Questions matter

GCSE

Combined Science: Trilogy

8464/B/2H Combined Science: Trilogy Biology Paper 2H

Report on the exam

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Contents

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Overview

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of six questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 40% of marks target Standard demand, 40% of marks target Standard/high demand and 20% of marks target High demand.

Questions 1 and 2 on this paper and questions 5 and 6 on the Foundation Tier paper are common. These questions are identical and are targeted at standard demand.

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade is based on their attainment across all six papers.

Summary of overall performance

Generally, on the Higher tier, students tried to give detailed responses. Credit can never be awarded for repeating information given in the question, however, and some students are spending significant time doing this across the whole paper.

Students were occasionally using the word 'it' in their responses in ways that were not clear enough to award marks. See the guidance on page 4 of the mark scheme.

Describing changes in reaction time continues to be a challenge for many students, who incorrectly refer to faster or slower reaction times rather than faster or slower reactions, or to lower or greater reaction times.

Descriptions of recall of knowledge, such as control of blood glucose concentration, appear to have improved. Likewise, understanding of the Required Practical Activity investigating abundance or distribution of a species appeared to be a strength, although a minority of students are still describing throwing of quadrats as an acceptable method of sampling, which it is not.

Students were frequently giving descriptions in questions that asked for explanations.

Question 1 (standard demand)

01.1 Many students could give the food chain in the correct order with appropriate arrows showing the flow of energy. Responses that used commas or hyphens, rather than arrows, did not gain the mark. Some students tried to give extra information, such as identifying the producer and primary consumer, but this was not required.

01.2 Some students demonstrated problems converting from centimetres to metres. Responses occasionally stated that 50 cm = 5 m.

Calculation of area was sometimes a challenge, with frequently seen responses such a 50 + 50 + 50 + 50 = 200 indicating confusion between area and perimeter.

Many students gave the incorrect response of 0.5 × 0.5 = 2.5, perhaps suggesting that they are not using their calculator.

01.3 Marks were often awarded for allowing error carried forward from the previous question.

Many students only calculated 2% of the area of the shore and then stopped. Therefore only the first mark was awarded.

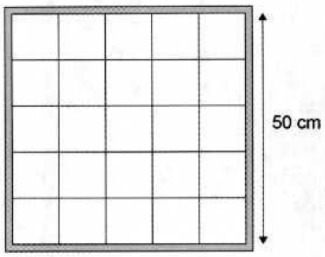
Some students who did not gain marks had attempted to calculate 2% of their answer to the previous question, indicating they had not understood the context.

Students estimated the population of limpets on a sea shore.

The students were given a square quadrat.

Figure 2 shows the quadrat.

Figure 2



0 1 . 2 Calculate the area of the quadrat in m^2.

[2 marks]

$50 \times 50 = 2500\ cm^2$

$2500\ cm^2 = 25\ m^2$

$\div 100$

Area of quadrat = 25 m^2

0 1 . 3 The total area of the sea shore was 1800 m^2.

The students sampled 2% of the total area of the sea shore.

Calculate the number of times the students needed to use the quadrat for the 2% sample.

Use your answer from Question **01.2**

[2 marks]

$10\% = 180\ m^2$ to capture $36\ m^2$

$1\% = 18\ m^2$ quadrat used 2 times.

$2\% = 36\ m^2$ 25

50

Number of times = 2

For question 01.2, the student gained marking point 1 only.

For question 01.3, the student has calculated 2% of 1800 m^2 then noted that the quadrat would need to be used twice (using their error carried forward) therefore 2 marks were awarded for question 01.3.

01.4 Most students could give a reason for not throwing the quadrat and gain the first mark. Usually, students stated throwing could be biased. Very few could explain why this was a problem. References to the effect it would have on the population estimate were rare.

Some students demonstrated the misconception that throwing quadrats is an appropriate sampling method. Others stated that the issue is that the quadrat could sample the same area twice, which was not correct, because that could also occur with a random method.

01.5 Some students had knowledge of using a random number generator on their calculator or phone and could describe the use of coordinates on the shore.

Many students incorrectly referred to throwing in random directions or being blindfolded. These are never appropriate methods for sampling. Others demonstrated the misconception that choosing locations with the most limpets would be appropriate. Some confusion between quadrats and transects was seen.

01.6 On the Foundation tier, many students gave a risk, such as drowning, rather than a hazard. This was rare on the Higher tier paper. Common incorrect answers referred to the quadrat being washed away, or gave descriptions of ways to reduce risk, such as 'wear sensible shoes'.

01.7 Most students could name one type of pollution that may affect the population of limpets. The most frequently seen answers were plastic and sewage.

Common responses that were not awarded the mark were chemicals, crabs and waste.

Question 2 (standard demand)

02.1 More than 50% of students could select that the classification group 'Eukaryota' is a domain.

02.2 Almost all students knew that asexual reproduction produces genetically identical offspring.

02.3 More than 80% of students knew that a gamete contains half the number of chromosomes compared to the other cells in a potato plant.

02.4 Most students could describe how a new plant species could be identified as being in the same genus as potatoes. DNA analysis or similar characteristics were the most common correct answers.

Misconceptions were seen, such as the idea that the species would have identical DNA.

02.5 Most students followed the direction of the question, stating that GM crops can be made to grow even if the climate changes.

Some students were aware of food insecurity as a result of climate change, and this could be given credit for the idea that current crops will not be able to grow/survive.

Lists of possible benefits of GM were limited to Level 1 if there was no link to climate change. Most students made very good attempts at this question and many recognised some of the effects of climate change and were able to link these to the idea that current crops would struggle to grow in these conditions. This was an attempt at a logical link and achieved a Level 2 mark.

Some students further developed this idea, and clearly had a grasp of the question being asked, as they then went on to describe how GM would enable crops (or potatoes) to survive the conditions that climate change brings. They could further strengthen their account with suggestions that more crops could be grown or crops could be grown faster. These responses were detailed and logically linked accounts and were therefore Level 3 responses.

Some students gave explanations of causes of climate change, but this did not answer the question.

Some students responded in terms of 'how' GM crops can be produced, mentioning enzymes and vectors. This was not answering the question and therefore could not be given credit. These responses often gained marks from the rest of their explanation.

0 2 . 5 Scientists have collected and stored seeds from species in the same genus as potatoes.

In the future, these seeds may be used for genetic modification of potato plants.

Genetically modified potato plants could help supply food to the human population as the climate changes.

Explain why genetic modification of crop plants may be important for the human population to survive climate change.

[6 marks]

As climate changes occurs the global temperature could get warmer. This means that agriculture will become harder and it will become harder for crops to be grown under hot conditions. This means that genetically modified crops could be modified to withstand greater heat and be produced in bigger yields. These crops could be produced with more nutrients and be bigger so that humans could get more energy in the future where there will be limited resources.

The student has described two effects of climate change (global temperature getting warmer and that it will be harder for crops to be grown). They then give two relevant benefits of GM linked to these ideas. This meets and exceeds the description for entry into Level 3, for both logical linking and detail, therefore 6 marks were awarded.

Question 3 (standard, standard/high & high demand)

03.1 There was only 1 mark available here and for this to be awarded it was essential that reference was made to both parents (without the disorder) and their children (who have the disorder). A common misconception was for students to base their descriptions on the (low) frequency of AKU within the family.

Students should be aware that using 'it' will be treated in terms of how the question is phrased, unless the student clarifies what they mean by 'it'. Please see page 4 of the mark scheme for more guidance on the use of 'it'. Here, 'it' unqualified was considered equivalent to 'AKU'.

No evidence could be obtained from C and D as parents. Answers which described this part of the family tree as evidence gained no credit as it is incorrect biology, even if a student went on to make further correct points.

Examples of answers which were too vague to match the mark scheme included:

- 'D has AKU and this means that his parents are heterozygous' ('Heterozygous' does not clearly suggest that a recessive AKU allele is present but the parents do not have AKU)
- 'A and B don't have AKU but future generations do' ('Future generations' is too vague)
- 'AKU skips generations'.

03.2 Fewer than 50% of students could identify which person is definitely heterozygous for AKU. More students selected the incorrect answer of 'D'.

03.3 Most students were able to correctly identify the gametes for both parents, although where one of these marks was not awarded it was often because students presumed that the female with AKU had the genotype AA rather than aa and therefore were struggling to tell the difference between recessive and dominant despite being told AKU was recessive earlier in the question.

Almost all students were able to derive the offspring in the Punnett square and were awarded marking point 3.

For marking point 4, very few students attempted to identify the offspring phenotypes, and when there was an attempt at this, the mark wasn't awarded if only the phenotype 'having AKU' was indicated rather than the phenotype for both having AKU and not having AKU. Many students drew circles around offspring genotypes in the belief that this would be sufficient to suggest a phenotype of 'having AKU', but this was not creditworthy. Another frequent mistake was referring to the phenotype of Aa offspring as being 'heterozygous' or 'a carrier'. Although not incorrect descriptions, these are not actual phenotypes.

Giving the probability of having AKU was, in the majority of cases, done correctly and was usually given as a percentage or a fraction. This was very rarely given as a ratio. When incorrect gametes were given, a common mistake made when working out the probability was that offspring with Aa or AA would have AKU.

Other, more occasional, errors included giving an incorrect probability, such as 1:2 or 50/50 or 50 and using symbols other than those (A and a) directed in the question.

It was noted that quite a few students changed their minds when answering this question and made alterations to the gametes and genotypes they originally opted for. If students do this, they must make sure that the changes are unambiguous and, if necessary, rewrite their choices. It was sometimes very difficult for examiners to decide what the student intended to be marked.

0 3 . 3 A female who has AKU and a male who is heterozygous for AKU plan to have a child.

Determine the probability that the child will have AKU.

You should:

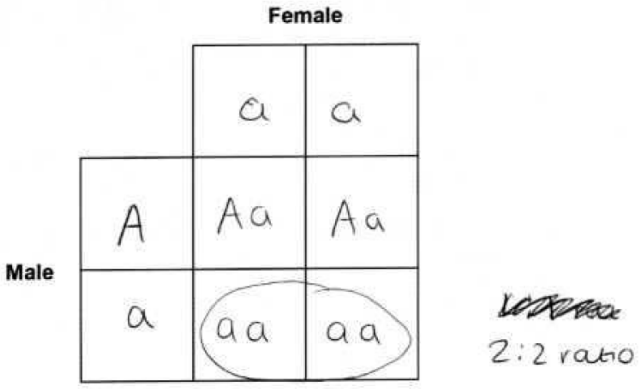
- complete **Figure 4**
- identify the phenotype of each offspring genotype
- use the symbols:

  A = dominant allele

  a = recessive allele.

[5 marks]

Figure 4



Probability that the child will have AKU = 50%

In a typical response, as shown above, students gave the correct parental gametes, and derived offspring genotypes correctly. The student has not indicated the phenotype of each offspring genotype, therefore marking point 4 was not awarded. However, the probability is acceptable, so 4 marks could be awarded.

03.4 Students found this question difficult with very few gaining both marks. They struggled to make appropriate connections between the mutation and the non-functioning enzyme.

Answers were often too general and repetitive of information given in the question to be adding any value, such as 'a mutation could change the cell's DNA to stop producing functioning enzymes' or 'if the gene has changed it will mean that the enzyme has changed'.

In other cases, students clung to the familiarity of terms in the question but created their own, inappropriate, narratives around them. So, 'mutation' triggered reference to 'random changes', incidence in the family tree, links to cancer and 'uncontrollable cell division'; 'protein' prompted discussions of ribosomes, protein digestion by protease, proteins being needed for growth and repair; 'enzyme' opened the way to details of denaturation.

Misconceptions were quite frequently seen, such as:

- 'DNA is made of amino acids'
- 'DNA a protein'
- 'genes make amino acids that code for a protein'
- 'the enzyme is 'mutated'
- 'the enzyme changes shape and can then no longer fit the active site'.

Overall, marking point 2 was seen far more frequently than marking point 1. Students clearly felt more comfortable discussing why enzymes might not be functioning rather than the reason behind this (the immediate consequence of the mutation).

03.5 This question was set at high demand. It closely reflects the specification content for the use of hormones in the treatment of infertility. Answers were often confused and poorly sequenced. Appreciation of the distinctions between 'egg', 'fertilised egg' and 'embryo' and between 'ovary' and 'uterus' was often lacking.

For the first mark, students had to refer only to FSH and LH being given to the female to stimulate maturation of eggs. Incorrect answers included ideas of the hormones 'increasing the chances of fertilisation', 'making the eggs more fertile', 'strengthening the eggs'. Students occasionally suggested that FSH and LH production was stimulated through treatment rather than the hormones being given directly. No credit was given for this.

The second marking point was the most commonly awarded mark. Credit was not given, however, for vague references such as the eggs and sperm were 'combined' or 'joined together'. The term 'fertilisation'/'fusion' was required or a suitable description of sperm being injected into eggs (ICSI). No mark was given when the student described fertilisation 'in the woman'.

Very few students achieved marking point 3. Words that were too vague such as 'growing'/'forming'/'turning into' were used instead. Mention of 'mitosis' was exceptionally rare. No credit was given if it was implied that embryo development only happened at a later stage within the uterus.

For the fourth mark, many students did not state that the embryo was inserted into the uterus. Answers which said that the embryo was 'put back into the woman' were insufficient. Reference to anything other than the 'embryo' or the 'ball of cells' at this stage, such as 'fertilised egg'/'baby', was incorrect. Some students wrongly suggested that the embryos were inserted into ovaries.

03.6 This was generally well answered. The most commonly awarded marks were for bullet point 4 and bullet point 5, as students clearly understood the high cost of the process and that it might lead to parents choosing to terminate their pregnancy. Some students attempted bullet point 1 but did not understand the process and wrote about the embryo being harmed due to the radiation used in the process, which was incorrect.

Some students simply wrote 'ethics' without giving details on why some people might think this and there were often references to 'designer babies', which was incorrect. Some students appeared to be talking about IVF, such as 'not always successful', with some confusion about what embryo screening involves.

Some students described ideas of prejudice against people with inherited disorders. This was described in a variety of ways and was creditworthy.

Question 4 (standard, standard/high & high demand)

04.1 Many students referred to increased adrenaline release as referred to increased thyroxine release. Either approach could gain 2 marks. Some students gave responses that were slightly too vague, such as just 'adrenaline' rather than the idea of 'adrenaline is released'. Some confusion was seen between the thyroid gland, adrenal gland and the pituitary. References to TSH and TRH were seen, but are beyond the specification and this was not required for the award of full marks.

Where students did not gain credit, it was common for them to give answers describing why the BMR had increased in terms of the need to compete for food or the need to gain more energy quicker in order to be able to compete.

04.2 Most students only described the data, and were therefore limited to Level 1. Simply repeating figures from the table could not gain any credit. It was also common for students to link the increase with the idea of resistant rats reproducing, enabling Level 2 to be reached.

It was less common for an appropriate link to be made to a decrease in population. Many students made an attempt at linking the decrease to competition but where this had been attempted, it was often only repeating information given in the stem of the question.

Some students misinterpreted the question and referred to antibiotic resistance, bacteria, and the immune system. It was common to see references to white blood cells and memory cells. Some students did not mention resistance at all, but used 'immunity' instead. Immunity is not synonymous with resistance, therefore credit could not be given for indicative content that referred to immunity. A common misconception was that the warfarin caused a mutation. Some students incorrectly assumed that the table showed the population size.

Where students had attempted to explain the increase by referring to a mutation, it was more common to see them stating that the mutation had been caused by giving warfarin and the need for the rats to adapt. Likewise, there were many references to 'survival of the fittest' and 'natural selection' with no further qualification.

If a student had made any attempt to explain how resistance was passed on to offspring, it was more common for them to express it in terms of 'the resistance' being passed on rather than the gene/allele. A few students attempted to explain trends in terms of dominant/recessive alleles.

Rats with resistance to warfarin have a smaller mean mass than rats that are **not** resistant to warfarin.

Smaller rats are often at a disadvantage when competing against larger rats.

Explain the trends in the data when warfarin was being given and when warfarin was no longer given.

Use **Table 1**.

[6 marks]

- From 0 months when warfin was given only a few amount of rats had resitance
- From 0 – 4 months where warfain was given shows an increase of rats being resitant to warfan
- Showing how ene rats had a mutation that now allowed more of them to Survive
- At 6 months warfin was stop being given but has reached its peak (more rats are resitance)
- 8 - 12 months decrease of population of rats rescance because warfin wasnt given there was no need for ene rats to rave that mutation anymore
- 12 months reached the lowest since the start

This student has described both trends, as shown on the indicative content in the mark scheme. They also link the increase in the percentage of the population that are resistant to warfarin with an explanation. This is in the third paragraph.

The student does not explain the decrease when warfarin stopped being given, therefore the response meets and exceeds the generic Level 2 descriptor, but does not match Level 3, therefore 4 marks were awarded.

Question 5 (standard, standard/high & high demand)

05.1 Students found this a very challenging question with very few giving creditworthy responses. It was evident that students did not understand the breadth of the term ecosystem, with few students gaining the mark. The definition is given within the specification, so this was an AO1 question.

Some students correctly recognised that both living organisms and the environment were part of an ecosystem but expression was weak and did not meet the requirements of the definition, often referring to just plants and animals, instead of organisms, or to area rather than to environment or habitat.

Many students omitted the idea of interaction between organisms or organisms and their environment. A large proportion of responses used vague language, particularly of biological terms that students are expected to know, such as habitat, population or community.

05.2 The most common correct answer related to bullet point 1 and the control of prey populations. Students could answer in terms of animal species in general, or otters, or any other named animal.

Many attempts at other points were too vague. Statements such as ‘they are prey’ or ‘they are part of a food chain’ did not go far enough to gain credit for the idea that the species may be prey and therefore provide energy for a predator.

Many students gave examples that lacked enough detail to gain the mark such as ‘beavers build dams’, ‘birds build nests’ or 'prey feed the predators'. These did not go far enough to describe how that effects another species. Some students stated that otters defended smaller animals against larger predators, and this did not gain credit.

Marking point 4 was often awarded for faeces providing minerals for plants. Note that named examples such as this were acceptable, as shown in the extra information column of the mark scheme. Some students misunderstood the idea of stability and suggested that a species increases biodiversity.

05.3 Most students could select the correct figures and calculate the correct answer. The most common error was attempting to subtract one figure from the other.

05.4 Students more often gave marking point 1 than marking point 2. There were some references to inversely proportional, which were ignored, as shown on the mark scheme.

Simply quoting figures from the table was not enough to gain either mark. Likewise, just identifying that the symbol in the question means proportional was not sufficient for the mark.

05.5 Many students gave detailed explanations that matched all three marking points on the left-hand side of the mark scheme. The alternative approach (given on the right-hand side of the mark scheme) was seen occasionally and when it was seen often gained all 3 marks.

Some students referred to marking point 2 incorrectly, either in terms of fish breathing underwater, or otters needing oxygen from the water. References to ‘affecting the otter population’ were not given credit for the idea of ‘decreasing the otter population’.

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

06.1 Nearly all students could identify that the pituitary gland releases hormones to control other glands.

06.2 Most students knew that adrenaline increases blood flow to muscles.

06.3 Most students could give the correct answer of receptor or sensory neurone/cell.

Some students were unaware that receptors that respond to stimulus are types of cells. Common incorrect answers were red blood cells, white blood cells, effector, muscle, named organs and nerve cells or neurones unqualified.

06.4 Very few students gained 2 marks. Many students stated that blood glucose goes up or is high in people with diabetes, but this is also true of people without diabetes, so the mark could not be awarded. The answer needed to be comparative.

Many students simply stated that people with diabetes do not produce enough insulin. This did not go far enough for either mark to be awarded.

Some students demonstrated confusion between Type 1 and Type 2 diabetes. Other students tried to answer in terms of how reaction time would be affected rather than blood glucose concentration.

Confusion was evident in terms of incorrect responses stating that 'insulin breaks down into glucose', or 'people with diabetes don't produce enough glucose'.

The answers to this question highlighted that many students did not understand the biological basis of diabetes. Common misconceptions included:

- people with Type 1 diabetes cannot make their own glucose (and this was sometimes followed by comments implying it is therefore safer for people with diabetes to drink glucose)
- glucose is the same as insulin
- insulin is converted to glucose
- insulin is converted to glycogen
- a lack of insulin means blood glucose concentration is lower.

06.5 The most frequent correct responses related to amount of sleep or minimising distractions.

Common misinterpretations of the question referred to controlling the volume or concentration of glucose solution. Students should take care to read all the information provided. Different volumes or concentrations of glucose solutions would be necessary to change the independent variable. Food and drink were controlled, so references to controlling caffeine and alcohol intake could not be credited.

Many students assumed the reaction time test was the ruler drop test. If they described a suitable control variable, such as 'using dominant hand to catch the ruler' this was credited, but often these attempts at control variables were incorrect, such as 'same ruler' or 'same person dropping the ruler'.

06.6 Some students incorrectly interpreted the question as being an issue with recording accurate results. Many responses did not go far enough to be awarded the mark, such as 'blood glucose goes too high' without giving a reason why this is problematic. Common incorrect responses were too vague, such as 'in case they fell ill' or 'to give insulin injections'.

Some students suggested the health of the patient would affect the results/reaction times in the experiment, rather than considering the risk to the person with diabetes. These were not awarded the mark.

There were some good answers in which the students understood that both low and high blood glucose concentration are dangerous.

06.7 Students found this question challenging. Many simply defined homeostasis rather than answering the question. Some students approached the right idea but were imprecise with their language, such as 'faster/slower reaction times' indicating confusion between reactions, reaction times and the time recorded. Students need to be careful they are not describing time as speeding up or slowing down, which is not possible. Reactions can be faster but not reaction times.

Some students did identify that reaction times in the range for people without diabetes were lower but did not go far enough to state lowest. Similarly, some identified high blood glucose concentration increased reaction time but did not refer to low blood glucose concentration.

06.8 Many students are confused between glucose, glycogen, glucagon. Glycerol was also seen. Hybrid spellings between these terms was common and whilst phonetic spelling is acceptable, marks cannot be credited where there is ambiguity between technical terms.

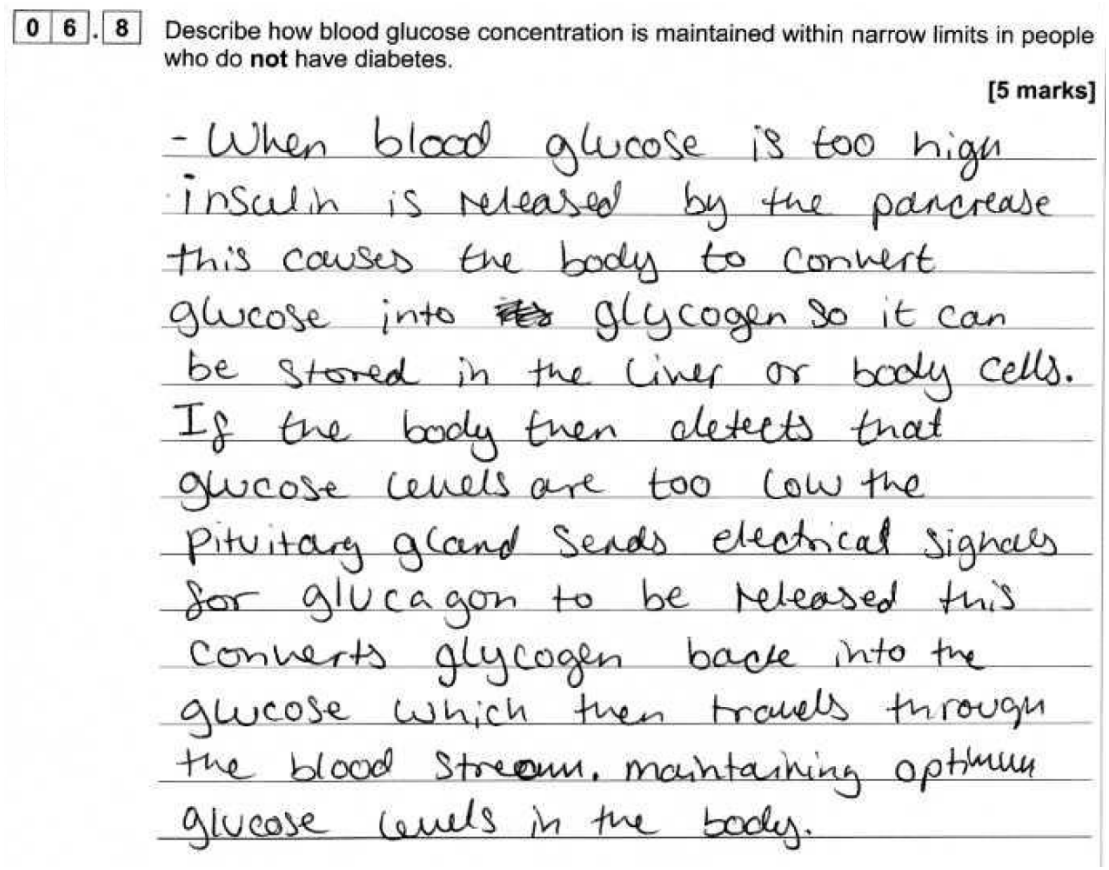
Common misconceptions were that insulin or glucagon are broken down into glucose. For marking point 1, students often missed mention of the pancreas, in which case the mark would not be awarded. Few students gave marking point 2.

Some students misunderstood the question and described how people with diabetes control their blood sugar levels through diet and exercise.

Students sometimes spend time starting this style of question by re-writing the question. This is not necessary.

0 6 . 8 Describe how blood glucose concentration is maintained within narrow limits in people who do **not** have diabetes.

[5 marks]



The student has given marking points 1 and 3. 'Pancrease' is given benefit of the doubt as a phonetic spelling of pancreas.

The student is not clear whether glucose or glycogen is entering liver cells, therefore marking point 2 cannot be awarded.

The student has not referred to where glucagon is released from when blood glucose concentration decreases, therefore marking point 4 cannot be given.

Marking point 5 is given, so the student gains 3 marks for this question.

06.9 Many students answered as if the reaction time has increased, despite the question. For the first marking point, many stated that the increase in chemical would decrease the rate of diffusion, or 'overwhelm' the body. Few students made appropriate mention of impulses. Very few students could link the role of the diffusion of chemicals to impulses in the next/motor/relay neurone.

There was frequent use of incorrect terminology, such as:

- electrical impulses travelling across a synapse
- chemical impulses travelling across a synapse
- chemicals diffusing down neurones
- neurones moving from receptors to effectors.

Although it's beyond the specification, the term 'neurotransmitters' was seen and could be used.

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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