaerobic (respiration) **or** and prevents oxygen debt ignore feeding allow made	4
Total			**6**

4.2.2.2 The heart and blood vessels

Answer 03 · Mark scheme

January 2010 | BLY3H | Original Q1 | Legacy

BLY3H

4.2.2.2 The heart and blood vessels

Answer 04 · Mark scheme

January 2013 | BL1HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4		ignore descriptions of LDL levels	
	A + B most effective (treatment)		1
	D is (the most) effective (treatment)	D is the best single (treatment)	1
	neither A nor B (alone) are effective	allow increase risk of heart disease instead of not effective	1
	can't tell if C is effective		1
	OR		
	A + C is not effective		
Total			**4**

4.2.2.2 The heart and blood vessels

Answer 04 · Mark scheme

January 2013 | BL1HP | Original Q4 | Legacy

BL1HP

4.2.2.2 The heart and blood vessels

Answer 05 · Mark scheme

Question 1

question	Answers	extra information	mark
1(a)	A aorta B ventricle C atrium D vena cava	ignore left and right allow atria 	1 1 1 1
1(b)(i)	(coronary) artery	allow arteriole	1
1(b)(ii)	stent / description	accept (coronary) by-pass operation allow statins allow diets low in cholesterol allow balloon (angioplasty)	1
1(b)(iii)	(stent) keeps artery open **or** (by-pass) new blood vessel / vein connecting around narrowed region; **or** (statins / low cholesterol diet) remove some of the cholesterol blockage **or** (balloon) widens / opens the blood vessel which allows (more) blood through or allows blood to go around the blockage	must relate to (b)(ii) ignore reference to capillary / vein	1 1

Question 1 continues on the next page . . .

Question 1 continued

question	Answers	extra information	mark
1(c)(i)	F artery	accept arteriole / branch of pulmonary artery	1
	G capillary		1
	H vein	H accept venule / branch of pulmonary vein;	1
1(c)(ii)	F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose/sugar	accept F (Pulmonary artery) is deoxygenated accept converse for H (Pulmonary vein) 'It' refers to F	1
Total			**12**

4.2.2.2 The heart and blood vessels

Answer 06 · 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	

4.2.2.2 The heart and blood vessels

Answer 06 · Mark scheme

June 2014 | BL3HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / spec ref.

4.2.2.2 The heart and blood vessels

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	any **two** from: • right amount of nutrients **or** different / all foods • right amount of energy • for (individual) needs	‘right amount’ only needed once for both marks to be awarded	2	AO1 1.1.1a
9(b)(i)	ovaries / ovary	allow placenta	1	AO1 1.2.2d
9(b)(ii)	any **one** from: • inhibits follicle stimulating hormone / FSH production • inhibits maturation of eggs	ignore ref to site of production of FSH allow stimulates LH production **or** stimulates preparation of womb lining	1	AO1 1.2.2d
9(b)(iii)	any **one** from: • stimulate muscle growth • used in (oral) contraceptives		1	AO1 1.3.1i / 1.2.2e
9(c)	small (rate of) decrease then bigger (rate of) decrease idea that change of rate (of decrease) at 900 (mg per day)	If no other mark awarded allow **1** mark for decrease	1 1	AO2 1.3
9(d)(i)	gene(s) / nucleus / chromosome(s) / DNA	allow ribosome	1	AO2 1.7.1a/b/c/d
9(d)(ii)	reduces production of cholesterol (by liver)	allow idea of switching off gene for reductase (production) allow switch off / reduce / inhibit reductase (production) allow reduces absorption of cholesterol (by intestine) allow statins (might) breakdown / destroy cholesterol	1	AO2 1.1.1d
Total			**9**	

4.2.2.2 The heart and blood vessels

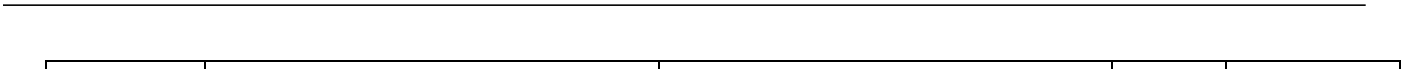
Answer 08 · Mark scheme June 2015 | BL2HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	5624	**allow 2 marks** for: • correct HR = 148 **and** correct SV = 38 plus wrong answer / no answer **or** • only one value correct **and** ecf for answer **allow 1 mark** for: • incorrect values **and** ecf for answer **or** • only one value correct	3	AO2 2.6, 2.6.1g
5(b)(i)	**Person 2** has low(er) stroke volume / SV / described	eg **Person 2** pumps out smaller volume each beat do **not** allow **Person 2** has lower heart rate	1	AO3 2.6, 2.6.1g
5(b)(ii)	**Person 1** sends <u>more blood</u> (to muscles / body / lungs) (which) supplies (more) oxygen (and) supplies (more) glucose (faster rate of) respiration **or** transfers (more) energy for use removes (more) CO_2 / lactic acid / heat **or** less lactic acid made **or** (more) muscle contraction / less muscle fatigue	 ignore aerobic / anaerobic allow (more) energy release allow aerobic respiration transfers / releases more energy (than anaerobic) do **not** allow makes (more) energy allow less oxygen debt if no other mark awarded, allow person 1 is fitter (than person 2) for max 1 mark	1 1 1 1 1	AO1 / AO2 2.6.1b,e,f, g,h, 2.6.2c,d
Total			**9**	

4.2.2.2 The heart and blood vessels

Answer 08 · Mark scheme

June 2015 | BL2HP | Original Q5 | Legacy



4.2.2.2 The heart and blood vessels

Answer 09 · 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

Answer 09 · Mark scheme

June 2015 | BL3HP | Original Q2 | Legacy

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.

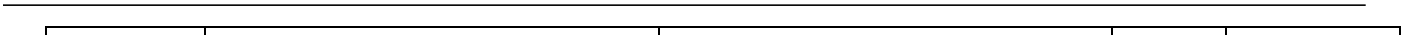
examples of the points made in the response	extra information
Advantages of cow tissue valve: • abundant supply of cows • so shorter waiting time • no need for tissue typing • quicker operation • less invasive **or** shorter recovery time • cheaper operation costs • less operation / anaesthetic risks	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

4.2.2.2 The heart and blood vessels

Answer 09 · Mark scheme

June 2015 | BL3HP | Original Q2 | Legacy



4.2.2.2 The heart and blood vessels

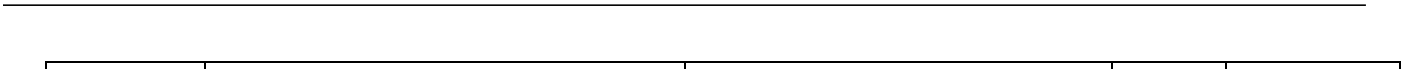
Answer 10 · Mark scheme June 2016 | BL3HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	doesn't have valves has a thicker wall **or** thicker layer of muscle	allow veins have valves allow has a smaller lumen ignore references to elastic (in walls)	1 1	AO1 3.2.1e
6(a)(ii)	any **two** from: • (artery has) more oxygen • (artery has) more glucose • (artery has) less carbon dioxide • (artery has) less lactic acid	ignore reference to pressure accept converse for veins if veins is clearly stated allow (artery has) more amino acids / fatty acids ignore urea	2	AO1 3.2.1g
6(b)	any **two** from: • no rejection • abundant supply • low risk of infection • longer shelf life	ignore side effects allow no tissue matching required allow named example ie HIV, CJD allow less space needed for storage	2	AO2/3 3.2
Total			**6**	

4.2.2.2 The heart and blood vessels

Answer 10 · Mark scheme

June 2016 | BL3HP | Original Q6 | Legacy



Answer 11 · Mark scheme

June 2017 | BL3HP | Original Q2 | Legacy

The full source mark scheme begins on page 40. Follow original question 2 in that document.

4.2.2.2 The heart and blood vessels

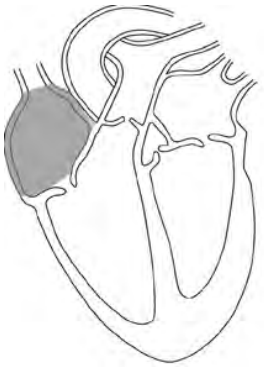
Answer 12 · Mark scheme June 2018 | 8461/1H | Original Q3

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

4.2.2.2 The heart and blood vessels

Answer 12 · Mark scheme

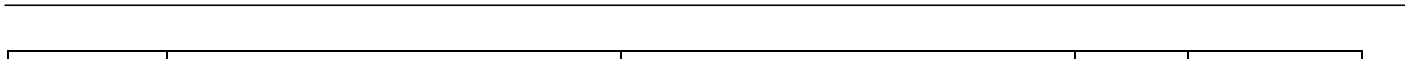
June 2018 | 8461/1H | Original Q3

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**	

4.2.2.2 The heart and blood vessels

Answer 12 · Mark scheme

June 2018 | 8461/1H | Original Q3



4.2.2.2 The heart and blood vessels

Answer 13 · Mark scheme

June 2019 | 8461/1H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		3–4	4.2.2.4 4.2.2.2 4.1.3.1 AO2
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.		1–2	
	No relevant content		0	
	Indicative content: • backflow can occur **or** some blood flows backwards • less blood leaves the heart **or** less blood is pumped around the body **or** some blood stays in the heart (instead of being pumped out) **or** reduced blood pressure **or** reduced flow rate • less oxygen supplied to muscles / cells • (so) less aerobic respiration • (so) less energy released • (so) less (efficient) muscle contraction • anaerobic respiration takes place • less (efficient) removal of lactic acid **or** lactic acid builds up **or** oxygen debt occurs • (lactic acid building up) causes muscle fatigue • less (efficient) removal of carbon dioxide (from blood) a **level 2** response should refer to both respiration **and** the effects on exercise			

4.2.2.2 The heart and blood vessels

Answer 13 · Mark scheme

June 2019 | 8461/1H | Original Q5

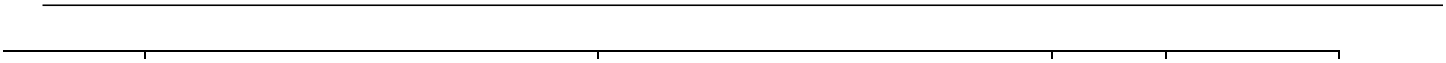
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2		ignore raw numbers from **Table 4**		4.2.2.4 AO3
	(deaths mechanical valve =) 6% / 6.31136%	allow correctly rounded value	1	
	(deaths biological valve =) 10% / 10.14823%	allow correctly rounded value	1	
	(therefore a) higher proportion / percentage of patients die with biological valve **or** patients are more likely to die with biological valve	do **not** accept more patients die with a biological valve allow **2** marks for ratio mechanical : biological = 1:1.6 **or** 1:1.7 **or** correctly calculated value allow **3** marks for deaths with biological valves = 4% / 3.83687% higher **or** correctly rounded value **or** patients are 1.6 / 1.7 times more likely to die with biological valves if **no** other marks awarded, allow for **1** mark chance of death after a valve replacement is 8% / 7.77247% **or** correctly rounded value	1	AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	platelets	allow thrombocytes	1	4.2.2.3 AO1
05.4	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.		5–6	4.2.2.4 AO2 AO3
	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: **mechanical valves** • longer lasting **or** more durable **or** don't wear out as easily **or** less likely to need replacing (within 6 years) • blood clots (on the brain) are more likely (after surgery) • patient has to take anti-clotting medication (for the rest of their lives) • if medication not taken (correctly), clots can lead to blood clots on brain / heart attack • medication can lead to excessive bleeding (after injury) • some patients say they can hear the valves opening and closing • survival rate at 5 years is slightly higher for mechanical valve • lower percentage of deaths due to heart-related problems **biological valves** • no additional medication required • ethical issues surrounding use of animal tissue • valve may harden • more likely to need further operation **or** another new valve • more likely to be rejected • more likely to need (immuno-suppressant) medication **both valves** • both are readily available • little wait time a **level 2** response should contain comparisons of both valves **and** some reference to own knowledge			
Total			**14**	

4.2.2.2 The heart and blood vessels

Answer 13 · Mark scheme

June 2019 | 8461/1H | Original Q5



4.2.2.2 The heart and blood vessels

Answer 14 · Mark scheme

June 2023 | 8461/1H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	A		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.2	C		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	right atrium		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	any **two** from: • (artery) has a thick**er** muscle (tissue) • (artery) has a thick**er** elastic (tissue) • (artery) has a narrow**er** lumen • (artery) does not contain valves	allow converse if clearly referring to a vein if neither mark awarded allow **1** mark for artery has a thick**er** wall allow description of lumen	2	AO1 4.2.2.2

4.2.2.2 The heart and blood vessels

Answer 14 · Mark scheme

June 2023 | 8461/1H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	as the percentage of the (coronary) artery that is blocked increases, blood flow decreases	allow converse allow the greater the blockage, the less blood flows allow negative correlation **or** inversely proportional allow as one increases, the other decreases	1	AO2 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.6	scale on y-axis	must take up at least 50% of axis	1	AO2 4.2.2.2
	all points plotted	allow 3 or 4 correct plots for **1** mark allow a tolerance of ± ½ small square	2	
	correct curved line of best fit	ignore line joined point to point with straight lines ignore extrapolation	1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.7	correct answer from student's line in **Figure 3**	allow a tolerance of ± ½ small square if no line drawn on **Figure 3**, allow a value from 18 to 24 (cm^3/minute)	1	AO3 4.2.2.2

4.2.2.2 The heart and blood vessels

Answer 14 · Mark scheme

Question	Answers	Mark	AO / Spec Ref.
02.8	**Level 3**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6	AO1 AO2 4.2.2.2 4.2.2.4 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: • reduced blood flow to heart (muscle / tissue / cells) • (so) less oxygen to heart (muscle / tissue / cells) • (so) less glucose to heart (muscle / tissue / cells) • (so) less (aerobic) respiration (in heart / body cells) • (more) anaerobic respiration • (so) less energy (released) • (so) less muscle contraction • (so) less blood / oxygen / glucose around the body (from heart) **or** slower flow of blood / oxygen / glucose to body (from heart) • less carbon dioxide removed from body (muscle / tissue / cells) • (resulting in) breathlessness • (resulting in) tiredness • (anaerobic respiration causes) production of lactic acid • (build-up of lactic acid) causes muscle fatigue / pain **or** chest pain For **Level 3**, students must explain the effect of reduced oxygen / glucose on respiration **or** energy release and its consequence		

4.2.2.2 The heart and blood vessels

Answer 14 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.9	any **one** pair from:	mark as a pair		AO1 4.2.2.4
	• (insert) stent(s)	allow description	1	
	(to) open (coronary) artery	ignore unblock (coronary) artery	1	
	• (prescribe) statins (1)			
	(to) reduce (blood) cholesterol (1)	allow to slow down the rate of fatty material deposit		
	• heart (and lung) transplant (1)			
	(to) replace the diseased heart with a healthy heart (1)			
	• use an artificial heart (1)			
	(to) keep the patient alive while waiting for a transplant (1)	allow (artificial heart) pumps blood around the body in place of the heart		
	• (artery / heart) bypass (1)	allow description		
	(to) divert blood around the blockage (1)			

Total Question 2	19

4.2.2.2 The heart and blood vessels

Answer 15 · Mark scheme

June 2024 | 8461/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.1	arteries		1	AO1 4.2.2.2 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.2	pushes / moves blood to get <u>oxygen</u> around the body	 allow description of getting <u>oxygen</u> around the body, such as through blood vessels **or** to get <u>oxygen</u> to a named organ do **not** accept to get oxygen to the lungs ignore reference to restarting the heart ignore reference to the pacemaker	1 1	AO2 4.2.2.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.3	provides oxygen (for respiration)	allow idea of carbon dioxide triggering breathing to restart	1	AO2 4.2.2.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.4	statin(s)	allow named statin	1	AO1 4.2.2.4

4.2.2.2 The heart and blood vessels

Answer 15 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.5	(stent) opens / widens (blocked blood) vessel to allow (more) blood to flow **or** to allow (more) glucose / oxygen to the heart (cells / tissue / muscle)	allow (stent) keeps (blocked blood) vessel open allow a description of the blood vessel being opened ignore type of blood vessel ignore unblocks (blood) vessel	1 1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.6	any **two** from: • smoking increases the (%) risk of **all** types of (cardiovascular) disease • smoking increases the (%) risk of having (disease) **H** more than any other type of (cardiovascular) disease • smoking increases the (%) risk of having (disease) **E** less than any other type of (cardiovascular) disease	ignore smoking causes (cardiovascular) disease allow not smoking decreases the risk of **all** types of (cardiovascular) disease allow if you smoke, you are **most** likely to get (disease) **H** allow if you smoke, you are **least** likely to get (disease) **E** allow a comparison of the effect of smoking on the risk of two (cardiovascular) diseases allow two comparisons of the effect of smoking on the risk of two (cardiovascular) diseases for **2** marks	2	AO3 4.2.2.6

4.2.2.2 The heart and blood vessels

Answer 15 · Mark scheme

June 2024 | 8461/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.7	*y*-axis labelled 'Percentage / % increase in risk (compared to people who have never smoked)'		1	AO2 4.2.2.6
	correct scale of 1 cm = 5% on *y*-axis		1	
	all bars plotted correctly	allow a tolerance of ±½ small square ignore bars touching ignore width of bars	1	
	all bars correctly labelled		1	

Question	Answers	Extra information	Mark	AO / Spec Ref.
01.8	any **one** from: • poor diet	ignore obesity allow descriptions of poor diet eg diet high in (saturated) fat / cholesterol ignore diet unqualified	1	AO1 4.2.2.6
	• lack of exercise	allow descriptions of lack of exercise allow high alcohol intake allow other correct lifestyle factors such as having a stressful job		

Total Question 1	14

Answer 16 · 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

Answer 16 · Mark scheme

June 2025 | 8461/1H | Original Q5

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec Ref.</th></tr>
<tr><td>05.3</td><td>
<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</td><td>2</td><td>AO3
4.2.2.2</td></tr>
</table>

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) oxygen debt	allow the lactic acid concentration is high	1	AO2 4.4.2.1 4.4.2.2
	(so more) oxygen is required to oxidise lactic acid	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	

Question	Answers	Extra information	Mark	AO / Spec Ref.
05.8	(there is) more haemoglobin so more oxygen (carried **/** bound)	allow more oxyhaemoglobin (is formed)	1	AO2 4.4.2.1 4.2.2.3
	(athlete can do) more aerobic respiration to transfer / release (more) energy **or** (athlete can do) more aerobic respiration so less muscle fatigue / cramp	allow (athlete will do) less anaerobic respiration which transfers / releases less energy allow (athlete will do) less anaerobic 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	

Total Question 5	16

4.2.2.2 The heart and blood vessels

GCSE

Biology

BL3HP

Final Mark Scheme

4401

June 2017

Version/Stage: v1.0

4.2.2.2 The heart and blood vessels

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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4.2.2.2 The heart and blood vessels

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

MARK SCHEME – GCSE BIOLOGY – BL3HP – JUNE 2017

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation 'ecf' in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Written Communication and levels marking

In Question 3 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	less CO_2 absorbed / taken in (by trees from the atmosphere)	allow release / increase of CO_2 from burning / use of (heavy) machinery ignore less photosynthesis unqualified	1	AO1 3.4.2a
1(b)(i)	0.8		1	AO2 3.4.2
1(b)(ii)	anywhere in range: 3(.0) – 3.4		1	AO2 3.4.2
1(c)	microorganisms respire **and** release CO_2	allow bacteria / fungi / decomposers allow anaerobic decay / respiration releases methane	1 1	AO1 3.4.2a
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.2.2.2 The heart and blood vessels

2(a)(i)	left ventricle		1	AO1 3.2.1c
2(a)(ii)	aorta	ignore artery allow aortic (artery)	1	AO1 3.2.1d
2(a)(iii)	(to keep) blood flowing in the right / one direction **or** prevent backflow (of blood)	ignore ref to veins	1	AO1 3.2.1e

MARK SCHEME – GCSE BIOLOGY – BL3HP – JUNE 2017

2(b)	Reasons for: • less likely to die (44% cf. 59%) • lower risk of death from having a second operation • lower risk of heart infections • less chance of the valve stopping working • longer lasting • doesn't cause rejection • avoids religious issues of using organs from a pig **or** no ethical issue from using part of a living organism Reasons against: • chance of death by bleeding is increased • offers no advantage against clots **or** equal risk of blood clots • have to take anti-clotting drugs for life • can be noisy	max 3 marks if only reasons for or reasons against given allow converse for each point if clearly referring to the pig tissue valve ignore cost allow doesn't stop working allow been used for a longer period of time ignore religion **or** ethical unqualified	4	AO3 3.2

2(c)	(inserted to) keep the (coronary) artery / arteries open allows more blood to flow (to the heart muscle) **or** return blood flow to normal	do **not** allow veins allow (more) glucose / oxygen to reach the heart (muscle)	1 1	AO1 3.2.1f

Total		**9**

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec.
3			6	AO1 3.3.1a/c 3.1.2b

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	The name (N) of a waste product is given **or** a process (P) that makes a waste product **or** an organ (O) involved	The name of a waste product is given which is linked to **either** the process that it is made in **or** the organ involved	The names of waste products are given of which at least one is correctly linked to the process it is made in **and** the organ(s) involved

examples of the points made in the response

- (N) urea
- (P) from the breakdown of amino acids
- (O) (amino acids broken down) in the liver
- (O) removed by kidneys
- (O) bladder removes urine (from the body)

- (N) CO_2
- (P) from respiration
- (O) in a named organ **or** in cells
- (O) breathed out from lungs

- (N) water
- (P) from respiration
- (O) in a named organ **or** in cells
- (O) breathed out from lungs
- (O) through skin (by sweating)
- (O) by kidneys
- (O) bladder removes urine (from the body)

extra information
ignore faeces

'Give credit for any extra correct knowledge – eg toxins are broken down in the liver and the products removed in kidneys/urine.'

- (N) ions
- (P) from eating and drinking
- (O) skin (through sweating)
- (O) by kidneys
- (O) bladder removes urine (from the body)

Total		6

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	Causes acid rain		1	AO1 3.4.1b
4(b)(i)	66(%) or 65.7(%)	allow 1 mark for 920 **or** ecf from first line	2	AO2 3.4.1b
4(b)(ii)	it rises **and** then falls maximum level in 2005 **or** maximum reached at 400 (thousand tonnes)		1 1	AO2 3.4.1b
Total			**5**	

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	xylem transports mineral (ions) phloem transports sugars	allow xylem transports water allow phloem transports sucrose / glucose / carbohydrate ignore minerals / ions transported in phloem if no other marks given allow one mark for xylem and phloem	1 1	AO1 3.2.3a
5(b)(i)	lost the most water **or** lost water faster than the others (it) has the greatest number of stomata (per mm^2) (and) water is lost through the stomata	allow mass decreased the most	1 1 1	AO3 3.1.3d
5(b)(ii)	(transpiration rate would be) lower (because) slow(er) evaporation / diffusion (into the air) **or** (because) concentration gradient will be less (due to) high(er) humidity	at least one comparative must be given allow 'lower rate of evaporation' for these 2 marks allow air becomes saturated	1 1 1	AO2/3 3.1.3d
Total			**8**	

4.2.2.2 The heart and blood vessels

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**	

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	(detected by) thermoregulatory centre	allow thermoregulatory part of brain allow detected by receptors in the brain	1	AO1 3.3.2b
7(b)	muscles contract (rapidly) this requires respiration (which) releases energy	 do **not** allow making energy allow making / releasing 'heat' ignore warms you up	1 1 1	AO1 3.3.2e
7(c)	blood vessels supplying the skin constrict (so) less blood flows to the skin / surface (of skin) (and) less energy is transferred (to the environment)	'skin' must be mentioned once for full marks allow vasoconstriction do **not** allow capillaries / veins constrict do **not** allow capillaries moving allow less heat is lost (to the environment) if no other marks awarded allow reduce sweating for 1 mark	 1 1 1	AO1 3.3.2e
Total			**7**	

4.2.2.2 The heart and blood vessels

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)		allow converse if clearly explaining about healthy person		AO2/3 3.1.1a/h/k/l
	any **two** from: • (shorter villi gives) a smaller surface area • (thicker cells give) a longer diffusion path • (capillaries are further from the lining) giving a longer diffusion path • fewer capillaries **or** less blood flow	if no marks awarded in this section allow one mark for two unqualified features eg there are shorter villi and thicker cells or capillaries are further from the lining 'longer diffusion pathway' unqualified only gains 1 mark	2	
	and (therefore) lower rate of diffusion / active transport / absorption		1	
	(so) less glucose / vitamins / minerals are absorbed	allow correct named example	1	
	(and) fat (stores) are broken down (to release glucose for energy so lose weight)		1	
8(b)	against the concentration gradient	allow from a low concentration to a high concentration **or** up the concentration gradient do **not** allow along the concentration gradient	1	AO1 3.1.1g
	requires energy	allow using ATP do **not** allow making energy allow correct use of terms carrier **or** transport proteins	1	
Total			**7**	

MARK SCHEME – GCSE BIOLOGY – BL3HP – JUNE 2017

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	pancreas releases <u>insulin</u> glucose moves into the cells **or** pancreas stops releasing glucagon glycogen stops being converted to glucose	do **not** allow liver releasing / producing insulin allow glucose is converted to glycogen	1 1	AO1 3.3.3a
9(b)	(exercise) uses up <u>glucose</u> idea of no <u>glucose</u> released into the blood(stream) (because) no available glycogen **or** glycogen cannot be broken down **or** no glycogen stored (and) <u>blood</u> sugar levels fall too low **or** (and) blood sugar levels remain low	 allow glucagon has no effect (on faulty glycogen) **or** glucagon doesn't break down glycogen ignore glycogen does not form properly 	1 1 1 1	AO2 3.3.3b
Total			**6**	

4.2.2.2 The heart and blood vessels

Answer 12 · 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.

4.2.2.2 The heart and blood vessels

Answer 12 · 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.

4.2.2.2 The heart and blood vessels

Answer 14 · Examiner comments

June 2023 | 8461/1H | Original Q2

Question 2 (Standard demand)

02.1 Around 78% of students could identify part A as the part that received oxygenated blood from the lungs.

02.2 Over 75% of students could identify part C as the part that pumps deoxygenated blood to the lungs.

02.3 Just over 63% of students could identify the right atrium as the part where the pacemaker was found.

02.4 This question was generally answered well with all of the marking points seen, including the fall-back mark. Almost 75% of student gained 2 marks, with a further 17% gaining 1 mark. Comparative terms were used by a large number of students but there were also many who simply described both vessels and achieved the marks that way. A lot of students gained two marks in one sentence by talking about the thicker muscle and elastic layers in the artery and then went on to give a third creditworthy response. The comparison of the lumen size was seen slightly more often than mention of valves, and most students used the correct term. If the student tried, instead, to describe the lumen they were often less successful. The most commonly seen uncreditworthy responses referred to cell walls, made general reference to the size of the vessels or, occasionally, mis-identified the two vessels completely.

4.2.2.2 The heart and blood vessels

Answer 14 · Examiner comments

02.5 Over 97% of students were able to successfully describe the trend, with many students doing so by using the whole of the headings from the table columns in their answers. Some used the terms correlation and proportional but there were as many incorrect uses of these terms as correct ones. Some students negated a correct description of the trend with an incorrect term. The most commonly seen uncreditworthy responses were references to a negative trend without further clarification or numbers quoted from the table with no trend referred to.

02.6 The graph appeared to be tackled better this year than it often has been in the past, may be because the y-axis scale was a simple one to determine and the points lead to a fairly easy curve to draw.
The axis mark was frequently awarded with only a few students squashing it into less than half of the grid available or using strange intervals.
The points were generally well plotted with the most frequent error being the failure to spot that they were not evenly spread along the x-axis and therefore plotting them in the wrong places.
There were fewer straight and point-to-point lines seen this year than there often have been, but there were still a significant number. However, some of the curves drawn missed the points by more than half a small square so were not acceptable.
The most commonly seen errors were points plotted with a large spot or a tiny mark rather than a cross, both of which made it very difficult to judge the accuracy of the plot, or thick, smudged or feathery lines, which again were too inaccurate to be awarded the mark.

02.7 Almost 90% of students were able to read accurately from their graph even if their line had not been creditworthy. Many drew construction lines but some of these were in the wrong place, reading from 25 or 30 on the x-axis. A few read from 35 on the y-axis.

02.8 This levelled response question required students to explain the effect of a partly blocked coronary artery on the human body. Answers across the whole mark range were seen for this question with less than 3% gaining no marks at all. Level 2 answers were seen in 45% of student responses with quite a variety in the quality of answers gaining 4 marks. The lack of understanding about the position and function of the coronary arteries prevented a large number of students accessing level 3. There were many suggestions that these arteries took the blood to the lungs or around the rest of the body, and reference to blood going through, rather than to the heart.
Many students correctly referenced reduced aerobic respiration, or increased anaerobic, with the consequent reduction in energy release, although there were the usual references to energy being produced, this was not penalised in this question. The most frequently seen part of the indicative content was reference to ‘reduced blood flow around the body’. Better responses referenced the production of lactic acid and linked it to muscle fatigue. Some referred only to ‘fatigue’ so this was accepted as meaning general body tiredness. There were a lot of vague references to heart attacks and strokes, and these were only considered to be creditworthy at level 1 but elevated several answers from 1 mark to 2 within level 1.
The most commonly seen uncreditworthy sections of an answer concerned references to blood clotting or immunity and the blockage causing back flow of blood. A minority of students referred only to what normally happens rather than what is happening in this scenario and there were a few lengthy responses that mentioned little that was creditworthy apart from a heart attack.

4.2.2.2 The heart and blood vessels

Answer 14 · Examiner comments June 2023 | 8461/1H | Original Q2

02.9 76% of students achieved 2 marks on this question, with the most common route to doing so via reference to stents. Most students could name them (and describe how they are fitted) although some did have to rely on describing them. Statins were also often seen although the second mark of that pair was a bit more elusive with lots of students suggesting they broke down the deposits that were already there. There were a few correct references to HDL and LDL cholesterol.
Reference to bypass surgery was occasionally seen although often not well enough described to attain 2 marks. An attempt at an explanation of a transplant was seen occasionally but there were no references to artificial hearts. The most common errors seen referred to surgery to physically open the vessel to remove the blockage.

Answer 15 · Examiner comments

Question 1 (standard demand)

01.1 93% of students selected the correct answer in this question.

01.2 50% of students achieved one mark in this question, with 38% gaining full marks. Many students believed that the principle reason for putting pressure on the heart was to restart the heart first and then to get the blood flowing generally to the lungs to get rid of carbon dioxide and to collect oxygen.

01.3 Three quarters of students answered this question correctly. Of those that did not, the idea of forcing air into the lungs helping to restart breathing was often given, but with no link to carbon dioxide triggering breathing to restart.

01.4 75% of students were able to recall the term 'statins' from the specification, with a small number giving incorrect answers such as 'blood thinners', 'insulin' or 'anti-cholesterol drugs'.

01.5 Nearly three quarters of students achieved full marks in this question. Of the 20% that scored one mark, most did not elaborate on the idea of the vessel being wider and therefore, that more blood could flow.

01.6 50% of students gained no credit in this question and found making conclusions based on the results in Table 5 difficult. The data showed to what extent the percentage risk of getting four different cardiovascular diseases increased as a result of smoking when compared with people who had never smoked. As a result, all conclusions had to reflect both the increased risk and its association with smoking. They also needed to be comparative, either on the basis of one disease over all others, by using words such as 'most' or 'least', or on the basis of one disease over one other by using words such as 'more' or 'less'. Answers invariably failed to match all of these requirements. Some students also mistakenly believed that the results reflected the 'risk' or 'danger' of the diseases rather than the risk of 'developing' them. Other answers revealed the misconception by some that the letters E to H referred to individual people rather than to the different diseases.

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4.2.2.2 The heart and blood vessels

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01.7 Students' graph drawing skills were generally good, with 84% of students achieving full marks in this question. In the 12% of responses that scored three marks, the most commonly omitted feature was the *y*-axis label, and some students truncated their label so much as to omit the reference to 'risk', which was not creditworthy. Students should be reminded to ensure that they use a ruler for graph drawing, as a number attempted to draw their bars freehand, resulting in missing out on credit due to inaccuracy.

01.8 68% of students answered this question correctly. The most common incorrect answers were those that lacked qualification, such as references to 'drinking alcohol' or to 'eating fatty foods', which needed the added idea of consumption of these being 'high'. Obesity was a common incorrect answer; it is not a lifestyle factor.

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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.

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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

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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.