Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2023

Pearson Edexcel International GCSE

In Human Biology (4HBI) Paper 02

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Introduction

Despite some aspects of the paper being quite challenging, it was pleasing to see that candidates of all abilities made an admirable attempt at completing the questions. This paper allowed candidates to demonstrate their competence in several key areas of the human biology specification. It is pleasing to note that responses to simple calculation-based questions are improving across all abilities, however, stronger candidates generally perform better on multi-step calculations. Some candidates lose marks for miscalculating or noting the answer shown on their calculator incorrectly. As highlighted in previous series, it is advisable that candidates show there working as they may access some marks even if their final response is incorrect.

Question 2 offered candidates the opportunity to draw a biological diagram and many learners across all the ability ranges, accessed 2 or more marks on this question. It was particularly welcoming to see that previous recommendations for using a sharp pencil for diagrams have been noted by centres.

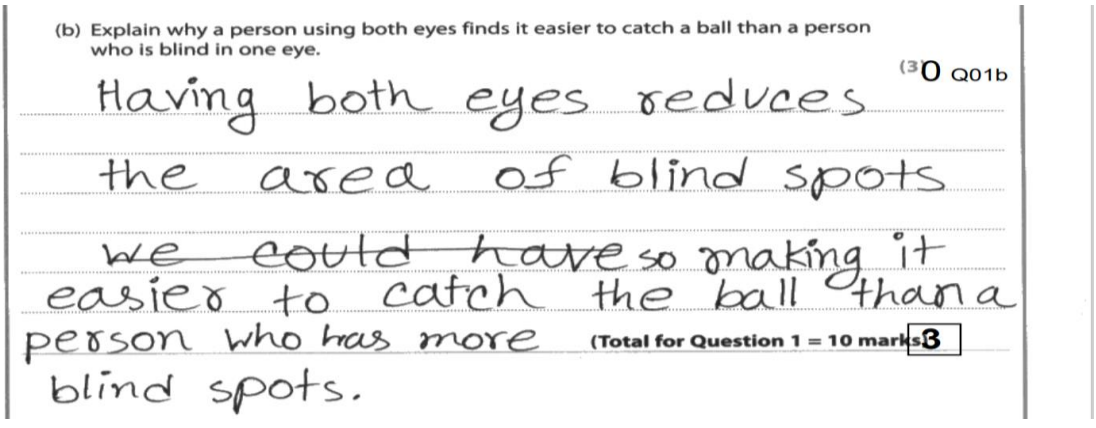
One of the main challenges faced by all candidates was interpreting written and numerical information, especially where more in depth processing is required. For example, for Q4cii a discussion of some information was required and, whilst many attempted the question, very few candidates accessed the full 4 marks allocated even in the higher end of the cohort.

Another challenge that has arisen again on this paper is the use of the term 'amount' which is not acceptable as an alternative to 'mass', ‘concentration’ or 'volume'. Q7ai saw many candidates losing marks for using this term rather than the acceptable scientific terminology.

Question 1

This question was generally well answered by candidates across the range of abilities. However, stronger candidates found the second part of the question more accessible. For Q1a, learners were required to identify structures of the eye based on their functions. This question was generally well answered with candidates across all grades accessing some of the marks allocated. Many learners struggled to identify the cochlea, based on the function given, with many incorrectly stating the auditory nerve turns vibrations into nerve impulses.

Most of the weaker candidates failed to access any of the 3 marks allocated to Q1b where an explanation of why catching a ball would be easier for someone using both eyes. Incorrect responses often referred to ‘blind spots’ which was not creditable. was seen much less often that the other marking points.



(b) Explain why a person using both eyes finds it easier to catch a ball than a person who is blind in one eye.

(3) 0 Q01b

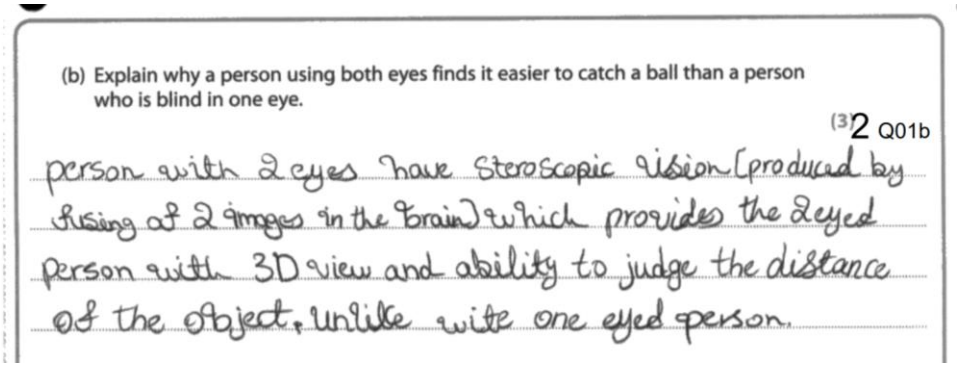
Having both eyes reduces the area of blind spots we ~~could have~~ so making it easier to catch the ball than a person who has more blind spots.

(Total for Question 1 = 10 marks) 3

This is a common incorrect response for question 1b

Many of the candidates who gained credit, could articulate that using both eyes would give a 3-dimensional view which would allow for better judgement of speed and distance. Stereoscopic vision elicited some interesting spellings, however, where errors were made, it was usually clear what the

intended meaning was and so the mark was allocated. Marking point 2 was mainly awarded for 'wider field of view/vision' rather than 'each eye giving a slightly different image', however this response.

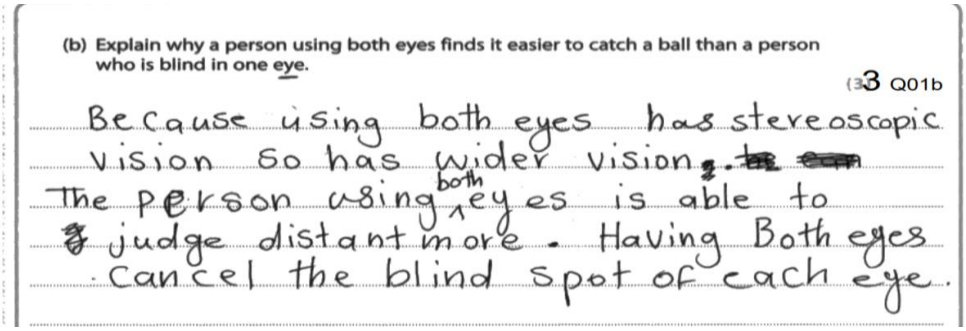


(b) Explain why a person using both eyes finds it easier to catch a ball than a person who is blind in one eye.

(3) 2 Q01b

person with 2 eyes have Stereoscopic vision (produced by fusing of 2 images in the brain) which provides the 2eyed person with 3D view and ability to judge the distance of the object. Unlike with one eyed person.

Example of a 2 mark response for question 1b with an acceptable misspelling of stereoscopic.



(b) Explain why a person using both eyes finds it easier to catch a ball than a person who is blind in one eye.

(3) 3 Q01b

Because using both eyes has stereoscopic vision so has wider vision. The person using both eyes is able to judge distant more. Having Both eyes cancel the blind spot of each eye.

This is a common 3 mark response for question 1b

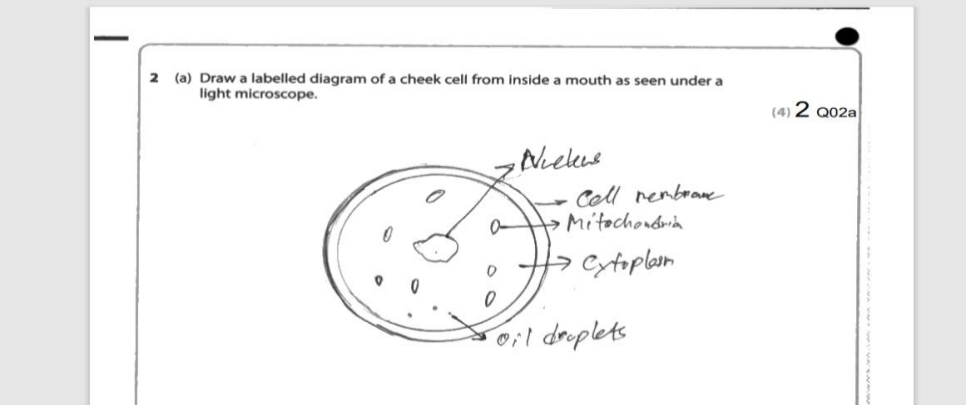
Question 2

Q2a required candidates to draw a labelled diagram of a cheek cell as seen under a light microscope. It was pleasing to see that most candidates accessed at least two of the four available marks for correctly labelling their diagram.

Common areas where marks were lost were:

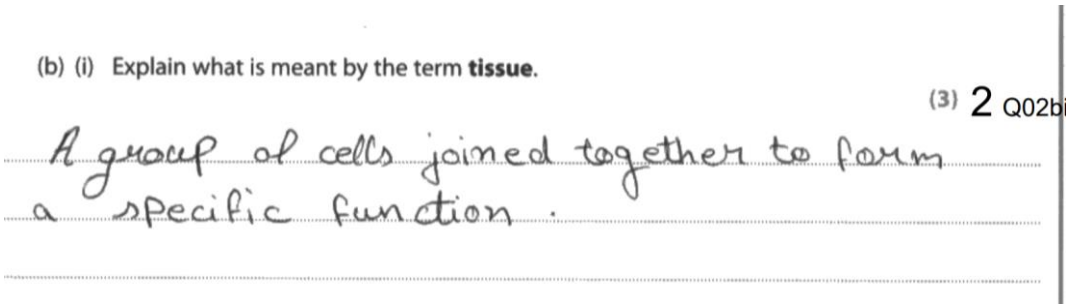
- Circular or square cell shape drawn.
- Spindle cell shape drawn.
- Double membrane surrounding the cell, indicating the presence of a cell wall.
- Missing/incorrect labelling of cell structures.

Some diagrams, like the one below, included cellular organelles too small to be seen by a light microscope, however these were ignored.



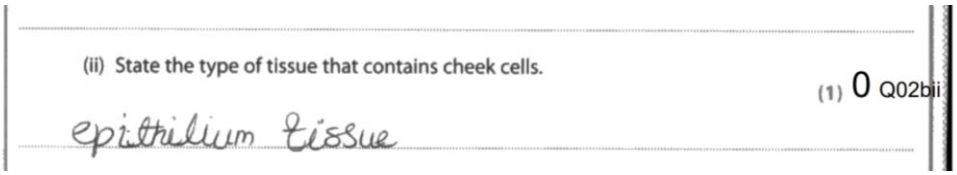
This response gained two marks for the labelling of the nucleus and the cytoplasm. The diagram was circular so did not gain the mark for cell shape. Cell membrane wasn't credited as a cell wall was drawn which would indicate a plant cell.

Q2bi was generally a well answered question with most gaining at least one of the three available marks. The most common reason for losing marks was for not specifying that the cells forming a tissue were similar.



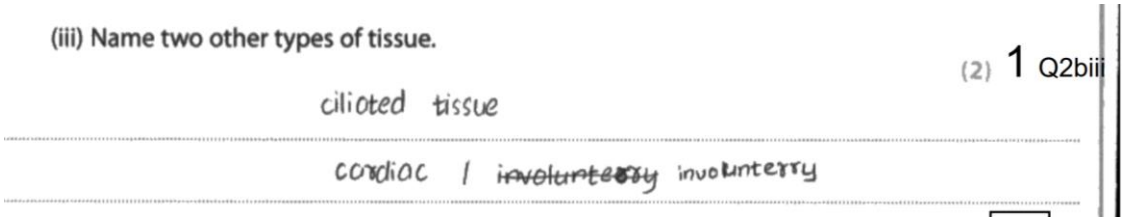
An example of a 2 mark response for Q2bi where the candidate has not specified that the cells forming the tissue are similar.

The responses to Q2bii were disappointing with very few candidates able to identify that the tissue in cheek cells was squamous epithelium. Some incorrect responses included 'skin', 'smooth tissue' and 'epithelium' unqualified.



A common example of a 0 mark response for question 2bii showing 'epithelium' unqualified.

In contrast, Q2biii was successfully attempted across all the ability ranges with most of the tissue types on the mark scheme being covered in the responses. Where marks were lost, skeletal tissue or cardiac tissue were written on the answer line without reference to 'muscle'. Some candidates stated 'ciliated' only rather than ciliated epithelium but still gained 1 mark.



This 2biii response scored 1 mark for ciliated tissue, however cardiac tissue couldn't be credited without specifying it was 'muscle tissue'.

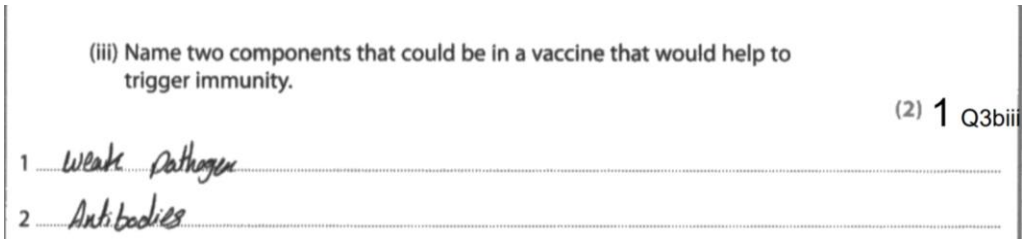
Question 3

Almost all candidates gave the correct response of 'pathogens' for Q3a.

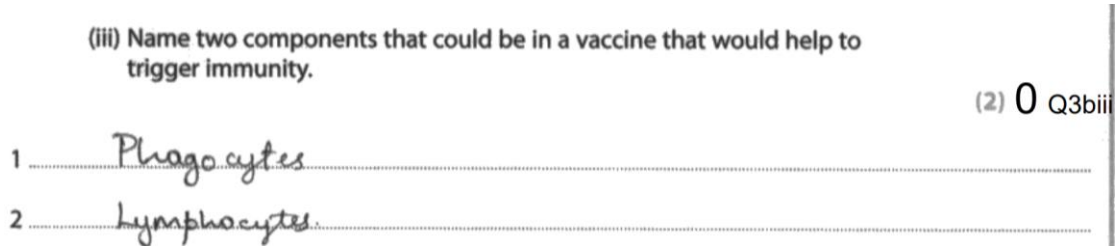
Q3bi involved a simple calculation based on extracting data from a graph and most candidates across all the ability ranges were able to correctly answer this question.

Q3bii required candidates to state that vaccination produces 'active artificial immunity' however many of the weaker candidates did not gain either mark available for this question.

Similarly, many of the weaker candidates were unable to name the components in a vaccine that would trigger immunity and so failed to score on Q3biii. Incorrect responses included antibodies, pathogens unqualified and named white blood cells. Some stated weakened pathogens on one line and dead pathogens on the other line but could only score one due to them being the same marking point.



1 mark response for Q3biii showing one correct response and the common incorrect response of antibodies.

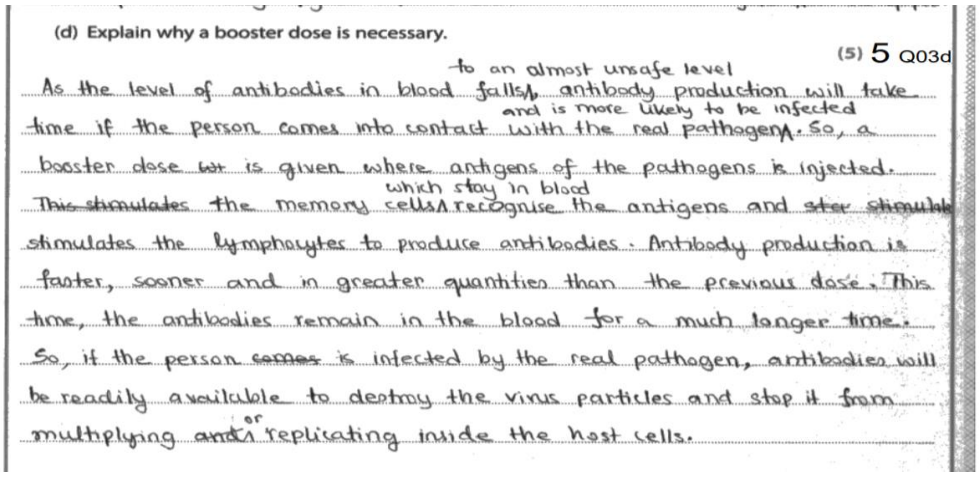


0 mark response for Q3biii showing a common incorrect response.

Q3ci was generally well answered with many candidates gaining at least 1 mark for this question. The stronger candidates generally scored full marks with variations of 'antibodies being passed from the mother during breastfeeding being seen most often. Some candidates were credited 2 marks for (gaining antibodies) 'from the mother's milk' which encompassed the first two marking points. Antibodies passing across the placenta was seen less often.

Q3d was an extended response question and consequently many candidates gained at least one of the available 5 marks. The most common marking points were (booster doses) 'increase the level of antibodies' and (booster doses) increase the number of memory cells. These were usually seen in isolation in weaker responses. Stronger responses linked several of the keys points together in a logical order.

Some incorrect responses discussed what the data showed rather than explaining why the booster was necessary highlighting the requirement of reading the question carefully.

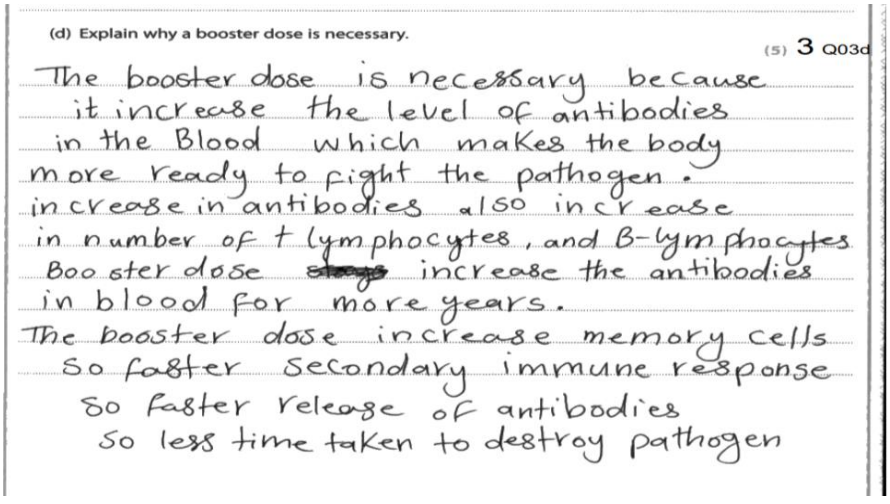


(d) Explain why a booster dose is necessary.

(5) 5 Q03d

As the level of antibodies in blood falls to an almost unsafe level, antibody production will take time if the person comes into contact with the real pathogen and is more likely to be infected. So, a booster dose ~~or~~ is given where antigens of the pathogens is injected. ~~This stimulates the~~ memory cells which stay in blood recognise the antigens and ~~ster stimulate~~ stimulates the lymphocytes to produce antibodies. Antibody production is faster, sooner and in greater quantities than the previous dose. This time, the antibodies remain in the blood for a much longer time. So, if the person ~~comes~~ is infected by the real pathogen, antibodies will be readily available to destroy the virus particles and stop it from multiplying ~~and~~ or replicating inside the host cells.

An example of response for Q3d which scored full marks



(d) Explain why a booster dose is necessary.

(5) 3 Q03d

The booster dose is necessary because it increase the level of antibodies in the Blood which makes the body more ready to fight the pathogen. increase in antibodies also increase in number of t lymphocytes, and B-lymphocytes Booster dose ~~stays~~ increase the antibodies in blood for more years. The booster dose increase memory cells So faster secondary immune response So faster release of antibodies So less time taken to destroy pathogen

This 3d response gained 3 marks and shows some of the common responses to this question.

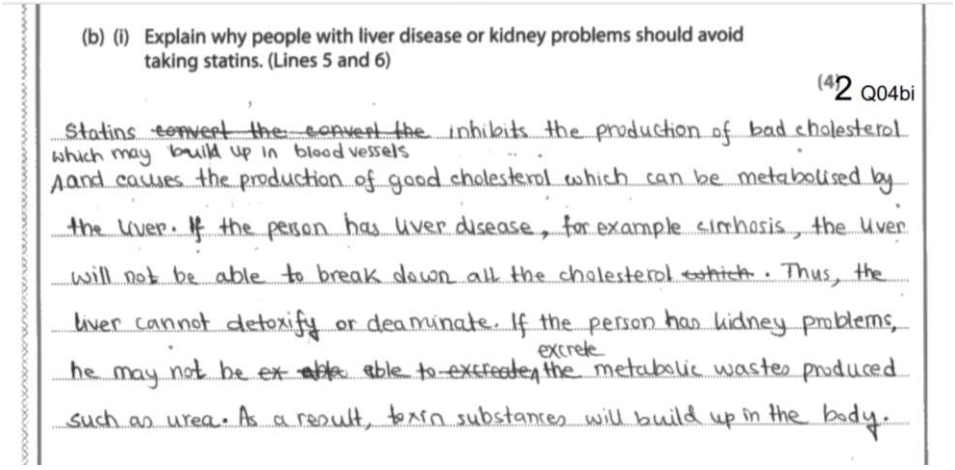
Q3e saw most candidates scoring at least 1 mark for this question. Many could identify that antibody levels increased faster and to a higher level after the booster dose and that this lasted for much longer than the initial three doses.

Question 4

Many candidates identified that reducing the fat intake in the diet and/or exercising would lower cholesterol levels and gained at least one mark for this two mark question.

Part 4bi and 4bii required candidates to read a passage about statins. The questions then required the learners to apply knowledge from different areas of the specification to fully answer the questions.

Q4bi required and explanation why people with liver and kidney problems should avoid taking statins. Many found this difficult with incorrect responses focussed on the action of the statins rather than how the statins were dealt with by the liver and kidneys.



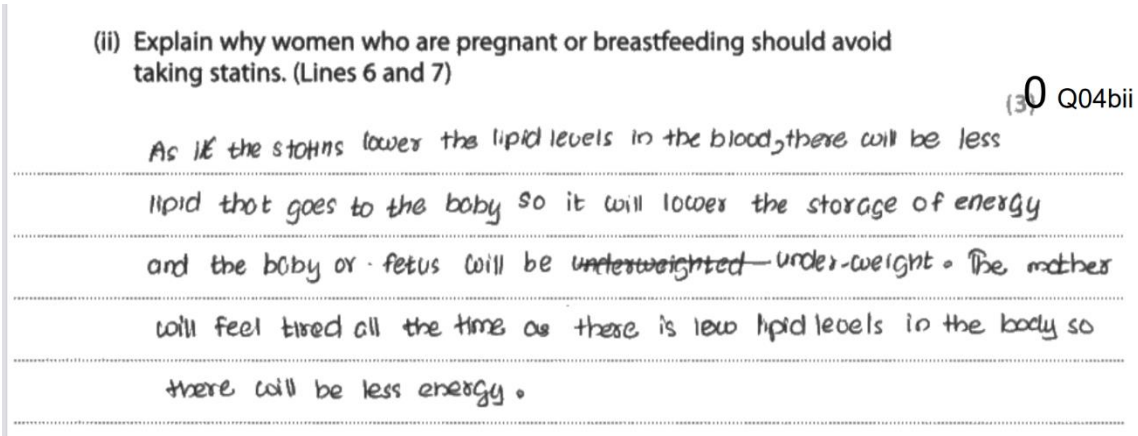
(b) (i) Explain why people with liver disease or kidney problems should avoid taking statins. (Lines 5 and 6)

(4) 2 Q04bi

Statins ~~convert the~~ ~~convert the~~ inhibits the production of bad cholesterol which may build up in blood vessels and causes the production of good cholesterol which can be metabolised by the liver. If the person has liver disease, for example cirrhosis, the liver will not be able to break down all the cholesterol ~~which~~. Thus, the liver cannot detoxify or deaminate. If the person has kidney problems, he may not be ~~ex able~~ ~~able to excrete~~ excrete the metabolic wastes produced such as urea. As a result, toxin substances will build up in the body.

This 4bi response focuses on the action of statins rather than why they should be avoided. This response gained two marks for reduced detoxification and for the reference to the removal of urea by the kidneys.

Q4b(ii) required candidates to explain why pregnant or breastfeeding women should avoid taking statins. Most understood the concept of the statins harming the foetus, however, some talked about statins reducing fats in the mother therefore less fats would be transported to the foetus rather than the statins crossing from the mother to the foetus. Some candidates stated that statins crossed the 'umbilical cord' rather than placenta and failed to gain this mark. The most common correct answer for 1 mark was that the statins would cause damage to the foetus.



(ii) Explain why women who are pregnant or breastfeeding should avoid taking statins. (Lines 6 and 7)

(3) 0 Q04bii

As if the statins lower the lipid levels in the blood, there will be less lipid that goes to the baby so it will lower the storage of energy and the baby or fetus will be ~~underweighted~~ under-weight. The mother will feel tired all the time as there is less lipid levels in the body so there will be less energy.

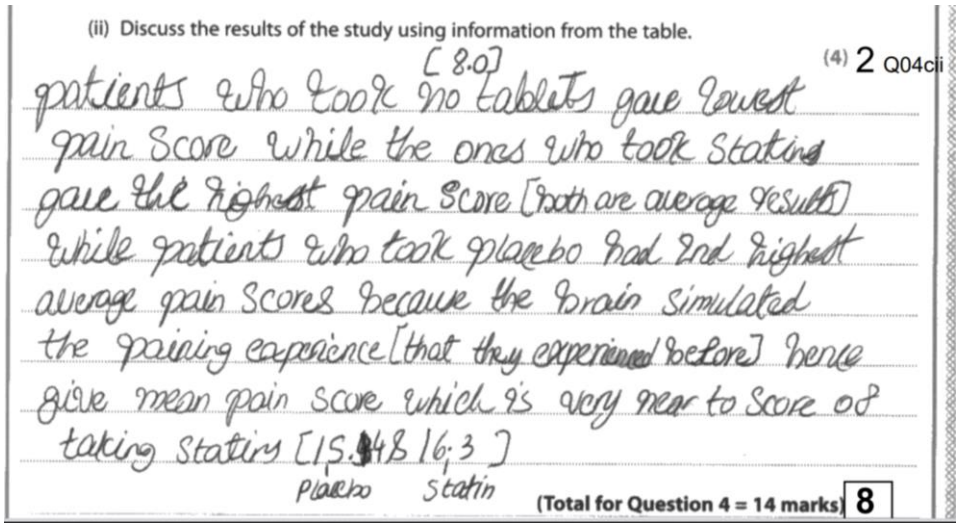
A common incorrect response to Q4bii.

Q4ci required the learners to complete a simple calculation and was well answered across all the ability groups.

Conversely, the answers to Q4c(ii) were poor and even the strongest candidates failed to score more than two or three marks out of a possible four for this question. Failure to properly interpret the information and data on the study, meant that responses were not fully developed. Many candidates did not identify that symptoms experienced on both statins and placebos were similar to each other. They also failed to identify that symptoms were still present when no statins were being taken and so the symptoms must have other causes.

Many incorrect responses quoted data from the table with no further interpretation/ explanation/ comparison.

Some quoted data only with no reference to side effects so it was unclear whether the candidates fully understood what the data was showing.



(ii) Discuss the results of the study using information from the table.

[8.0]

(4) 2 Q04cii

patients who took no tablets gave lowest pain score while the ones who took statins gave the highest pain score [both are average results] while patients who took placebo had 2nd highest average pain scores because the brain simulated the pairing experience [that they experienced before] hence give mean pain score which is very near to score of taking statins [15.8 & 16.3]

placebo statin

(Total for Question 4 = 14 marks) 8

A response to Q4ci which scored 2 marks.

Question 5

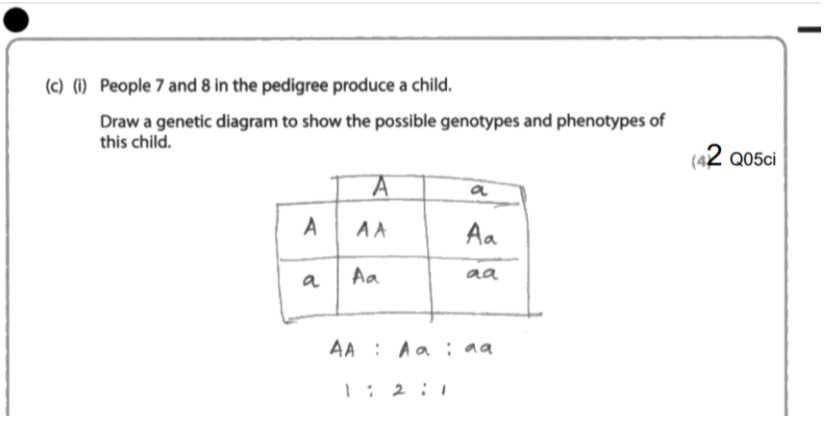
For Q5ai, many candidates across all the ability ranges gained at least one mark for stating that recessive alleles are only expressed in a homozygote (or a variation of this response). Only the strongest candidates stated that a recessive allele was an alternative form of a gene.

Many candidates also scored well on Q5b, for identifying two homozygous recessive people from a family pedigree chart.

Q5ci was well answered across all the ability groups with many candidates gaining at least one of the four available marks. Where marks were lost, it was for not identifying the phenotype of the F1's. Some weaker candidates drew Punnett squares rather than genetic diagrams and could only gain credit for the correct gametes and F1 crosses.

Some responses had incorrect parent genotypes.

The most common reason for failing to score on this question were for answers including sex linked crosses.



(c) (i) People 7 and 8 in the pedigree produce a child.

Draw a genetic diagram to show the possible genotypes and phenotypes of this child.

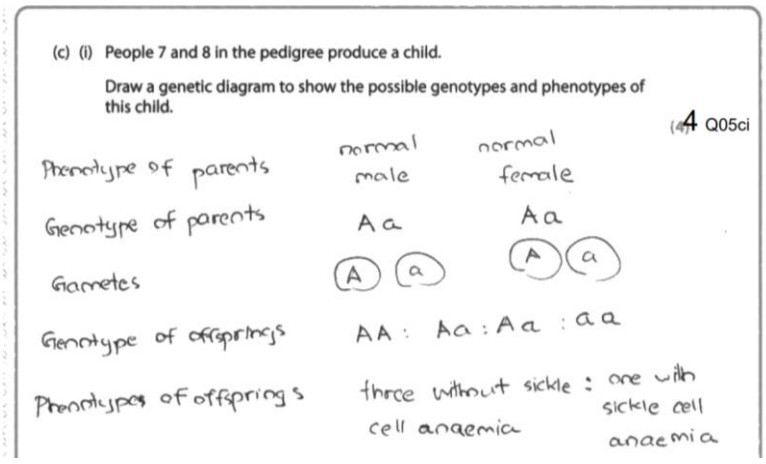
(4) 2 Q05ci

	A	a
A	AA	Aa
a	Aa	aa

AA : Aa : aa

1 : 2 : 1

A 5ci response showing a Punnett square rather than a genetic diagram. This response scored 2 marks.



(c) (i) People 7 and 8 in the pedigree produce a child.

Draw a genetic diagram to show the possible genotypes and phenotypes of this child.

(4) 4 Q05ci

Phenotype of parents: normal male, normal female

Genotype of parents: Aa, Aa

Gametes: (A) (a), (A) (a)

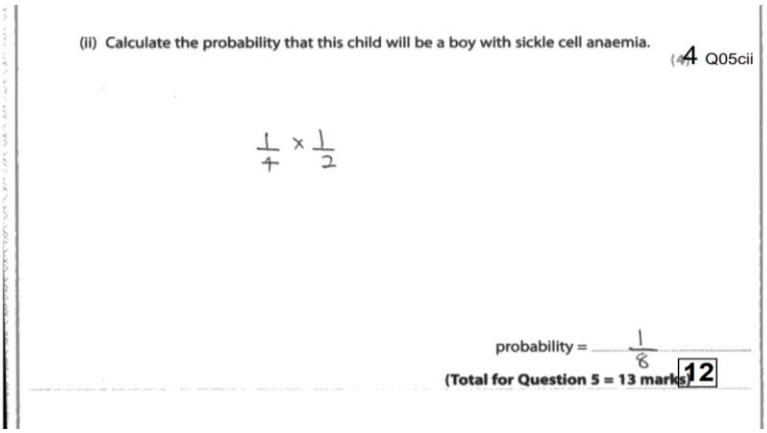
Genotype of offsprings: AA : Aa : Aa : aa

Phenotypes of offsprings: three without sickle cell anaemia : one with sickle cell anaemia

A 5ci response which scored full marks.

Q5cii involved a multistep calculation with many of the stronger candidates achieving 2 or more of the 4 marks available. Common errors, where calculations were correctly done, were stating the chance of sickle cell was 50% resulting in a final answer of 25%/ 0.25

Many weaker candidates failed to attempt the question.



(ii) Calculate the probability that this child will be a boy with sickle cell anaemia.

(4) 4 Q05cii

$\frac{1}{4} \times \frac{1}{2}$

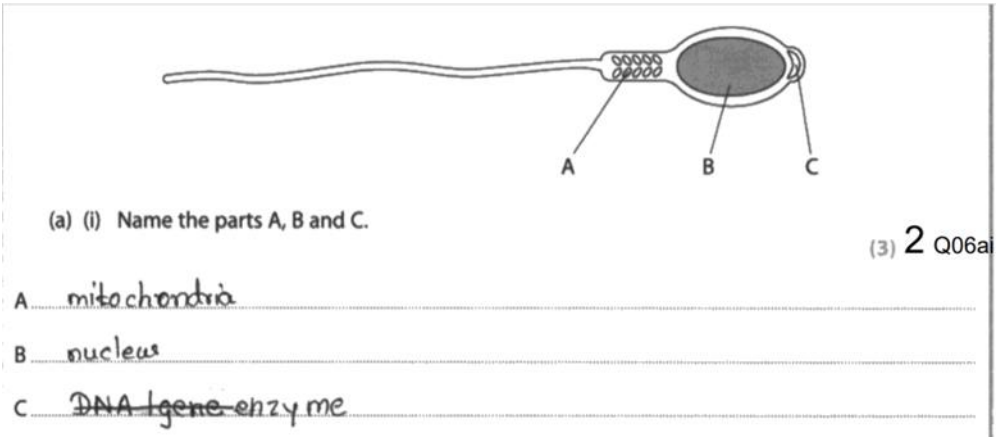
probability = $\frac{1}{8}$

(Total for Question 5 = 13 marks) 12

A 5cii response showing a correct answer for full marks. Full marks can be awarded without clear working if the correct answer is on the answer line.

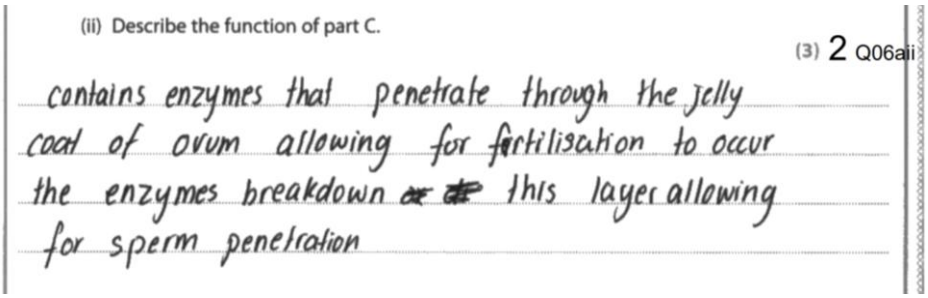
Question 6

Most candidates could identify at least one labelled structure in a sperm cell for Q6ai. The most identified structures were the mitochondria and the nucleus. The least commonly identified structure was the acrosome; incorrect responses for acrosome include sac, nucleus, mitochondria, and enzyme.



A 6ai response showing an incorrect response for label C.

6aii required a description of the function of the acrosome. Many mid to high ability candidates gained at least one mark out of the three available. Incorrect responses included stating that the acrosome contained rather than released enzymes. Digestion of the cell membrane instead of the outer part of the ovum/ jelly coat was another common incorrect response. Many responses for MP3 failed to state the sperm nucleus enters – referring simply to the sperm or sperm head entering the ovum. The most common correct answer was for a reference to / description of fertilisation.



A 6aii response showing the common response of 'contains' rather than 'releases' enzymes. The second mark was awarded for the reference to fertilisation. Note that this response refers to the 'sperm' penetrating rather than the sperm nucleus, so this cannot be credited.

For Q6aiii, most candidates who gained marks measured the length of the diagram as 120mm resulting in an answer of 2400 for 4 marks. Incorrect conversions from millimetre to micrometres were the main reason for loss of marks.

6b was well answered across all the ability groups. Some incorrect responses are still referring to energy being created/made.

Question 7

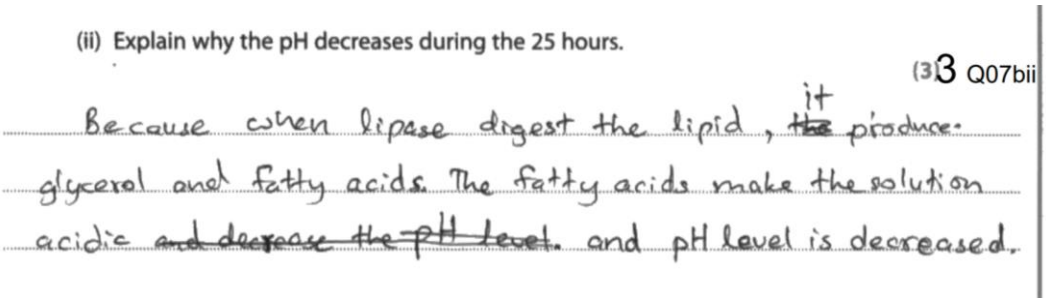
Q7ai, was well answered by all the ability ranges. Where candidates failed to gain credit, it was for using the term 'amount' instead of concentration or volume. Other incorrect responses were time, size of the test tubes, pH and temperature.

Most candidates gained one mark for correctly identifying the optimum temperature for Q7aii.

Q7aiii was poorly answered with most candidates only gaining 1-2 marks maximum out of the 4 marks available. Many could not explain why 40 degrees approximated the optimum temperature. The most common response was for identifying that the optimum temperature could be anywhere between 30-50 degrees.

7bi required a two-step calculation using data extrapolated from the graph. The question was well accessed across all ability ranges. Where incorrect responses were given, it was usually due to noting down the data incorrectly or using the right data but noting down the wrong answer.

Q7bii was well answered by the stronger candidates with many scoring full marks. Weaker candidates often failed to access any of the available marks as they misunderstand the question. For example, some incorrect responses talked about the bile salts increasing alkalinity rather than explaining why the pH decreases.



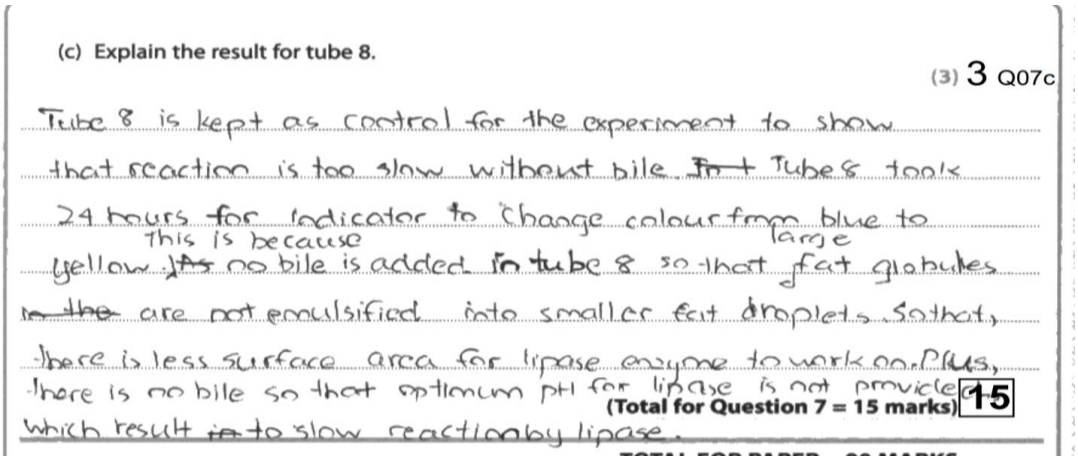
(ii) Explain why the pH decreases during the 25 hours.

(3) 3 Q07bii

Because when lipase digest the lipid, ~~the~~ it produce glycerol and fatty acids. The fatty acids make the solution acidic ~~and decrease the pH level.~~ and pH level is decreased.

An example of a 7bii response that scored full marks

Similarly weaker candidates failed to access any marks on Q7biii. Many responses described the action of bile salts rather than explaining what happens if they are not present. Stronger candidates often accessed the full 3 marks for explaining that the lack of bile salts meant emulsification did not occur resulting in less surface area being available for enzyme action resulting in a slower reaction.



(c) Explain the result for tube 8.

(3) 3 Q07c

Tube 8 is kept as control for the experiment to show that reaction is too slow without bile. ~~For~~ Tube 8 took 24 hours ~~for~~ indicator to change colour from blue to yellow. This is because ~~this~~ no bile is added ~~to~~ tube 8 so that large fat globules ~~in the~~ are not emulsified into smaller fat droplets. So that, there is less surface area for lipase enzyme to work on. Plus, there is no bile so that optimum pH for lipase is not provided which result ~~in~~ to slow reaction by lipase.

(Total for Question 7 = 15 marks) 15

An example of a 7bii response that scored 3 marks.

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