AQA GCSE Biology | 8461

SPECIFICATION POINT 4.4.2.3

Metabolism

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**12**
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.

4.4.2.3 Metabolism

Answer 01 · Mark scheme

June 2008 | BLY3F | Original Q4 | Legacy

question	answers	extra information	mark
4(a)(i)	red cell		1
4(a) (ii)	diffusion		1
4(a) (iii)	haemoglobin		1
4(a) (iv)	a nucleus		1
4(b)	(on diagram) arrow from any part of blood to air		1
Total			**5**

4.4.2.3 Metabolism

Answer 01 · Mark scheme

COMPONENT NUMBER: BLY3F

COMPONENT NAME: Biology

STATUS: Final

DATE: June 2008

4.4.2.3 Metabolism

Answer 02 · Mark scheme

question	answers	extra information	mark
4(a)	respiration	clear indication eg tick, underlining, others crossed out	1
4(b)	lungs		1
4(c)	liver		1
4(d)	amino acids		1
Total			**4**

4.4.2.3 Metabolism

Answer 02 · Mark scheme

COMPONENT NUMBER: BLY2F

COMPONENT NAME: Additional Science / Biology

STATUS: Final

DATE: January 2009

4.4.2.3 Metabolism

Answer 03 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	glycogen		1
4(a)(ii)	respiration		1
4(b)(i)	483 kJ		1
4(b)(ii)	oxygen		1
4(b)(iii)	dilate		1
4(c)	supplies more / a lot of oxygen **or** removes more carbon dioxide **or** release more energy / faster respiration		1
Total			**6**

4.4.2.3 Metabolism

Answer 03 · Mark scheme

June 2011 | BLY3F | Original Q4 | Legacy

BLY3F

4.4.2.3 Metabolism

Answer 04 · Mark scheme

June 2012 | BL2FP | Original Q9 | Legacy

Question 9

question	answers	extra information	mark
9(a)(i)	any **three** from: • age (of athlete) • gender (of athlete) • starting concentration of glycogen • type / intensity of exercise • length of exercise period • number of training sessions • time interval between exercise sessions • exercise at same time of day	if diet given as answer = max **2** if none of these points gained amount of exercise = **1** mark if last four points not awarded allow time (for exercise) for **1** mark ignore references to amount of energy ignore they are both athletes	3
9(a)(ii)	any **two** from: • intensity of exercise • amount of exercise between sessions • starting concentration of glycogen • fitness / health • metabolic rate / respiration rate • amount / mass of muscle / physique • aspects of diet qualified, eg amount of food eaten	do **not** accept amount of carbohydrate if no other marks awarded allow height / mass / weight for **1** mark	2

4.4.2.3 Metabolism

9(a)(iii)	(B has) less glycogen **or** (B's glycogen) fell more **or** (B's glycogen) built up less	he = B accept use of approximate figures allow other correct observations from graph eg A is lower at end of first session ignore rate of fall	1
9(b)	athlete **A** (no mark) athlete **A** had more glycogen / **B** has less (only if A chosen to complete marathon) (glycogen / glucose) used in respiration (more) energy released / available in athlete **A** **and either** energy used for movement / muscle action / to run **or** (extra) glycogen → (more) glucose	to gain full marks 'more' must be given at least once accept converse argument for **B** ignore anaerobic allow 'energy made'	 1 1 1 1
Total			**10**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.4.2.3 Metabolism

Answer 05 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	any **two** from: • constant speed • constant effort • constant temperature	**or** allow converse for outdoors • variable speed • variable terrain • traffic conditions • variable temperature • wind (resistance) • rain / snow } allow weather allow pollution only if qualified by effect on body function but ignore pollution unqualified if no other marks obtained allow variable conditions outdoors	2
6(b)	Brain		1
6(c)(i)	20 800	correct answer with or without working gains **2** marks if answer incorrect, allow **1** mark for use of 1200 and 22 000 only	2
6(c)(ii)	oxygen glucose / sugar	apply list principle do **not** accept other named substances eg CO_2 water allow glycogen ignore food / carbohydrate	1 1
6(c)(iii)	respire aerobically		1
6(c)(iv)	carbon dioxide lactic acid		1 1
6(d)	increased heart rate	ignore adrenaline / drugs accept heart beats more but not heart pumps more	1
Total			**11**

4.4.2.3 Metabolism

Answer 05 · Mark scheme

January 2013 | BL2FP | Original Q6 | Legacy

BL2FP

4.4.2.3 Metabolism

Answer 06 · Mark scheme June 2015 | BL2FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	glycerol		1	AO1 2.5.2f
7(a)(ii)	pancreas / small intestine	accept duodenum / ileum ignore intestine unqualified	1	AO1 2.5.2f
7(b)	any **two** from: • type of milk • volume / amount of milk • vol. bile equals vol. water • volume of lipase • concentration of lipase • temperature	ignore time interval ignore solution unqualified do **not** allow pH ignore starting pH ignore volume / amount of bile / water ignore concentration of bile accept amount of lipase if neither volume nor concentration given	2	AO3 2.5.2f,h
7(c)(i)	fatty acid (production)		1	AO2 2.5.2f,h
7(c)(ii)	faster reaction / digestion (with bile) **or** pH decreases faster (with bile) **or** takes less time (with bile) **or** steeper fall / line (with bile)	allow use of data ignore easier	1	AO3 2.5.2f,h

4.4.2.3 Metabolism

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(c)(iii)	all fat / milk digested **or** same amount of fatty acids present **or** (lower pH) denatures the enzyme / lipase	allow all reactants used up ignore reference to neutralisation allow enzyme won't work at low pH do **not** allow enzyme killed	1	AO2 2.5.2f,h
Total			**7**	

4.4.2.3 Metabolism

Answer 06 · Mark scheme

June 2015 | BL2FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref

4.4.2.3 Metabolism

Answer 07 · Mark scheme

June 2018 | 8461/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • respiration • formation of proteins • formation / breakdown of glycogen • breakdown of (excess) protein **or** formation of urea • photosynthesis **or** formation of glucose / starch (in plants)	allow other correct reference to metabolic reactions in cells ignore reference to digestion ignore formation of carbohydrates	1	AO1 4.4.2.3
08.2	males have a higher metabolic rate than females after five years of age the mean metabolic rate of females decreases faster than males up to 25 years of age	each additional tick negates a mark	1 1	AO3 4.4.2.3
08.3	$\frac{17}{53} \times 100$ 32.075472… 32.1	an answer of 32.1 scores **3** marks allow correct rounding of this to at least 4 significant figures allow a correct reduction to 3 significant figures from an incorrect calculation for marking point 2	1 1 1	AO2 4.4.2.3

4.4.2.3 Metabolism

Answer 07 · Mark scheme

June 2018 | 8461/1F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **two** from: • (person) R heart rate rose / increased more slowly than (person) S • (person) R heart rate levelled off whereas (person) S continued to increase • (person) R heart rate rose less (overall / after 5 minutes of exercise) than S	allow converse allow correct use of figures eg R increased (overall) by 39 bpm / 65% and S by 54 bpm / 69% ignore lack of units	2	AO3 4.4.2.2
08.5	correct scale and axis labelled all points plotted correctly (to within ± ½ square) line joined point to point or correct curved line of best fit	allow min(s) do **not** accept 'm' the zero is not required on the *x*-axis allow 4 or 5 correct plots for **1** mark	1 2 1	AO2 4.4.2.2
08.6	$\frac{132 - 78}{12}$ 4.5 (minutes) / 4½ minutes / 4 minutes 30 seconds / 4:30	an answer of 4.5 minutes scores **2** marks allow $\frac{54}{12}$ allow sequential deductions of 12 four or five times do **not** accept 4:50 **or** 4 minutes 50 seconds	1 1	AO2 4.4.2.2

4.4.2.3 Metabolism

Answer 07 · Mark scheme

June 2018 | 8461/1F | Original Q8

Question	Answers	Mark	AO / Spec. Ref.
08.7	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO3 4.4.2.2
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • two groups of people - non-smokers and smokers • have at least five people in each group or large groups • get each person to do (named) exercise • controlled variables: - same number of people in each group or large groups - same gender - same level of activity / exercise - same age - no health issues / illnesses - same type of exercise - same time for exercise • record heart rate for each person before and after exercise • calculate increase in heart rate for each person after exercise • compare results for each group for **level 3**, students should refer to at least 5 smokers and 5 non-smokers, carrying out exercise with control variables and a means of determining an increase in heart rate for **level 2**, students should refer to 'groups' of smokers and non-smokers exercising		
Total			**20**

4.4.2.3 Metabolism

Answer 08 · Mark scheme June 2018 | 8461/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	pancreas		1	AO1 4.5.3.2
05.2	liver glycogen	in this order	1 1	AO1 4.5.3.2
05.3	would be digested / broken down (by enzymes / protease / pepsin / acid or to amino acids)	allow denatured (by acid)	1	AO2 4.2.2.1 4.5.3.2
05.4	use of 14.2 **and** 6.8 7.4	an answer of 7.4 scores **2** marks allow an answer of 7.2 or 7.3 (using 14.1 and / or 6.9) for **1** mark	1 1	AO2 4.5.3.2 AO3 4.5.3.2
05.5	any **one** from: • (person A's) results are higher • (A) increases for a longer time **or** peaks later • (A) takes longer to decrease **or** takes longer to return to normal	allow converse comparisons with person B as the subject ignore A peaks at a higher level than B allow other correct comparisons allow a description using pairs of figures from graph at a given time	1	AO2 4.5.3.2

4.4.2.3 Metabolism

Answer 08 · Mark scheme

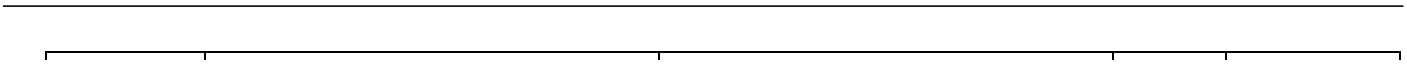
June 2018 | 8461/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	a negative correlation		1	AO2 4.5.3.2
05.7	less carbohydrate / sugar / fat in diet **or** lose weight **or** maintain a healthy weight (more) exercise	allow go on a diet allow eat less allow balanced / healthy diet ignore diet unqualified allow examples of exercise	1 1	AO1 4.5.3.2
Total			**10**	

4.4.2.3 Metabolism

Answer 08 · Mark scheme

June 2018 | 8461/2F | Original Q5



4.4.2.3 Metabolism

Answer 09 · Mark scheme

June 2018 | 8461/2F | Original Q11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	2400 **and** 2280 **or** 500 **and** 380	an answer of 120 scores **2** marks	1	AO2 4.5.3.3
	120		1	
11.2	respiration of glucose		1	AO1 4.4.2.1 4.4.2.3
11.3	(more) sweating	ignore reference to vasodilation / vasoconstriction	1	AO2 4.5.2.4 4.5.3.3
	(because) exercise releases heat **or** need to cool the body **or** need to lose heat **or** need to maintain body temperature	do **not** accept energy being produced	1	
11.4		'more' does not need to be stated a second time to gain marking point 1 and marking point 2		AO2 4.5.2.4 4.5.3.3
	more energy needed	do **not** accept energy production do **not** accept energy needed for respiration	1	
	(so) more (aerobic) respiration		1	
	(so) increased breathing (rate / depth) (to supply oxygen **or** remove carbon dioxide / water)		1	
Total			**8**	

4.4.2.3 Metabolism

Answer 10 · Mark scheme

June 2019 | 8461/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	protein		1	AO1 4.4.2.3 4.5.3.3
06.2	urea is a waste (product)	allow toxic / poisonous **or** may damage cells **or** denatures proteins ignore harmful / dangerous	1	AO1 4.5 4.5.3.3
06.3	respiration breathing	in this order	1 1	4.4.2.1 4.4.2.2 4.7.4.3 AO1
06.4	least medium most	in this order 3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO3 4.5.2.4 4.5.3.3
06.5	diffusion		1	AO1 4.1.3.1 4.5.3.3
06.6	protein (molecules too) large	this mark may only be awarded if mp1 is correct or not attempted allow pores in membrane are too small	1 1	AO3 4.5.3.3
06.7	3	allow three	1	AO3 4.5.3.3
06.8	increases	ignore numbers	1	AO3 4.5.3.3

4.4.2.3 Metabolism

Answer 10 · Mark scheme

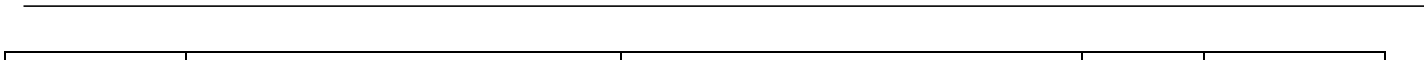
June 2019 | 8461/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.9	any **two** from: • has a low(er) concentration of urea • constant urea concentration / level • less time attached to machine **or** fewer hospital visits • no / less restriction on travel • not piercing skin repeatedly • less chance of infection / blood clots • cheaper in the long term • no restrictions on diet	allow converse points for person **A** / dialysis allow substance (if named must be correct) ignore cheaper unqualified	2	AO3 4.5.3.3
Total			**13**	

4.4.2.3 Metabolism

Answer 10 · Mark scheme

June 2019 | 8461/2F | Original Q6



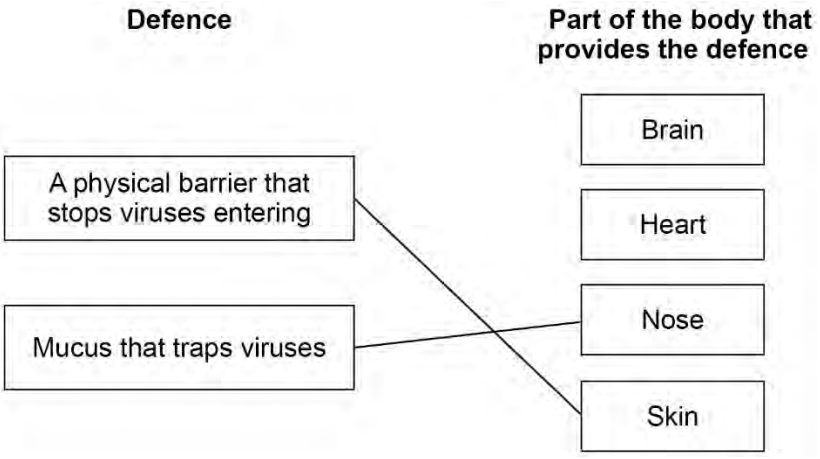
4.4.2.3 Metabolism

Answer 11 · Mark scheme

June 2023 | 8461/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.1	pathogens		1	AO1 4.3.1.1

Question	Answers	Mark	AO / Spec Ref.
02.2	 do **not** accept more than one line from a box on the left	1 1	AO1 4.3.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.3	division		1	AO1 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.4	malignant tumours have cells that can spread to other parts of the body malignant tumours may form secondary tumours		1 1	AO1 4.2.2.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.5	(percentage) decreases		1	AO3 4.2.2.7 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.6	more females were vaccinated (over time)	allow males may also be vaccinated allow more people were vaccinated allow increased use of (named) barrier methods of contraception allow more awareness / education (about HPV)	1	AO3 4.2.2.7 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.7	white blood cells		1	AO1 4.3.1.7

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.8	antibodies		1	AO1 4.3.1.7 4.3.1.6

Question	Answers	Extra information	Mark	AO / Spec Ref.
02.9	any **one** from: • people are afraid of side / unknown effects • religious / cultural objections • (some people) believe they don't work • some people think (HPV) vaccine encourages sexual activity	ignore pain of injection allow there are side effects allow people think they cause (named) disease ignore religion unqualified ignore moral / ethical objections	1	AO3 4.3.1.7

Total Question 2	11

4.4.2.3 Metabolism

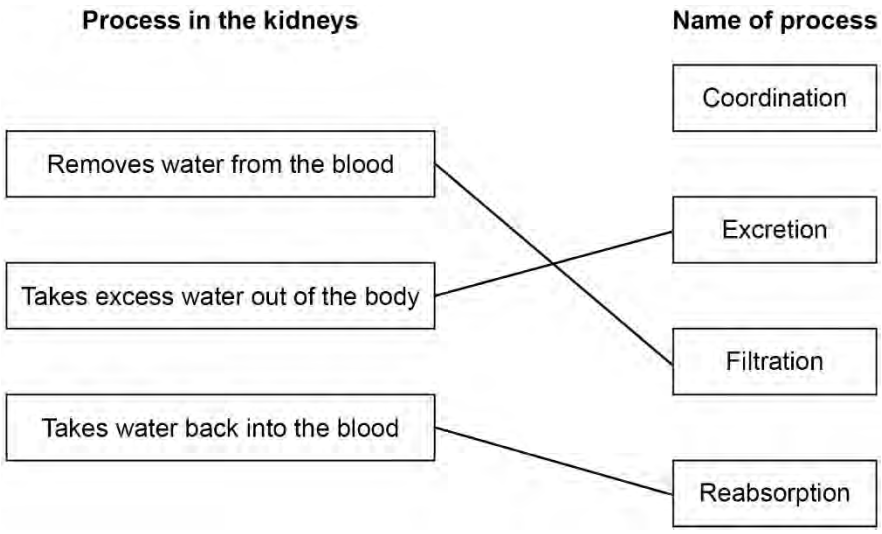
Answer 12 · Mark scheme

June 2025 | 8461/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	bars plotted at 420 **and** 340 bars correctly labelled	allow a tolerance of ± ½ a small square allow bars touching ignore width of bars ignore shading	1 1	AO2 4.5.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	increase		1	AO3 4.5.2.4

Question	Answers	Mark	AO / Spec. Ref.
04.3	 do **not** accept more than one line from a box on the left	1 1 1	AO1 4.5.3.3

4.4.2.3 Metabolism

Answer 12 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
04.4	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.5.3.3
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content **in favour of a kidney transplant** • no need for regular / long hospital visits • could last for rest of lifetime • flexible lifestyle eg as can go on holidays • may not live near a hospital **or** reference to transport costs • no risk of infection from frequent piercing of skin **or** no risk of infection from blood exposed to equipment • no need for controlled diet • maintains correct concentration of substances in blood / body • cheaper in long term **against a kidney transplant** • may be rejected • need to keep taking anti-rejection drugs **or** immunosuppressants • (suitable) donor may not be available **or** donor may need tissue matching • risk from surgery (anaesthetic or infection) • recovery from surgery may take a long time • may need replacing eventually For **Level 2**, points for and against a kidney transplant must be given.		

Total Question 4	10

4.4.2.3 Metabolism

Answer 11 · Examiner comments

June 2023 | 8461/1F | Original Q2

Question 2 (Low demand)

02.1 Nearly all students were able to determine 'pathogens' as being the name given to microorganisms that cause disease.

02.2 Almost 90% of students correctly linked both defences to the part of the body that provided the defence. Students should be reminded that they must not draw more than one line from a box on the left in these questions, as this will not gain credit.

02.3 A pleasing 90% of students knew that a tumour can form when changes to cells cause uncontrolled cell division**.**

02.4 Students have a clear understanding of features of malignant tumours, and indeed only around 4% of students gained zero marks on this question. Almost two thirds of students gained both available marks.

02.5 Over 95% of students gained this mark. A number went on to use data in support of their statements but this was not necessary. Some simply said that Table 2 showed that 'the vaccine had worked', but as the question asked specifically about how the **percentage** of females with HPV had changed, no credit could be given.

02.6 Surprisingly, only around 42% of students could suggest a correct reason for the change in HPV cases from 2010-2016. Many of these students correctly referred to more females, and sometimes more males as well, being vaccinated. Those failing to gain credit however, often simply stated 'vaccination' as the reason but gave no idea as to why the percentage continued to fall over time.

02.7 Nearly 80% of students knew that white blood cells respond to an inactive virus, and gained the mark.

02.8 While the most common incorrect answer was 'antibiotics', it was pleasing to see over 93% of students correctly identifying antibodies as being produced in response to the inactive virus.

02.9 Most credited responses here were around concerns of side effects from the vaccine and this was expressed in many different ways. Around 60% were in fact successful in gaining the mark. Reference to 'anti-vax' parents was seen but unless qualified as to the reason behind refusal to vaccinate it failed to gain a mark. Many students correctly quoted religious or cultural objections although, 'religion' or 'beliefs' on their own were insufficient. The idea that the vaccine might simply not work was commonly credited but answers such as 'parents are scared of the vaccine' or 'it's too expensive' gained no marks.

Answer 12 · Examiner comments

June 2025 | 8461/2F | Original Q4

Question 4 (Low and Standard demand)

04.1
Students were given data showing how much water a person gained and lost by different methods and were asked to complete a bar chart. Generally, this question was answered very well, with 75% of students gaining both marks. Around 5% of students did not attempt the question. There was some mis-plotting seen, usually due to misreading the scale. A common error was not labelling the bars, so mark point 2 could not be awarded.

04.2
Over 70% of students knew that the volume of water lost by sweating on the day of a race would be greater.

04.3
In this question, the students were told to draw one line from each box on the left to the appropriate box on the right. Some students drew two lines from a box on the left and thus did not gain the mark for that process. A pleasing 66% of students gained full marks. A common error was to have 'Excretion' linked to 'Removes water from the blood' or 'Filtration' linked to 'Takes excess water out of the body'. Only just over 5% of students did not understand the processes in the kidney and scored no marks at all.

04.4
This was a levelled response question, in which students were given some facts about kidney transplants and dialysis, and asked to evaluate the two methods of treating kidney failure. They were also told to draw on their own knowledge in their answer. 10% of students did not attempt this question.
A significant proportion of students simply copied the information given in the question without any modification or comment and were among the 20% of students that scored no marks. There had to be some original content in the answer for it to be worthy of credit.
It was apparent that several students had little awareness of the processes involved with either type of treatment giving comments such as 'Transplants only take a couple of hours – you just need a donor'.

A pleasing number of students identified the improvement to lifestyle due to not needed to go for regular/long hospital visits, and similar numbers of students considered the issue of rejection. Over 40% of students that gave both an idea in favour and against kidney transplant were given credit in Level 2.

Many students gave a partial reason in their arguments which did not gain credit such as 'It is less expensive', 'You have to take drugs', 'It's risky'. The source of the donor organ was seldom referred to, and when it was, was generally assumed to be a living relative or a kind stranger. A large number thought that the cost of treatment was the responsibility of the patient and that might affect their choice of treatment. Giving a one-sided argument – that is - giving only points for or points against transplant, limited the student to one mark in Level 1.