AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 4.5.3.2

Control of blood glucose concentration

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**6**
Available paper years	**2020–2025**

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.

4.5.3.2 Control of blood glucose concentration

Answer 01 · Mark scheme

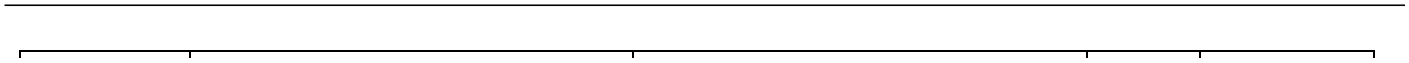
November 2020 | 8464/B/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	controlling water output in urine keeping cool on a hot day		1 1	AO2 4.5.1
04.2	pituitary		1	AO1 4.5.3.1
04.3	(8.4 – 5.2 =) 3.2 (mmol/dm^3)		1	AO2 4.5.3.2
04.4	diabetes	ignore type of diabetes	1	AO3 4.5.3.2
04.5	the pancreas is not releasing insulin		1	AO3 4.5.3.2
04.6	change diet take more exercise	allow description of suitable diet change e.g. use sweetener in hot chocolate, eat less sugary / starchy food or stop eating sugar-coated cereal allow description e.g. go to gym instead of reading and TV, walk / cycle to work allow change to an active job if no other marks awarded allow 1 mark for lose weight.	1 1	AO3 4.5.3.2
Total			**8**	

4.5.3.2 Control of blood glucose concentration

Answer 01 · Mark scheme

November 2020 | 8464/B/2F | Original Q4



4.5.3.2 Control of blood glucose concentration

Answer 02 · Mark scheme

November 2021 | 8464/B/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	endocrine (system)	ignore hormonal (system)	1	AO1 4.5.3.1
06.2	D		1	AO1 4.5.3.1 4.5.3.2
06.3	A		1	AO1 4.5.3.1
06.4	(in / through / via) blood	allow (in / through / via) bloodstream allow (in / through / via) plasma allow (in / through / via) blood vessels **or** named blood vessel	1	AO1 4.5.3.1
06.5	ovary / ovaries testis / testes	in either order allow testicle(s) allow placenta if no other mark awarded allow gonad(s) for **1** mark	1 1	AO1 4.5.3.1 4.5.3.3
06.6	luteinising hormone (LH)		1	AO2 4.5.3.3

4.5.3.2 Control of blood glucose concentration

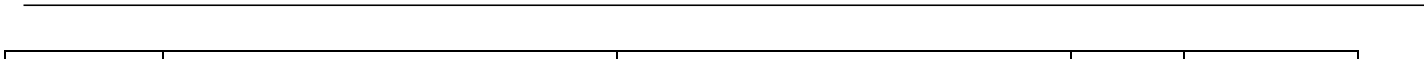
Answer 02 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
06.7	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.5.3.4 4.3.1.9
	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 Advantages • non-permanent like condom / diaphragm / IUDs / spermicides / abstinence **or** unlike surgical sterilisation • longer lasting than condom / diaphragm / IUDs / spermicides • no need to remember unlike oral contraceptive • one injection rather than surgery for sterilisation • surgery (for sterilisation) has risks, for example, infection • no other method of long-lasting contraception (rather than sterilisation) relies on men Disadvantages • no protection from sexually transmitted diseases unlike barrier methods **or** named barrier method • not as long lasting as (surgical) sterilisation • at clinical / drug trial stage, so unknown side effects • at clinical / drug trial stage, so unknown efficacy • do not know how long it will last (as info only states 'up to 13 years') • can stop taking a pill **or** using a condom if you change your mind / want to get pregnant, whereas have to wait 13 years with the injection • (minor) risk of infection posed with an injection compared to no risk with the oral contraceptive For **Level 3** references to advantages **and** disadvantages of the new drug compared to named existing methods are required.		
Total		**13**	

4.5.3.2 Control of blood glucose concentration

Answer 02 · Mark scheme

November 2021 | 8464/B/2F | Original Q6



4.5.3.2 Control of blood glucose concentration

Answer 03 · Mark scheme

June 2022 | 8464/B/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	D		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	B		1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels allow (in / through / via) arteries / veins / capillaries	1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	insulin		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	glucose is converted to glycogen glucose moves from the blood into the cells		1 1	AO1 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	8:30 (am)	allow 8:15 – 8:35 (am) allow time written in words	1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	any value in the range ≥ 6.5 to ≤ 20 ($mmol/dm^3$)		1	AO3 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	any **two** from: • low carbohydrate diet • exercise (regime) • lose body mass	 allow low calorie / fat / sugar diet allow eat fewer (sugary) snacks allow description of exercise allow lose weight allow (metformin) tablets to reduce blood glucose	2	AO2 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.9	(less) respiration		1	AO1 4.5.3.2
	(so) less energy released / transferred **or** less muscle contraction	do **not** accept energy produced / made / created	1	AO2 4.4.2.1

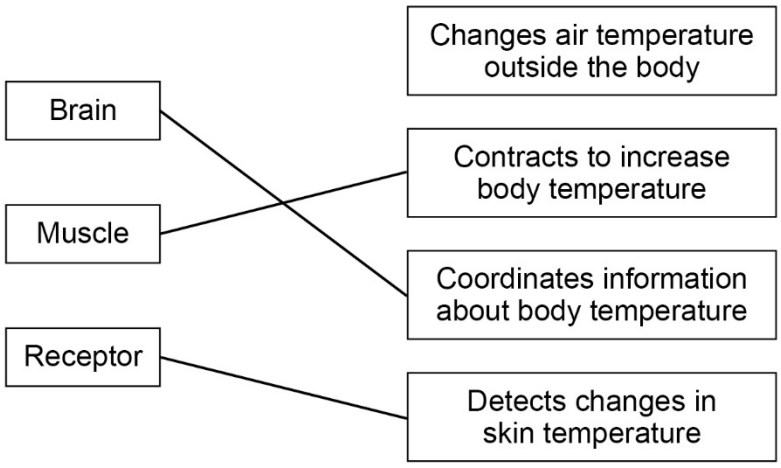
Total Question 4		**12**

4.5.3.2 Control of blood glucose concentration

Answer 04 · Mark scheme

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

Question 5

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	to allow cells to function properly to maintain the optimum conditions for enzymes		1 1	AO1 4.5.1

4.5.3.2 Control of blood glucose concentration

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(body) temperature decreases (with increasing time)	ignore decreases unqualified	1	AO2 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	37 – 35.5 1.5 (°C)	 ignore minus sign ignore decrease	1 1	AO2 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	suitable extrapolation line on **Figure 6** answer consistent with student's line	 if no extrapolation allow value in range 4.3 to 4.8 allow answer in minutes **or** hours and minutes if units are given	1 1	AO2 AO3 4.5.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	pancreas		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	endocrine (system)		1	AO1 4.5.3.1

4.5.3.2 Control of blood glucose concentration

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	decrease		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.9	obesity / overweight	allow any **one** from: • lack of exercise • inactivity • family history (of diabetes) • age • high blood pressure • high cholesterol • race • smoking • high BMI • diet high in carbohydrate / sugar / fat / salt	1	AO1 4.5.3.2

Total Question 5	**14**

4.5.3.2 Control of blood glucose concentration

Answer 05 · Mark scheme

June 2024 | 8464/B/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	pituitary (gland) adrenal (gland) ovary	must be in this order	1 1 1	AO1 4.5.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	receptor cells		1	AO2 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(in / through / via) blood(stream)	allow (in / through / via) plasma allow (in / through / via) blood vessels **or** named blood vessel do **not** accept (in / through / via) red / white blood cells	1	AO2 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	liver		1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	glycogen		1	AO1 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(11 – 5 =) 6 (arbitrary units)	allow answer on **Figure 3** if not on answer line	1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	increases then decreases	 allow decreases at the end allow then returns to normal ignore reference(s) to rate of increase or decrease ignore reference to remaining constant between increase and decrease ignore values of time / concentration	1 1	AO2 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	high / higher / highest (blood) glucose / sugar (concentration) **or** fast / faster / fastest (blood) glucose / sugar (concentration) rise / increase **or** slow / slower / slowest (blood) glucose / sugar (concentration) decrease **or** (blood) glucose / sugar (concentration) has not decreased (much)	allow (blood) glucose / sugar (concentration) goes up to 11 allow (blood) glucose / sugar (concentration) took longer to decrease	1	AO3
	(because) there is no / less insulin (produced by the body / pancreas) **or** (because cells of body / liver) not responding to insulin		1	AO2 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	any **two** from: • eat less carbohydrate / sugar **or** a low / controlled carbohydrate diet • eat less fat • lose (body) mass / weight • (more) exercise	if neither of these awarded allow **1** mark for a calorie-controlled diet **or** reduced calorie diet ignore go on a diet unqualified allow examples of (increased) exercise allow stop smoking ignore take medicine / insulin ignore named medicine ignore pancreas transplant	2	AO1 4.5.3.2

Total Question 2	**14**

4.5.3.2 Control of blood glucose concentration

Answer 06 · Mark scheme

June 2025 | 8464/B/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	blood glucose concentration increases		1	AO2 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	pancreas		1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	liver muscle		1 1	AO1 4.5.3.1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	glucose glycogen	must be in this order	1 1	AO1 4.5.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	decrease		1	AO2 4.5.3.2

4.5.3.2 Control of blood glucose concentration

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	any **two** from: • eat less carbohydrate / sugar **or** a low / controlled carbohydrate / sugar diet • eat less fat • lose (body) mass / weight **or** maintain healthy weight • (more) exercise	if neither mark awarded allow **1** mark for calorie controlled diet or reduced calorie diet ignore references to healthy / balanced diet or diet unqualified allow examples of (increased) exercise allow stop smoking allow named drug treatment eg metformin ignore take medicine / drug / insulin ignore pancreas transplant	2	AO1 4.5.3.2

Total Question 1	9

4.5.3.2 Control of blood glucose concentration

Answer 02 · Examiner comments November 2021 | 8464/B/2F | Original Q6

Question 6 (standard demand)

This question was about hormones and contraception. Early parts of the question requiring recall of correct terms such as 'endocrine' were not answered well. Common incorrect answers were digestive system, respiratory system or attempts to name the organs. The vast majority knew that hormones travel in the blood. Some students knew the hormones were likely to be in the plasma, which was creditworthy. Inaccuracies in responses such as 'in red blood cells' did not gain the mark. Confusion was seen regarding the term 'glands' in **06.5** in this context, with a wide range of other parts of the reproductive system being named.

There was a generally a good attempt at evaluating a new contraceptive method with existing methods in **06.7**. In this question students needed to consider both advantages and disadvantages compared with named existing methods of contraception to access 5 or 6 marks. Clear guidance relating to the command words used in AQA GCSE Sciences examinations is available. Students were not given information regarding the efficacy of the new contraceptive, but some students attempted to compare the efficacy with existing contraceptive methods.

Answer 03 · Examiner comments June 2022 | 8464/B/2F | Original Q4

Question 4 (low & standard demand)

04.1 Two-thirds of students could identify the pancreas on Figure 5.

04.2 72% of students could identify the thyroid gland on Figure 5.

04.3 62% of students gained this mark. Blood, bloodstream and blood vessels were the most commonly seen correct answers. Named blood vessels were acceptable, as was plasma, but this was rarely seen.

Common misconceptions were seen, such as hormones travelling in blood cells, electrical impulses transporting hormones or the brain sending hormones out to the rest of the body.

04.4 45% of students gave the correct answer 'insulin'. Phonetic spelling was allowed. Incorrect answers included a range of other hormones, diabetes and pancreas.

4.5.3.2 Control of blood glucose concentration

Answer 03 · Examiner comments June 2022 | 8464/B/2F | Original Q4

04.5 A fifth of students could identify two ways that hormone X causes a decrease in blood glucose concentration.

04.6 Students found this challenging, with fewer than 43% gaining the mark. Some students incorrectly gave the time that the graph peaked, others the trough or the start of the *x*-axis.

04.7 This was another challenging question, with a third of students gaining the mark.

04.8 Most students could give at least one lifestyle change. Exercise or descriptions of exercise were the most common correct response.

04.9 Students found this a very challenging question. Few students made correct reference to respiration. Energy was often referred to in incorrect terms, such as glucose making energy or glucose being needed to feel energised. Some students stated that you need lots of glucose for energy which was insufficient. Other students confused the idea that low blood glucose was because of insulin in this case.

Answer 04 · Examiner comments June 2023 | 8464/B/2F | Original Q5

Question 5 (Low and Standard demand)

05.1 Most students gained 2 or 3 marks. The most frequent error was to link 'Receptor' with 'Changes air temperature outside the body'.

05.2 40% of students could identify why homeostasis is important.

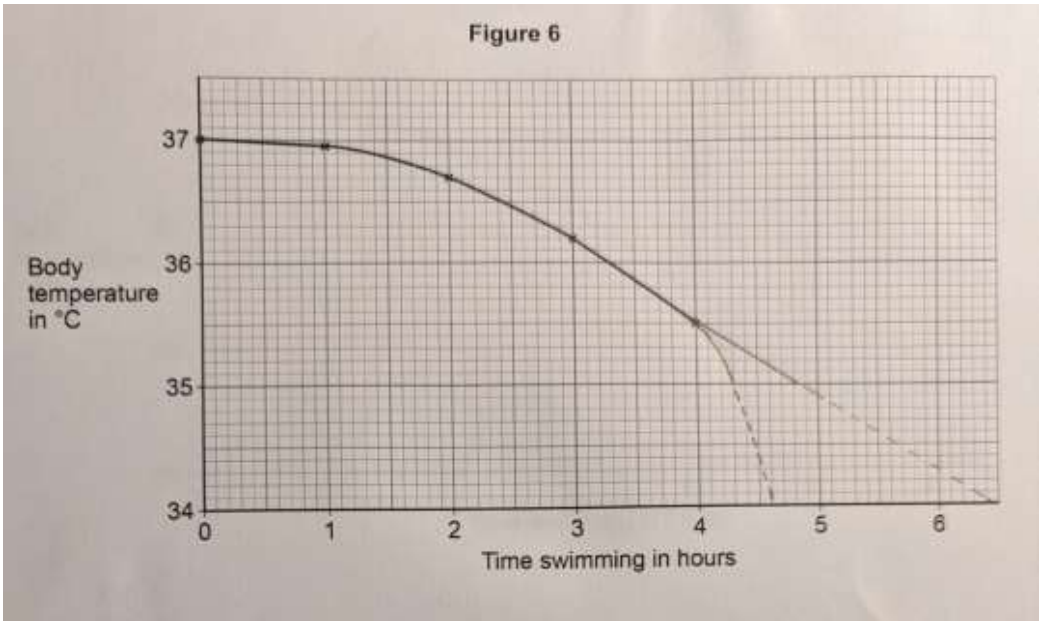
05.3 Most students could describe the trend as a decrease in temperature. Some students misinterpreted the graph as lower temperature causing longer time.

05.4 Most students could read the relevant values from the graph and subtract the values.

4.5.3.2 Control of blood glucose concentration

Answer 04 · Examiner comments June 2023 | 8464/B/2F | Original Q5

05.5 There was a generous tolerance on extrapolation lines, from appropriately curved to straight.



The illustration above shows the acceptable limits for the extrapolation line, which needed to reach 35 °C. Small imperfections were acceptable, but lines could not be too thick, wobbly or sketchy to allow a reading to be taken. Extrapolation of the line below 35 °C was ignored (as shown by the dashed lines above).

Where extrapolation lines were drawn most were acceptable and gained credit.

The mark scheme for marking point 2 details how this was marked if no extrapolation line was drawn, but in that instance **only** marking point 2 was awarded. Of the large number of students who did not draw a line many still scored a mark for predicting a suitable result, usually 4.5 hours.

Of those who did draw a line about half correctly read their result at 35 °C, and about half gave a different answer of 5 or 6 hours, which did not match to their graph line.

05.6 Most students knew that insulin is produced by the pancreas.

05.7 Very few students knew that the endocrine system is the name of the system involving hormones. Many incorrect answers were seen, such as glands, nervous, reproductive, stomach, capillaries, intestines and brain.

05.8 There was considerable confusion over the function of an increased insulin concentration, with only 55% of students choosing the correct option.

05.9 The most common correct answer was obesity, although the full range of other acceptable responses, as shown in the extra information on the mark scheme, was seen.

Many students misinterpreted the question and believed it was asking for a future risk if a person has Type 2 diabetes. Thus, common responses such as ‘coma’, ‘CHD’ and ‘high blood glucose level’ were frequently seen and did not gain credit.

4.5.3.2 Control of blood glucose concentration

Answer 04 · Examiner comments June 2023 | 8464/B/2F | Original Q5

Those that did read the question correctly generally gave ‘obesity’ to gain the mark. Specific types of eating or diets such as those high in fats or sugar were acceptable, but vague terms such as bad / poor / unhealthy diets or ‘eating junk food’ were not accepted.

4.5.3.2 Control of blood glucose concentration

Answer 05 · Examiner comments

June 2024 | 8464/B/2F | Original Q2

Question 2 (low & standard demand)

02.1 Students found it particularly difficult to label the pituitary gland and adrenal gland. Thyroid gland was commonly incorrectly given for either of these labels. A significant proportion of students could not label the ovary.

02.2 Over 50% of students could select 'receptor cells' as the correct response.

02.3 Most students knew that insulin is transported around the body in the blood, or correctly named a blood vessel. Some students incorrectly stated that the insulin is transported by red blood cells.

02.4 Fewer than 50% of students knew that the liver is the target organ of insulin.

02.5 Most students knew that glycogen is a store of glucose in human cells.

02.6 The majority of students could read the two values from the graph and calculate the increase. The most common incorrect answer was 11, where students had not appreciated the question asked for the change in blood glucose concentration. The word 'change' was emboldened on the question paper to try to avoid this error from occurring.

02.7 There were many ways to describe the trend between blood glucose concentration other than the words used on the mark scheme. For example, 'up, then back to normal', or 'up then down' or 'up and down' each gained 2 marks.

Credit was given whether the student was referring to all three people or to just one person.

Reference to 'a peak' was taken as equivalent to increase and awarded the first mark. Therefore, 'after a peak it decreases' was worth 2 marks.

Some students found it difficult to describe the decrease. 'After 60 minutes it decreases' is the correct idea so was given the mark. Simply stating as part of their answer, 'then it drops' was also equivalent to 'then decreases'. However, 'then it relaxes', 'then it releases' or 'it decreases' unqualified was insufficient.

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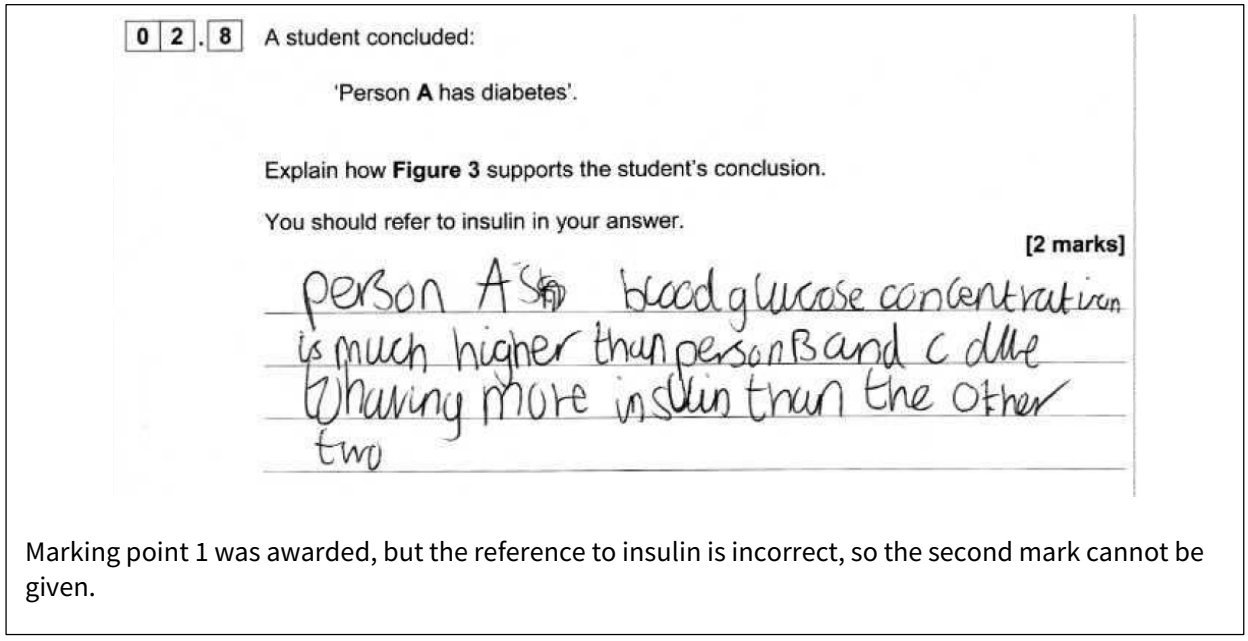
4.5.3.2 Control of blood glucose concentration

Answer 05 · Examiner comments June 2024 | 8464/B/2F | Original Q2

02.8 The mark points were independent. More students gained the first mark than the second. Despite the prompt in the question, many students made no reference to insulin.

Some students used the word 'it', such as 'it goes high'. Given the way the question was phrased, 'it' was taken to mean insulin, unless qualified. Note the guidance on page 4 of the mark scheme.

Many students have the misconception that insulin is broken down to produce glucose. Other students appear to have misinterpreted the graph as showing concentration of insulin.


0 2 . 8 A student concluded:

'Person **A** has diabetes'.

Explain how **Figure 3** supports the student's conclusion.

You should refer to insulin in your answer.

[2 marks]

person A has blood glucose concentration is much higher than person B and C due to having more insulin than the other two

Marking point 1 was awarded, but the reference to insulin is incorrect, so the second mark cannot be given.

02.9 Most students knew that more exercise is an appropriate lifestyle change for a person with Type 2 diabetes.

References to diets were often too vague, such as 'go on a diet' or 'eat healthy food'. The specification should be used to guide the level of detail required.

Many students incorrectly stated that the person should inject insulin or have an insulin pump. These are not lifestyle changes.

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4.5.3.2 Control of blood glucose concentration

Answer 06 · Examiner comments

June 2025 | 8464/B/2F | Original Q1

Question 1 (Low demand)

01.1 Nearly 90% of students correctly identified that blood glucose concentration increases soon after drinking a glucose solution.

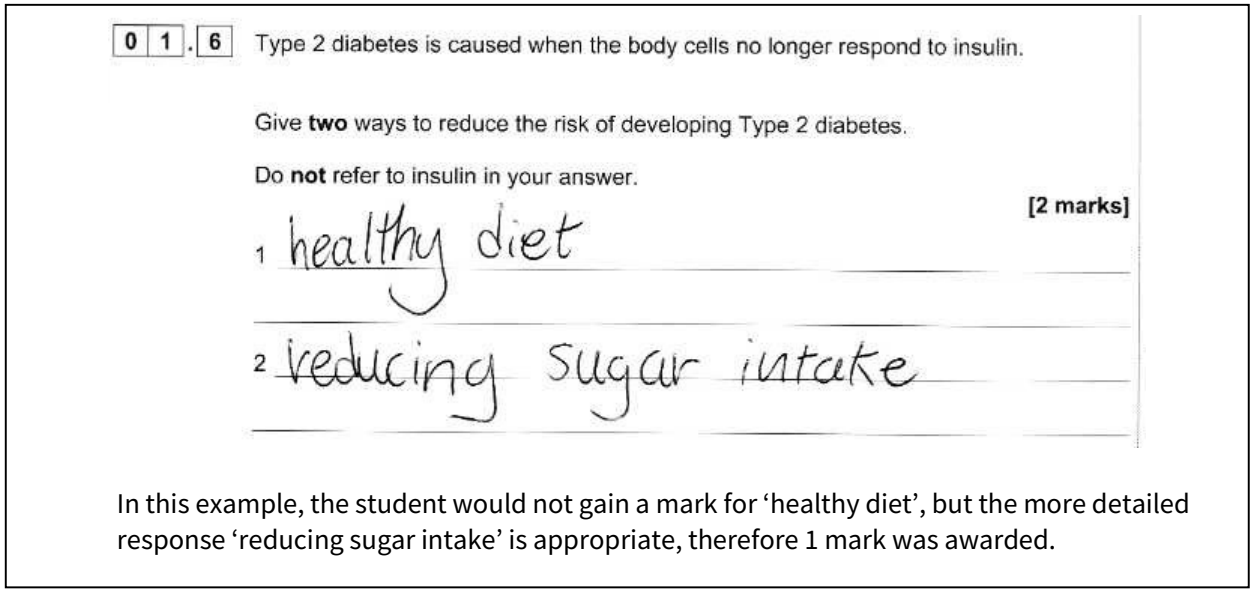
01.2 Over 85% of students knew that the pancreas produces insulin.

01.3 Over 40% of students correctly recalled that liver and muscle are target organs for insulin.

01.4 The most common error was to give the answer glycogen and then glucose to complete the sentences.

01.5 It was more common for students to incorrectly state that insulin causes blood glucose concentration to increase, rather than to decrease.

01.6 Many students were able to gain one of the two marks here, most often for stating 'do exercise' to reduce the risk of developing Type 2 diabetes. References to an appropriate diet change were rare, with students frequently giving answers that lacked sufficient detail, such as 'have a healthy diet' or 'eat a balanced diet'. The specification should be used as a guide to the level of detail students should include in their responses.



0 1 . 6 Type 2 diabetes is caused when the body cells no longer respond to insulin.

Give **two** ways to reduce the risk of developing Type 2 diabetes.

Do **not** refer to insulin in your answer.

[2 marks]

1 healthy diet

2 reducing sugar intake

In this example, the student would not gain a mark for 'healthy diet', but the more detailed response 'reducing sugar intake' is appropriate, therefore 1 mark was awarded.

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