GCSE
BIOLOGY
8461/2F

Paper 2 Foundation Tier

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

226G84612F/MS

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 Examiner.

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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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 their judgement
- 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus 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 errors / 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

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is 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.

3.10 Do <u>not</u> accept

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

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

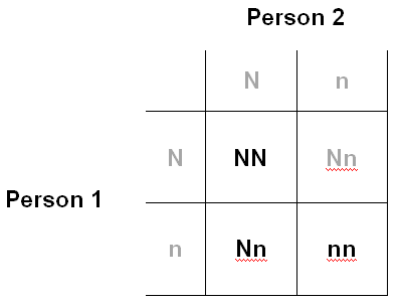
You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	an allele expressed only if a person has two copies of the allele		1	AO1 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	male with MSUD	allow equivalent statements eg affected male **or** MSUD male **or** man with the disease	1	AO3 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3 *mark with 01.4, 01.5*		3 correct = **2** marks 2 or 1 correct = **1** mark	2	AO2 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4 *mark with 01.3, 01.5*	does not have MSUD	allow equivalent statements – eg normal **or** not affected **or** healthy ignore carrier	1	AO2 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5 *mark with 01.3, 01.4*	correct percentage from **Figure 2**	if no answer in question **01.3** allow 25%	1	AO3 4.6.1.6 4.6.1.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	dominant		1	AO2 4.6.1.6

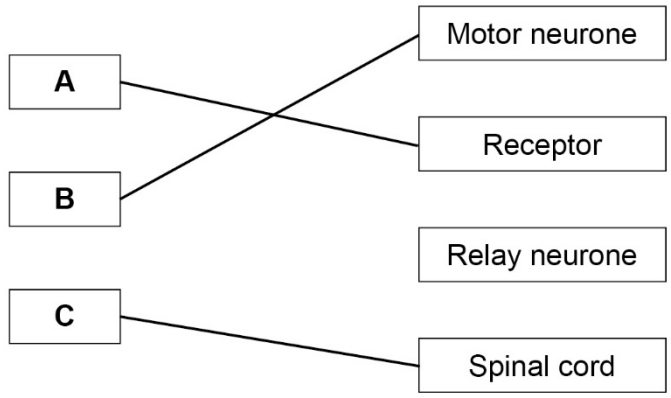
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	DNA	allow deoxyribonucleic acid allow nucleotide(s)	1	AO1 4.6.1.4 4.6.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	proteins		1	AO2 4.6.1.4

Total Question 1		**9**

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a reflex action is automatic		1	AO1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	 do **not** accept more than one line from a box on the left		1 1 1	AO1 4.5.1 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	blinking when an insect flies into the eye removing the hand from a hot object		1 1	AO2 4.5.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4 *View with Table 1* *Mark with 02.5*	$\frac{320 + 304 + 315 + 308 + 313}{5}$ 312	allow $\frac{1560}{5}$ if no other mark awarded allow **1** mark for $\frac{315 + 307 + 357}{3} = 326(.3)$	1 1	AO2 4.5.2.1 RPA7

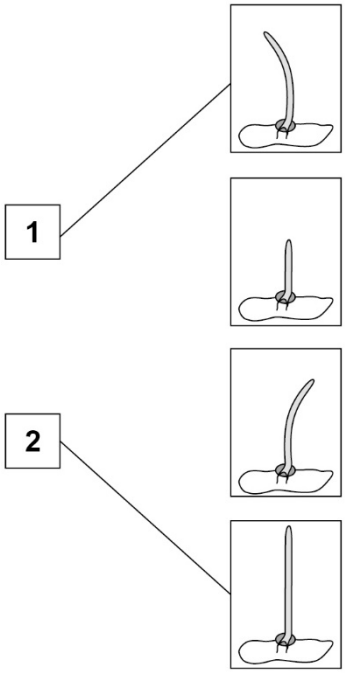
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5 *View with Table 1* *Mark with 02.4*	ring drawn around 635 in Table 1	allow 635 or test 5 (next to question) if no ring drawn on Table 1	1	AO3 4.5.2.1 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **two** from: • age • drugs • tiredness / sleep • sex	 allow a named example of a drug such as alcohol / caffeine allow gender allow practice at the test **or** playing computer games allow distractions	2	AO1 4.5.2.1 RPA7

Total Question 2		**11**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	tropism		1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	 do **not** accept more than one line from a box on the left		1 1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	to show the response in experiment **1** is caused by (1-sided) light **or** as a control	allow to compare with experiment **1** allow to show the difference between (1-sided) light and no light do **not** accept control variable	1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	shine light from all sides on the third seedling		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	keep each seedling at the same temperature		1	AO3 4.5.4.1 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	any **one** from: • gravity • water • chemicals / minerals / ions	allow moisture allow a named chemical such as nitrate ignore nutrients ignore light	1	AO1 4.5.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because of variation (in results) **or** to identify / eliminate anomalies	allow example such as some may not grow	1	AO2 4.5.4.1
	to calculate a mean **or** a mean value would be more representative / typical	allow to calculate an average ignore to improve accuracy / precision / validity	1	

Total Question 3		**9**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	bacteria		1	AO3 4.7.1.2 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	any **two** from: • bacteria increase **before** protozoa increase **or** when bacteria are high, protozoa increase • as protozoa increase, bacteria decrease • (after site **A**) as bacteria decrease, protozoa also decrease	 allow protozoa increase **after** bacteria increase allow when bacteria are low, protozoa are low	2	AO3 4.7.1.1 4.7.1.3 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(aerobic) respiration	do **not** accept anaerobic respiration	1	AO1 4.7.1.2 4.7.3.2 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(algae carry out) photosynthesis (which) produces oxygen	 allow algae produce oxygen	1 1	AO2 4.7.3.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	bars plotted correctly suitable shading	allow a tolerance of ± ½ a small square ignore column widths	1 1	AO2 4.7.1.2 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	more sludge worms at **A** (than at **B)** no mayfly nymphs at **A and** mayfly nymphs present at **B**	answers must be comparative allow fewer sludge worms at **B** (than at **A)** allow high number of sludge worms at **A and** low number at **B** allow more mayfly nymphs at **B** (than at **A**)	1 1	AO3 4.7.1.2 4.7.3.2

Total Question 4		**10**

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	oestrogen progesterone		1 1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	FSH causes an egg to mature in the ovary		1	AO1 4.5.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(from day) 9 (to day) 15	do **not** accept (from day) 15 (to day) 9	1	AO2 4.5.3.5

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.5.3.4 4.5.3.5
	Level 2: Relevant points (reasons/causes) are identified and there are attempts at logical thinking. 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 thinking.	1–2	
	No relevant content	0	
	Indicative content • oral contraceptive / the 'pill' o (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing **or** prevents ovulation • injection / implant / skin patch o (contains hormones / oestrogen / progesterone) to prevent egg / follicle maturing **or** prevents ovulation • condom / femidom o prevents sperm reaching egg or prevents sperm entering woman's body / vagina • diaphragm o prevents sperm reaching egg / womb / oviduct • IUD o prevents implantation **or** releases hormone / progesterone to prevent ovulation **or** (releases copper ions to) thicken mucus and prevent sperm passage • spermicide o kills sperm • sterilisation / vasectomy / tubular ligation o prevents passage of sperm / egg • rhythm method o no egg available for fertilisation		

Total Question 5		**10**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(lowest) 1 (ºC) (highest) 34 (ºC)	both correct for **1** mark allow a tolerance of ± 0.2 (ºC) allow a tolerance of ± 0.2 (ºC)	1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	5 / five		1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	so stored food **or** glycogen does not run out **or** to replace stored food **or** glycogen	allow so stored fat does not run out **or** to replace stored fat **or** because stored food **or** glycogen / fat has run out ignore to provide energy	1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	respiration		1	AO1 4.5.2.4 4.4.1.3 4.4.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	any **one** from: • movement • muscle contraction • keeping warm • growth / repair • active transport	allow functioning of internal organs – eg heartbeat allow synthesis / described	1	AO1 4.5.2.4 4.1.3.3 4.4.2.1 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	3200×2.5 8000 (kJ)		1 1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	$\frac{6000}{24\,000} \times 100$ 25 (%)	if no other mark awarded allow for **1** mark 0.25	1 1	AO2 4.5.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.8	reduced	do **not** accept no sweating	1	AO2 4.5.2.4

Total Question 6		**10**

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1 *view with Table 3*	kingdom genus	in this order only	1 1	AO1 4.6.3.5 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	Linnaeus		1	AO1 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	*Elrathia kingii*		1	AO2 4.6.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	trilobite **A** was found in older rocks than trilobite **B** trilobite **B** is more complex than trilobite **A**		1 1	AO3 4.6.3.4 4.6.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	sediments soft parts minerals	in this order only	1 1 1	AO2 4.6.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	any **three** from: • drought • ice age • global warming • volcanic activity • asteroid collision • (new) predators • (new) disease / pathogen • competition for food • competition for mates • lack of habitat or habitat change	 } if none of these, allow climate change for **1** mark ignore weather } if neither of these, allow catastrophic event **or** natural disaster for **1** mark allow named example allow hunters allow named example allow lack of food allow lack of mates ignore competition unqualified ignore isolation ignore pollution	3	AO1 4.6.3.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	no / insufficient evidence **or** cannot perform experiment to find out	allow lack of evidence allow no-one was there to observe	1	AO3 4.6.3.5 4.6.3.6

Total Question 7		**13**

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	<table><tr><th></th><th>Sexual reproduction</th><th>Asexual reproduction</th></tr><tr><td>Cell division occurs</td><td>✓</td><td>✓</td></tr><tr><td>Fertilisation occurs</td><td>✓</td><td></td></tr><tr><td>Genes are passed on from parent to offspring</td><td>✓</td><td>✓</td></tr><tr><td>Offspring are genetically identical to each other</td><td></td><td>✓</td></tr></table> allow **1** mark for 1 or 2 correct rows ignore 'x' in blank boxes		2	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	pollen (grain)	allow nucleus in pollen (grain)	1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	between 3 and 4 hours		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	5 hours 6 hours		1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	2		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	4		1	AO2 4.6.1.2

Total Question 8		**8**

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**abiotic** any **two** from: • water • oxygen / air (in soil) • pH (of soil) • minerals / ions • temperature • size of soil particles **or** texture / type of soil **biotic** any **two** from: • food • predators / consumers / carnivores • disease / pathogens / bacteria / fungi	 allow moisture / humidity / rain(fall) allow dryness ignore carbon dioxide allow acidity / alkalinity (of soil) allow salts allow named example of an ion ignore nutrients allow named example of soil type ignore space / toxins / weather allow amount of dead / decaying matter (in soil) ignore nutrients allow example – such as birds allow microorganisms / microbes / parasites if **no** other marks awarded allow **2** marks for **four** factors in reverse categories	2 2	AO1 4.7.1.1 4.7.1.2 4.7.1.3

Question	Answers	Mark	AO / Spec. Ref.
09.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO2
	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	AO2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO1
	No relevant content	0	
	Indicative content • same concentration of chemical / **X** applied to the soil • same volume / amount of chemical / **X** applied to the soil • same size of area sampled – eg 1 m^2 or 0.25 m^2 • use of a quadrat • same time between application and collecting worms • same time allowed for collecting worms after application • each sample area selected randomly • method of achieving randomness – eg random coordinates • (collect and) count worms in each of areas **A** and **B** • at least 5 repeats in each of areas **A** and **B** • calculate mean (per unit area) **or** total for each of areas **A** and **B** • compare means / totals for areas **A** and **B**		4.7.2.1 RPA9

Total Question 9		**10**

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	an answer in the range 1.1 to 2(.0) (hours)		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	*effect* : lowered *explanation*: glucose taken in **or** glucose converted to glycogen **or** glucose used in respiration by cells / liver / muscles		1 1 1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	underweight		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	(from) 67.5 (kg to) 90 (kg)	allow in the range 67 to 68 (kg) for 67.5 (kg) allow in the range 90 to 90.5(kg) for 90 (kg) allow from 90 (kg to) 67.5 (kg)	1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5		answers must be comparative		AO3 4.5.3.2
	(person **C** has) higher glucose (than mean)	allow comparison of higher glucose using numbers allow (person **C**'s) glucose is too high	1	
	(person **C** has) higher insulin (than mean)	allow comparison of higher insulin using numbers allow (person **C**'s) insulin is too high do **not** accept (person **C** has) higher cholesterol ignore unprocessed data	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	(more) exercise	allow example of (more) exercise	1	AO1 4.5.3.2
	eat less carbohydrate / sugar **or** eat a low carbohydrate diet	allow eat less fat allow eat a carbohydrate controlled diet if no other marks awarded allow **1** mark for lose weight **or** maintain healthy weight **or** eat less **or** eat fewer calories ignore references to healthy / balanced diet **or** diet unqualified	1	

Total Question 10		**10**