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Examiners' Report
Lead Examiner Feedback

January 2021

Pearson BTEC Nationals
In Applied Human Biology (21325L)
Unit 1: Principles of Human Biology

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Introduction

This is the third sitting of this unit and as seen in the previous series, learners appear to be increasingly well prepared for the demands of the question paper. One area in which this has been demonstrated is the number of questions completed by each learner. This series, we have seen papers completed in a much more balanced way – indicating that learners are increasingly aware of how to effectively manage their time during the exam itself. Learners this series appear to have a much better understanding of what is expected of them in each part of the assessment, and this goes to show the great effort that both learners and their centres have put in during the preparation for this exam series.

Introduction to the Overall Performance of the Unit

Learners appear to be confident in the way that they approach answering questions with most learners attempting every item on the paper. Non-responses were more common towards the end of the paper, but these appeared to be a less frequent occurrence than in previous series. Learners should be commended for their willingness to answer questions outside of the contexts with which they are familiar as in many cases these new contexts allowed for the demonstration of their skills in analysis and application of the subject content.

The most significant change in learner performance this series was at the distinction level. We saw an overall broader range of marks across the cohort this series, but this was most pronounced at the top end of the range of marks. Increasingly, learners are demonstrating their knowledge and understanding by providing more sophisticated responses, often including an impressive degree of detail to support their answers.

There was a general improvement seen in how learners engaged with the command words used throughout the exam paper – responses were more thoughtfully written to ensure that the question was approached in the correct way. This is encouraging to see and reflects the increasing refinement of learners' examination technique.

To improve even further, learners should be encouraged to be consistent in their application of any question-specific contexts when

writing their responses. This is a skill which is still lacking, even in the learners working at distinction level.

Learners continue to engage well with the extended open response questions worth either 6 or 9 marks. In many cases these answers were logically thought out, well-structured and written in a great amount of depth. Learner responses to these extended questions were, in some cases, supported through additional diagrams or labelling of provided figures. Although in most cases learners still provided responses in continuous prose for the 6-mark and 9-mark questions on the paper, some learners chose to use devices (subheadings, bullet points, tables, flow charts etc.) to provide structure in their longer responses and in many cases, this allowed learners to organise their thoughts more effectively.

Learners should be assured that there is no preference for style in assessment of the extended open response questions – the way that responses present information may be in any format that the learner feels comfortable with. There is a requirement for responses awarded marks in Level 3 to be well-developed with clear links and a logical structure. We are aware that some learners find this easier to demonstrate using continuous prose while others may find that the use of diagrams or structural elements such as lists or subheadings allow them to most effectively demonstrate their understanding. There is no preference for either approach - all responses will have appropriate credit given, regardless of the format in which the information is presented.

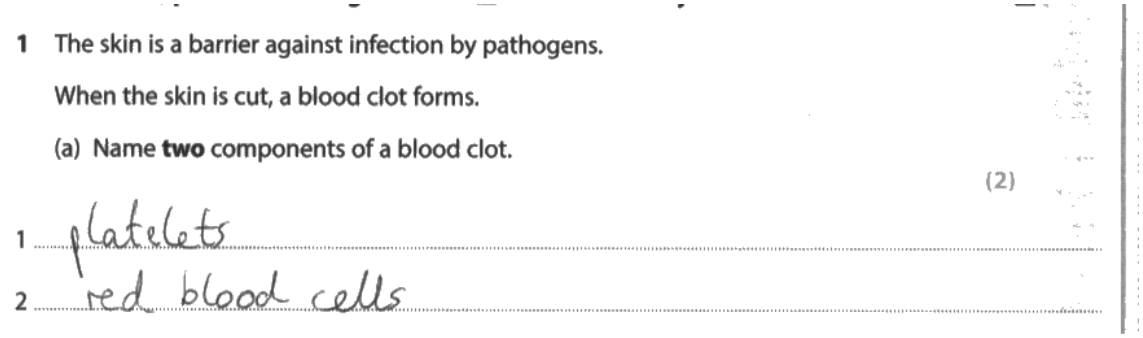
The questions focusing on biological processes were generally well answered across the paper, with learners demonstrating a particularly good level of understanding when questions were posed concerning the normal function of body systems. Where questions used specific terminology, especially for processes occurring at the cellular level, learner responses appeared to be less confident in nature. In some of the short answer questions learners gave responses which demonstrated a lack of familiarity with the terms they were using. In many cases this overcomplicated their answer and prevented them from accessing marks – examples could include where students have given a correct response of “high blood pressure”, which requires no further elaboration, but then added the term “hypotension” to their answer, rendering it incorrect.

The use of correct language is challenging for learners working at all levels, especially as there is a huge amount of new vocabulary associated with studying Applied Human Biology at Level 3. The most important focus for learners should be the clarity of their responses. In several cases learners provided long, descriptive responses to short open response questions which, in many cases answers that were provided ended up being too vague to meet any of the marking points. We do not expect that all learners will use the exact language seen in the mark schemes in their responses, credit can be given as long the learner's meaning is clear, but the more comfortable learners are around the specific terminology used within the specification the easier they will find it to write accurate responses.

Individual Questions

Question 1a

This question was well answered by most learners. The most common correct responses were platelets and red blood cells, as seen in the sample learner response below, given 2 marks.


1 The skin is a barrier against infection by pathogens.

When the skin is cut, a blood clot forms.

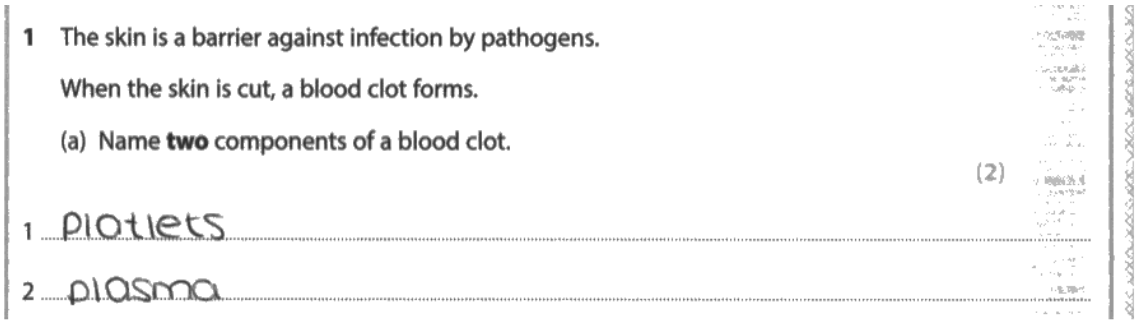
(a) Name **two** components of a blood clot.

(2)

1 platelets

2 red blood cells

The most common incorrect response given is shown in the learner response below, given 1 mark for the learner's correct recall of platelets. "Plasma" given as the second component of a blood clot is not given a mark, and this was the most frequent incorrect response for this question – either through a misconception about the process of blood clotting or through learners incorrectly interpreting the question and so recalling components of blood.


1 The skin is a barrier against infection by pathogens.

When the skin is cut, a blood clot forms.

(a) Name **two** components of a blood clot.

(2)

1 platlets

2 plasma

Also seen in some responses were references to "fibres", this was insufficient for mark. However, more specific answers such as "fibrin" were given credit.

Question 1b

Most learners were able to correctly classify antibody production and stomach acid as being specific and non-specific defences, respectively. A common response scoring 2 out of 3 possible marks can be seen below.

Here the learner has incorrectly stated that phagocytosis is a specific defence. The misconception that all forms of immunity involving any type of white blood cell is part of the specific immune response is held by many learners – showing a lack of clarity around the role of non-specific immune cells as biological defences against infection by pathogens.

(b) The immune system includes specific and non-specific defences.

Complete Table 1 by adding Yes and No to show whether each defence is specific or non-specific.

The first row has been completed for you.

(3)

defence	specific	non-specific
skin forming a physical barrier	**No**	**Yes**
antibody production by lymphocytes	Yes	no
hydrochloric acid in the stomach	NO	yes
phagocytosis by phagocytes	yes	no

Table 1

A response awarded all 3 marks can be seen below. Here the learner has correctly completed the row for each of the defences listed in the table.

(b) The immune system includes specific and non-specific defences.

Complete Table 1 by adding Yes and No to show whether each defence is specific or non-specific.

The first row has been completed for you.

(3)

defence	specific	non-specific
skin forming a physical barrier	**No**	**Yes**
antibody production by lymphocytes	yes	no
hydrochloric acid in the stomach	no	yes
phagocytosis by phagocytes	no	yes

Table 1

Question 1c

The learner responses to this question were more often given in general terms, e.g. “T cell” or “T Lymphocyte” and these were credited under the additional guidance on the mark scheme. The roles of the different types of white blood cells within the body is an area of the specification that does not appear to be well understood by learners.

An example of a correct learner response to this question can be seen below, although very few learners managed to answer this question correctly, overall.

(c) Viruses are pathogens that replicate inside the body's cells.

Name **one** type of white blood cell that destroys cells containing viruses.

(1)

Cytotoxic T Cell

Although many more general answers were awarded the mark for this question, some responses were too vague to be awarded a mark and an example of this can be seen below.

(c) Viruses are pathogens that replicate inside the body's cells.

Name **one** type of white blood cell that destroys cells containing viruses.

(1)

leukocytes

The use of leukocytes as a response demonstrates an unfamiliarity with the key terminology contained within the immunology sections of the specification. It could be that the learner has intended to give the response “lymphocytes” but ended up using the incorrect term instead.

A common incorrect response can be seen below. Here the learner has given the answer “antibodies” and has not been awarded the mark.

(c) Viruses are pathogens that replicate inside the body's cells.

Name **one** type of white blood cell that destroys cells containing viruses.

(1)

antibodies

While there may be a misconception about the nature of antibodies, this response may also be, as in the case for the learners giving the incorrect response of “plasma” in Q1a, a case of learners incorrectly interpreting the question and recalling different key term from the topic.

Question 2ai

This question was correctly answered by fewer candidates than would be expected. The idea of complimentary base pairing is generally well understood by learners although usually understanding is tested in a qualitative sense and so the quantitative nature of this question may have been unfamiliar to learners.

Question 2aii

This question was answered well by many learners, two examples of correct answers awarded 1 mark can be seen below.

(ii) Name the nucleotide base that is found only in RNA.

(1)

Uracil

(ii) Name the nucleotide base that is found only in RNA.

(1)

U

In the second example of these responses, the learner has given the name of the base as 'U' rather than uracil. As it is completely unambiguous as to which base the learner is referring, they have been awarded the mark. Several responses were seen with phonetic or nonstandard spellings of the answer and provided there was no ambiguity in the learner's meaning these were given credit.

Responses naming a different, incorrect, nucleotide base were very rare. It was more common to see responses naming components of the nucleotide base - either "phosphorous" or "ribose", as can be seen below.

(ii) Name the nucleotide base that is found only in RNA.

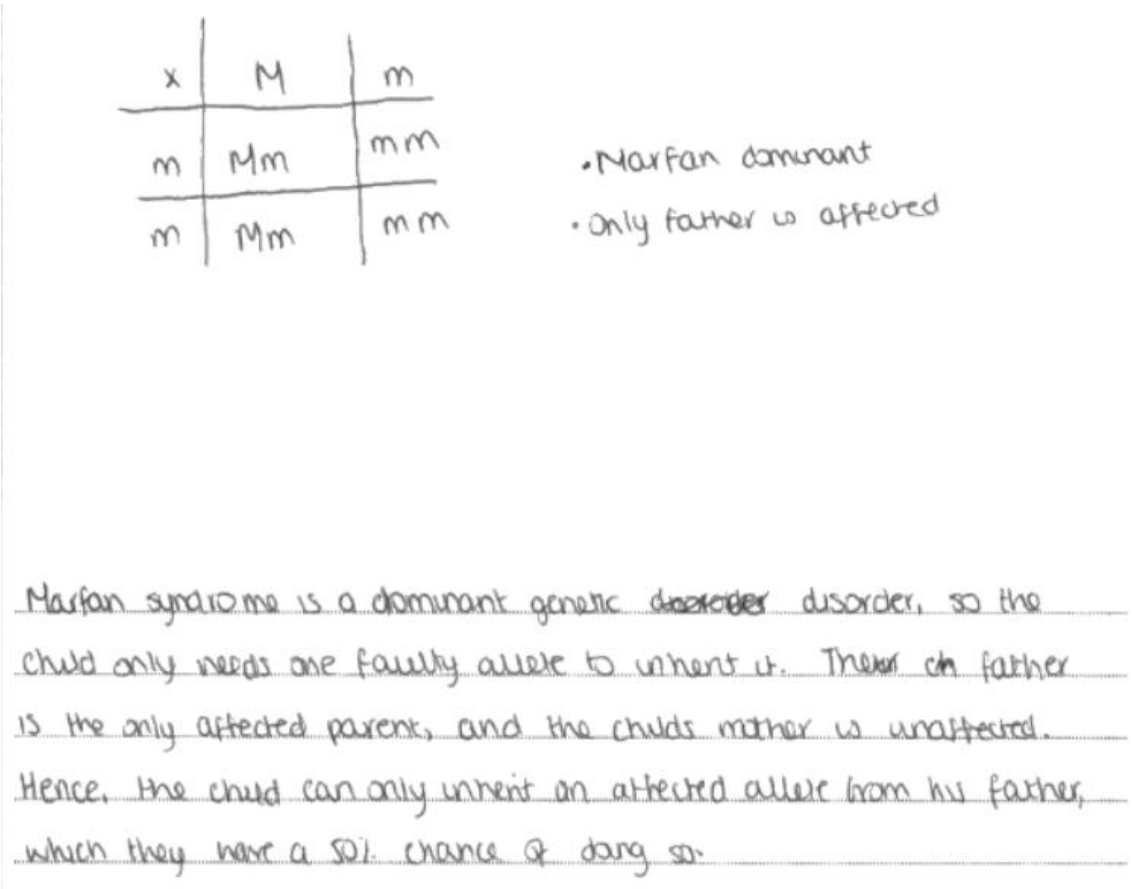
(1)

ribose

This learner has recalled a piece of knowledge about the difference between DNA and RNA but in the context of the sugars rather than the nucleotide bases and so has been awarded 0 marks.

Question 2b

This question was well answered by many learners and there were some very high-quality responses seen. Use of Punnett squares to illustrate responses was common among those learners scoring 2 or 3 marks on this question. Although many of these Punnett squares were correct, they were often unlabelled. However, lack of correct labelling did not prevent learners from being able to score full marks on this question. An example of a learner response with an unlabelled diagram but still awarded 3 marks can be seen below.



x	M	m
m	Mm	mm
m	Mm	mm

- Marfan dominant
- only father is affected

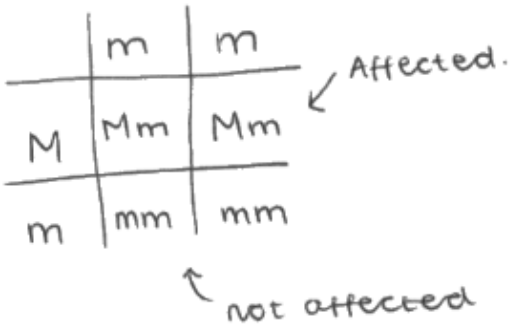
Marfan syndrome is a dominant genetic ~~disorder~~ disorder, so the child only needs one faulty allele to inherit it. Their ~~dad~~ father is the only affected parent, and the childs mother is unaffected. Hence, the child can only inherit an affected allele from his father, which they have a 50% chance of doing so.

Here the learner has drawn a Punnett square correctly showing the predicted ratio of genotypes for the two individuals given in the question. This would be enough for MP3 on the mark scheme as the diagram shows the M allele only inherited from one parent (which can be inferred to be the father as the genotype is given in the question). The other two marking points are addressed in the first line of the learner's response.

A Punnett square was not required for a learner to gain full marks on this question, all three marking points could be obtained from a learner's written answer. It was, however, often the case that where the written

response used language that was slightly too ambiguous the presence of a correct Punnett square could evidence the learner's understanding.

Many learners gave clear and correct answers, often including supporting diagrams but were only able to gain 2 of the 3 marks available. An example of a response awarded 2 marks can be seen below.

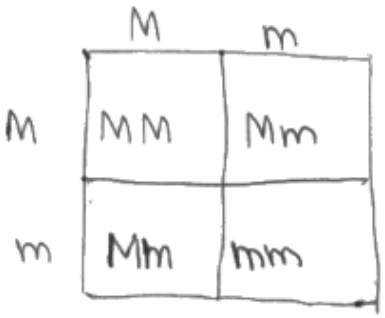


There is a 50% chance that their child will inherit Marfan Syndrome as 1:2 of the possible children will be a carrier of the mutated gene and affected just like their father.

Here the learner has given the second and third marking points but has not explained that the allele for Marfan syndrome is dominant, this was commonly missed by learners. As the command word is explain for this question it is vital that the learners expand on the information given in the stem of the question – most answers awarded 1 or 2 marks were describing the 50% chance of inheritance of Marfan syndrome rather than explaining why this was the case.

There was some confusion seen over the term "carrier" in many responses with several learners using it synonymously with "heterozygous" and so many responses referred to "affected carriers" of Marfan syndrome which reduced the clarity of their responses.

Most learners were able to apply their knowledge of inheritance to the context given within the question. However, in a few cases learners used more generic recall from the subject content – an example of a response awarded 0 marks can be seen below.



I have drew a Punnet square above to ~~show~~ show the allele combinations which are possible. In the Punnet Square we can clearly see that there is a 50% Chance the child will inherit Marfan Syndrome.

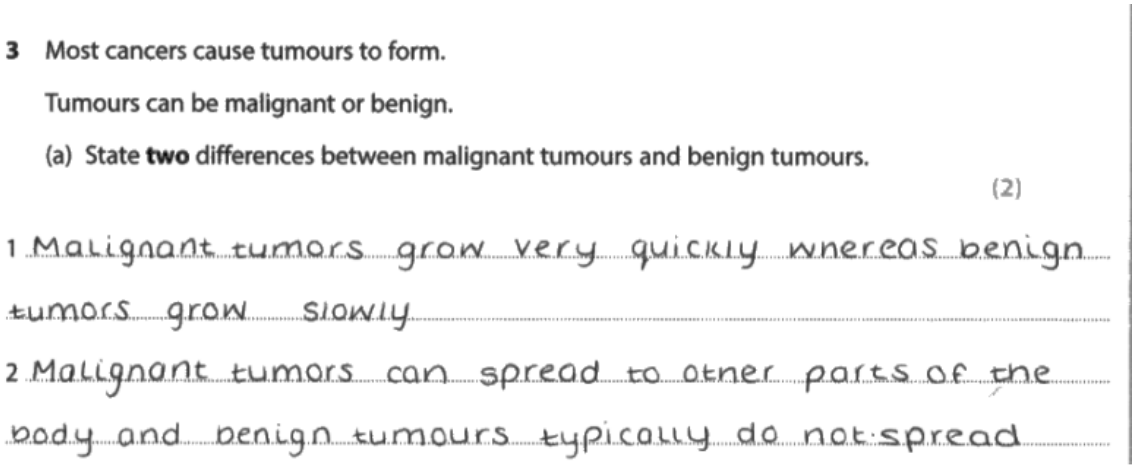
Here the learner has drawn a Punnett square for two heterozygous parents. The response states the 50% ratio is demonstrated by the Punnett square, but this does not match the information in the diagram itself. As the 50% ratio is given in the stem of the question there is, unfortunately, nothing in the response that can be given credit.

Question 2c

This question assessed learners' understanding of specific terminology, in this case for the genetics section of the specification. The number of learners correctly answering this question was much lower than would be expected, particularly as recall of terminology is a skill expected of learners working at all levels from pass onwards. It is vital that learners can understand and engage with the key terms listed in the specification both as a part of Assessment Objective 1 and to allow them to access all questions across the specification.

Question 3a

There were some excellent responses given by learners here, an example of which can be seen below. This response was given 2 marks.



3 Most cancers cause tumours to form.

Tumours can be malignant or benign.

(a) State **two** differences between malignant tumours and benign tumours.

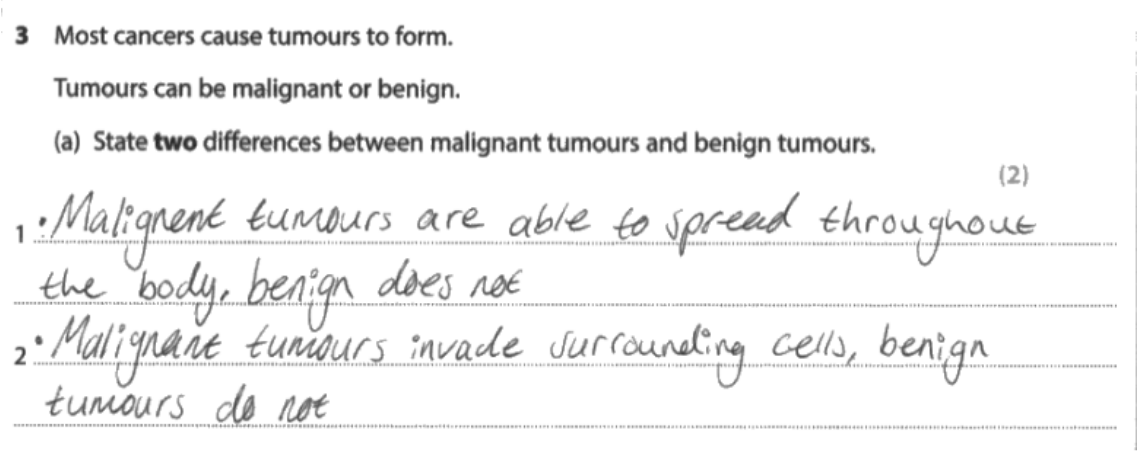
(2)

1 Malignant tumors grow very quickly whereas benign tumors grow slowly

2 Malignant tumors can spread to other parts of the body and benign tumours typically do not spread

The learner has made a clear distinction between the differences in the two types of tumours. The answer is precisely worded and there is no use of general language (e.g., "it grows quickly") to introduce uncertainty. Although this learner has given a very thorough answer, responses did not need to specifically mention both types of tumour if the difference was clear. For example, the phrasing "malignant tumours grow quicker" would have been awarded the marking point here as the difference is implied in the use of the comparative language.

A common theme seen in answers given one out of two marking points was learners giving the same marking point twice, phrased in slightly different ways. An example of a response given 1 mark for this reason is below.



3 Most cancers cause tumours to form.

Tumours can be malignant or benign.

(a) State **two** differences between malignant tumours and benign tumours.

(2)

1 • Malignent tumours are able to spreed throughout the body, benign does not

2 • Malignant tumours invade surrounding cells, benign tumours do not

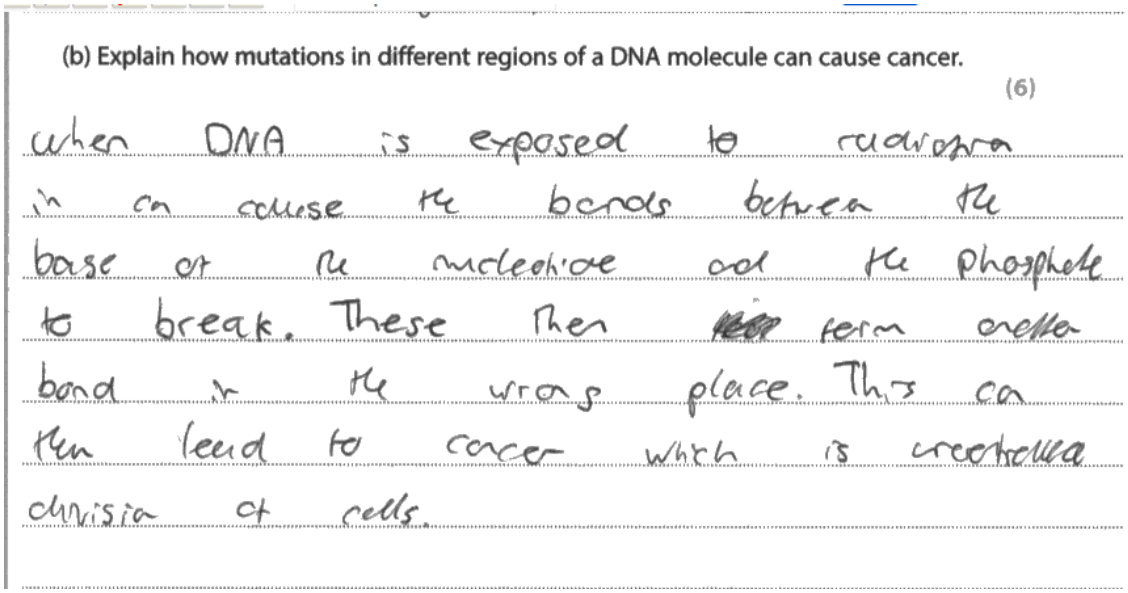
Here the learner has referred to spreading of malignant tumours and then the invasion of surrounding cells. These two statements are not sufficiently different to be awarded separate marking points. Another common phrasing of the same marking point was “malignant tumours are cancerous” which is referring to the same idea.

Many answers gave statements about malignant tumours being fatal, deadly and/or harmful – without a further elaboration these types of responses are too general to be awarded credit at Level 3. Where learners have made comparative statements, credit may be given e.g., “malignant tumours are more dangerous” would be credited with a mark under the additional guidance in the mark scheme.

Question 3b

This question was answered very well by some learners although the majority of answers lacked the level of detail that would be expected of answers given by learners at Level 3. Answers which contained more detail generally focused on the concept of mutations and how different types of mutation might arise. Those responses which used the context of how mutations could lead to cancer tended to be very limited in their application with mostly generic statements being made about uncontrolled cell division. Learners who gave Level 3 responses managed to link mutation to control of the cell cycle or to the prevention of apoptosis, however understanding of the role of oncogenes or tumour suppressor genes was almost entirely absent. Learners should have an understanding of this as the effect of mutations in these genes is covered by its own specification point.

An example of a Level 1 answer can be seen below. Here the learner has made some isolated, generic statements about DNA damage and has linked the idea of uncontrollable cell division to cancer which meets the criteria for a mark at Level 1.



(b) Explain how mutations in different regions of a DNA molecule can cause cancer.

(6)

when DNA is exposed to radiation it can cause the bonds between the base of the nucleotide and the phosphate to break. These then form cross bond in the wrong place. This can then lead to cancer which is uncontrolled division of cells.

The learner response below is an example of an answer which meets the criteria for Level 2 on the mark scheme. There is evidence here of accurate knowledge and understanding, and the learner has made some good linkages – for example between the lack of apoptosis and the development of a tumour. The level of detail is not quite enough for a Level 3 answer, although this is a very good Level 2 response. There is no sustained line of reasoning between the idea of the mutation and the effect on the cell as the comment on changing the DNA's "coded function" is too vague to provide an explanation.

(b) Explain how mutations in different regions of a DNA molecule can cause cancer.

(6)

- mutations in a DNA molecule will change the DNA's coded functions.
- a mutation will cause the cell to divide uncontrollably and rapidly due to the functions change.
- mutated cells do not undergo programmed cell death / apoptosis.
- this means that the cells will not 'die' at checkpoints in the cell cycle like they are supposed to but they will continue to repeat the stages of mitosis until a tumour has formed.

The learner response below is an example of a Level 3 answer, although one at the lower end of the band. There are some inaccuracies and a little confusion in some parts of the response, particularly when the response moves onto the idea of transcription and translation. However, the extended open response questions are not negatively marked – the less accurate parts of the response do not take away from the correct information given in the other parts of the response. Although the relevant part of the response is very brief, the learner has demonstrated a well-developed explanation with a clear and logical structure. They have made linkages between mutations to specific genes and the development of cancer as a result. Learners do not need to mention a minimum number of points from the indicative content in order to be awarded a particular level, and so a response which is brief is still able to be awarded marks from Level 3.

(b) Explain how mutations in different regions of a DNA molecule can cause cancer.

(6)

If there is a mutation in the tumour suppressor gene of the DNA molecule, the DNA will continue to divide as the mutation causes the tumour suppressor gene to lose it's function of stopping replication. A mutation along any part of a DNA sequence may result in the alteration of a codon (base triplet) which will affect how translation functions. This is because the ribosome molecule in translation works by moving along the mRNA transcript to find the correct base pair. If this base ~~pair~~ codon is mutated, it will not stop and will create bigger proteins in the long run which will increase cell size and cause cancer as cells begin to increase in size (hypertrophy).

Question 4ai

Answers scoring 2 marks were common here, although based on how learners have tackled questions on cell responses to injury during previous series it was unexpected to see that most learners scored more marks for their explanations of hyperplasia than for atrophy. It can be noted that the answers given surrounding atrophy tended to be much more generalised than those for hyperplasia and in many cases, this is where learners lost marks.

The response below scored 2 marks. The learner has correctly identified that hyperplasia leads to an increase in cell number but has not expanded on this for a second marking point. The explanation of atrophy includes general statements about cells becoming weaker through lack of use which are not sufficient for awarding of the second marking point. However, the statement that cells get smaller as a result is enough for MP3 on the mark scheme and so the learner is given 2 marks overall.

4 Cells in the body respond to injury.

(a) (i) Hyperplasia and atrophy are two examples of cell adaptation in response to injury.

Explain the effects that hyperplasia and atrophy have on cells.

(4)

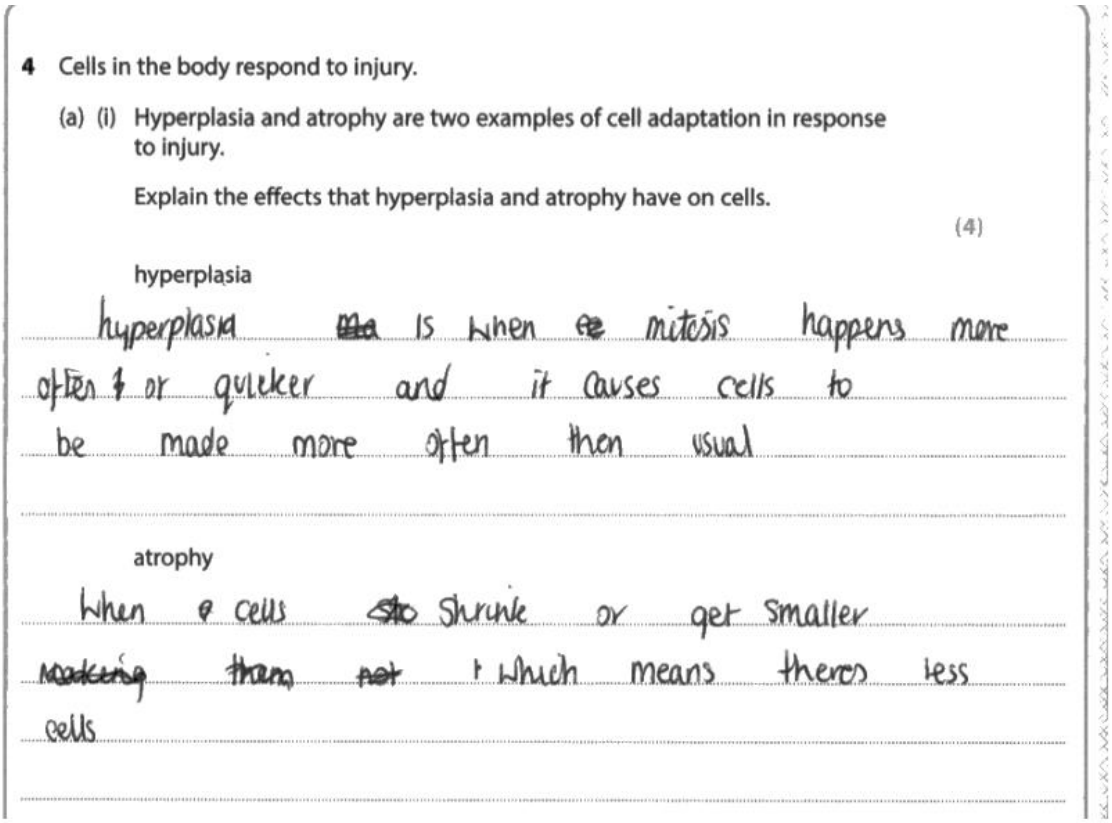
hyperplasia

this is when the number of cells increase ~~within an organ~~ causing ~~the cell~~ a greater number of them cells to help with repair.

atrophy

atrophy is when the cell in the body become weaker due to the lack of use for the single cell this causes them to get smaller in size.

The response below is an example where the learner narrowly misses out on marks due to repeating the same marking point twice in both cases. The learner begins by giving a very good explanation of the increased frequency of cell division but then does not link this to increased cell number but instead states that the cells are made more often which is a restatement of the same point. The explanation for atrophy includes mention of cells decreasing in size and in number, unfortunately these are both covered by the same marking point on the mark scheme (MP3) and so the learner can only be awarded a total of 2 marks for the response.



4 Cells in the body respond to injury.

(a) (i) Hyperplasia and atrophy are two examples of cell adaptation in response to injury.

Explain the effects that hyperplasia and atrophy have on cells.

(4)

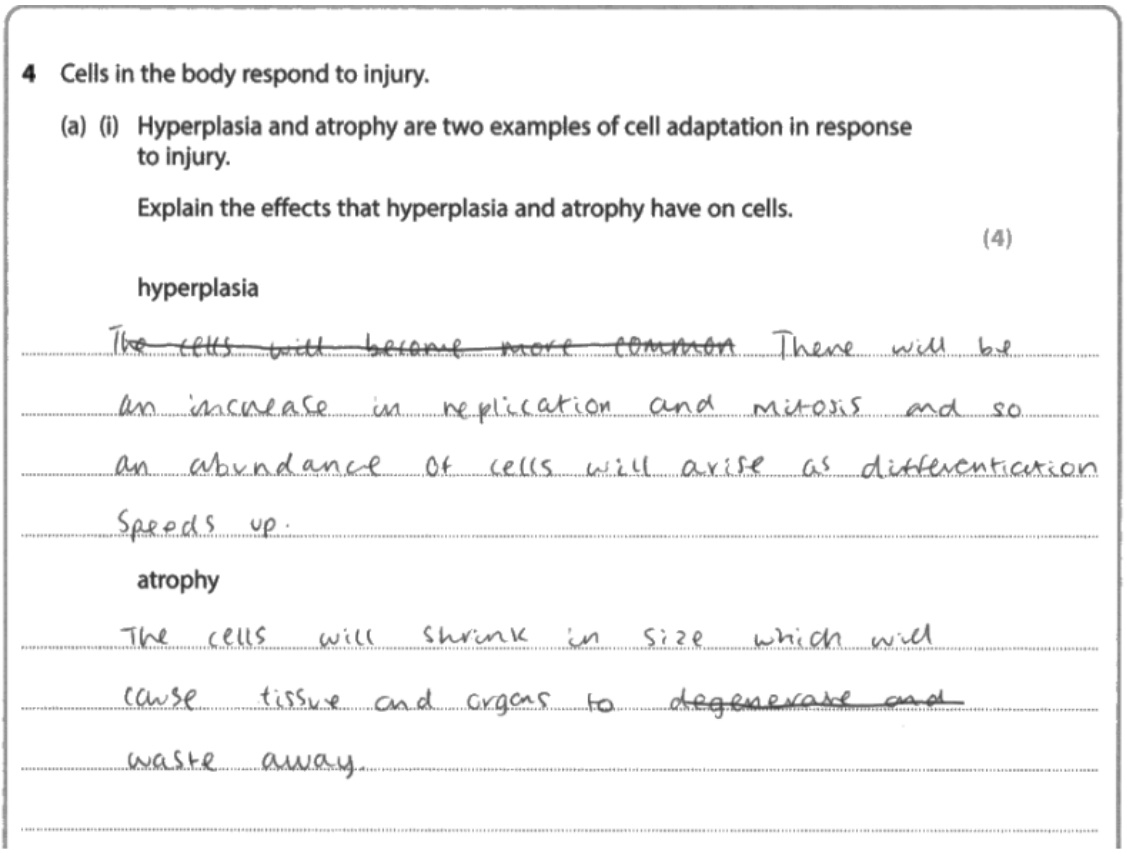
hyperplasia

hyperplasia is when mitosis happens more often or quicker and it causes cells to be made more often than usual

atrophy

When cells Shrink or get smaller than not which means theres less cells

The response below is an example of an answer awarded all 4 marks. The language used here is imprecise in places but there is enough to award each marking point. The learner refers to increased cell division for MP1, the phrasing “an abundance of cells” is not a typical response but the meaning of increased cell number is easily inferred, and this is enough for MP2. The response for atrophy is awarded MP3 for the comment about the decrease in cell size and the final marking point comes from the additional guidance where a decrease in organ size (here “wasting away” is an accepted description of that process) is allowed. This response scored 4 marks.



4 Cells in the body respond to injury.

(a) (i) Hyperplasia and atrophy are two examples of cell adaptation in response to injury.

Explain the effects that hyperplasia and atrophy have on cells.

(4)

hyperplasia

~~The cells will become more common~~ There will be an increase in replication and mitosis and so an abundance of cells will arise as differentiation speeds up.

atrophy

The cells will shrink in size which will cause tissue and organs to ~~degenerate and~~ waste away.

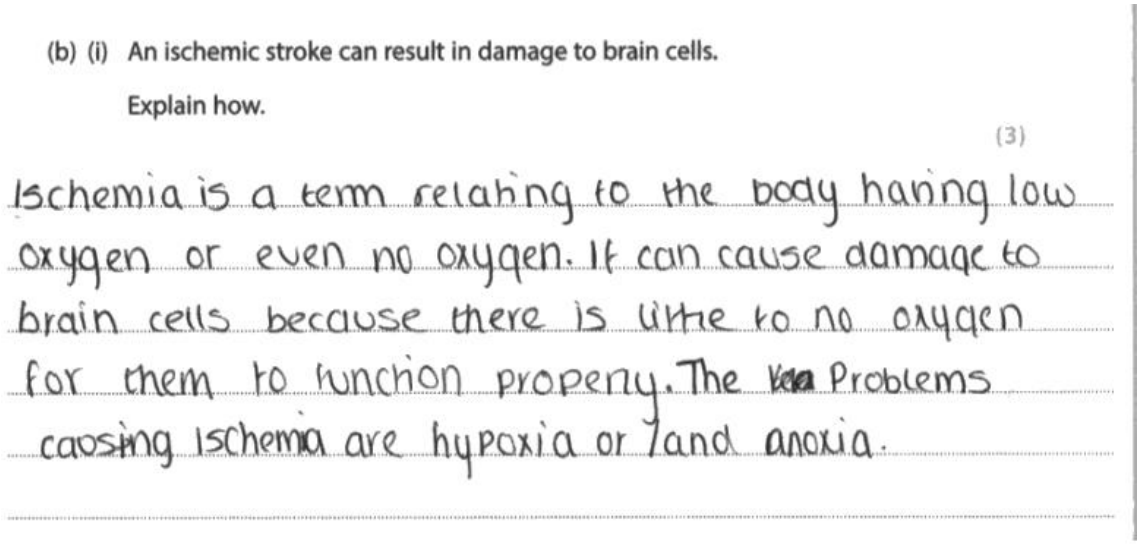
Question 4aii

This question was generally well answered with the majority of learners selecting the correct answer. Cell injury and repair is a topic that previously proved difficult for learners to access so this is an improvement that is good to see.

Question 4bi

This is an example of a question where learners often lost one or two marks by not following through to the logical conclusion of their explanation. Again, many answers provided descriptions of the process rather than an explanation.

The following response was awarded 1 mark.



(b) (i) An ischemic stroke can result in damage to brain cells.

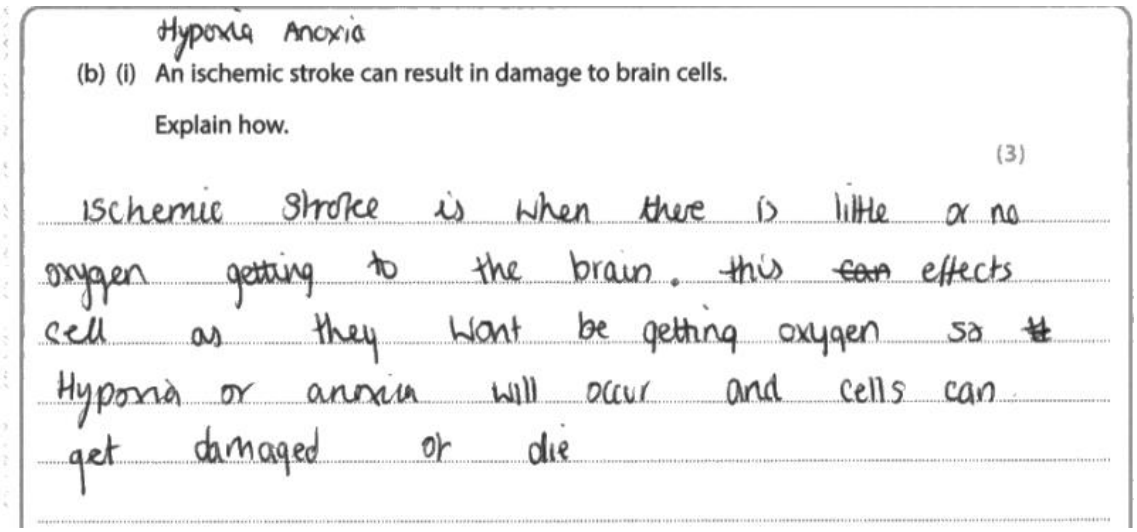
Explain how.

(3)

Ischemia is a term relating to the body having low oxygen or even no oxygen. It can cause damage to brain cells because there is little to no oxygen for them to function properly. The Problems caosing ischemia are hypoxia or and anoxia.

The learner has made reference to a lack of oxygen as a result of an ischemic stroke – they have not expanded further on this either in terms of what causes the lack of oxygen or in terms of why this lack of oxygen leads to damage of the brain cells. There is reference to brain cells not being able to "function properly" in this response which is not sufficiently detailed to be given credit at Level 3 as it is not clear how the function has been affected. This type of imprecise phrasing was common in learner responses. Where learners made reference to cells stopping working, this can be credited as a description of cell death (as can be seen in the response given 3 marks, which appears at the end of this section).

The response below was awarded 2 marks. This response is similar to the previous example, but the learner has expanded further when explaining the effect of decreased oxygen levels on the brain cells. Responses making reference to decreased aerobic respiration as a result of oxygen deprivation were infrequent. More commonly seen responses can be seen in the example response below where learners described cell death in some form, which is seen in the additional guidance section of the mark scheme.



Hypoxia Anoxia

(b) (i) An ischemic stroke can result in damage to brain cells.

Explain how.

(3)

Ischemic Stroke is when there is little or no oxygen getting to the brain. this ~~can~~ effects cell as they wont be getting oxygen so Hypoxia or anoxia will occur and cells can get damaged or die

An example of a response given 3 marks can be seen below. This learner does not explain what causes the brain to receive less oxygen, for MP1 - in fact, very few responses were awarded this marking point which is surprising. The learners have, however, given an expansion on the consequences of the decreased oxygen levels and these were awarded two further marking points. One for decreased ATP and one for the statement that "Having no energy prevents [brain cells] from working" as this is just sufficient for a description of cell death.

(b) (i) An ischemic stroke can result in damage to brain cells.

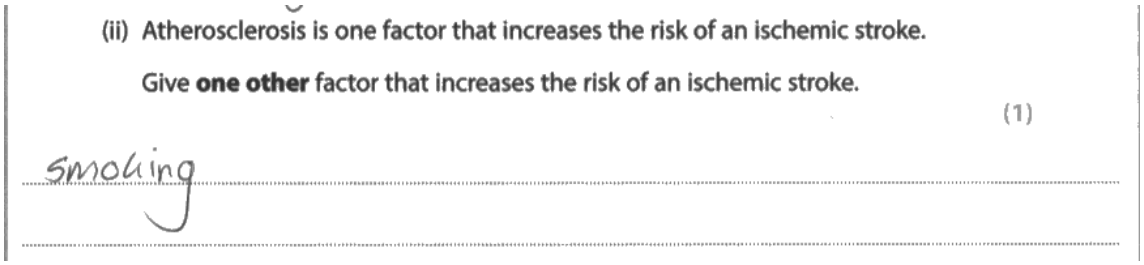
Explain how.

(3)

An ischemic stroke ~~puts alot of pressure on~~ prevents happens because not enough oxygen can get to the brain. This is bad because it prevents the mitochoddria in the brain cells from producing ATP (energy). Having no energy prevents them from working causing the brain to shut down. if the brain is without oxygen for long enough the brain cells will be damaged.

Question 4bii

This question was well answered by the majority of learners. The most common responses are shown below. Both were awarded 1 mark.

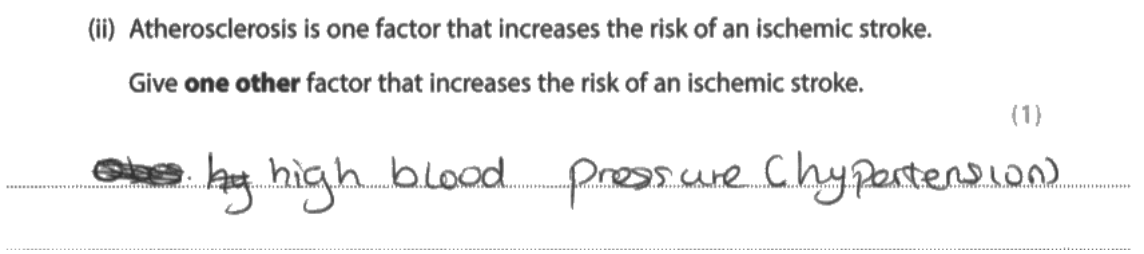


(ii) Atherosclerosis is one factor that increases the risk of an ischemic stroke.

Give **one other** factor that increases the risk of an ischemic stroke.

(1)

smoking



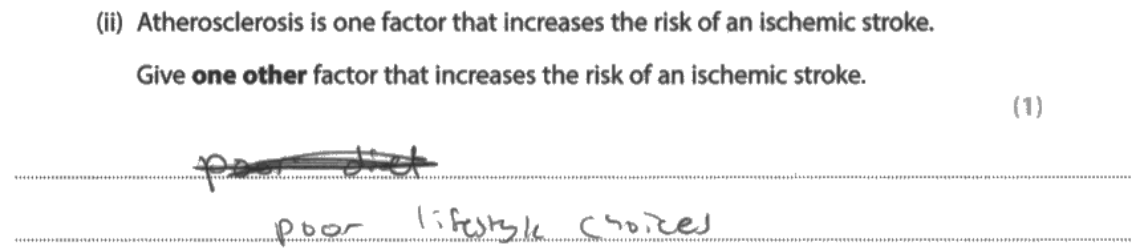
(ii) Atherosclerosis is one factor that increases the risk of an ischemic stroke.

Give **one other** factor that increases the risk of an ischemic stroke.

(1)

~~obes~~ by high blood pressure (hypertension)

Where learners did not score marks for this question it was usually the case that answers were too vague to be given credit, rather than being explicitly incorrect. An example of the most common incorrect response can be seen below, this was awarded 0 marks.



(ii) Atherosclerosis is one factor that increases the risk of an ischemic stroke.

Give **one other** factor that increases the risk of an ischemic stroke.

(1)

~~poor diet~~

poor lifestyle choices

The learner has referred to “poor” lifestyle choices, this was seen frequently along with alternate phrasings such as “bad” or “unhealthy” – this is not specific enough to be awarded a marking point at Level 3.

Question 5a

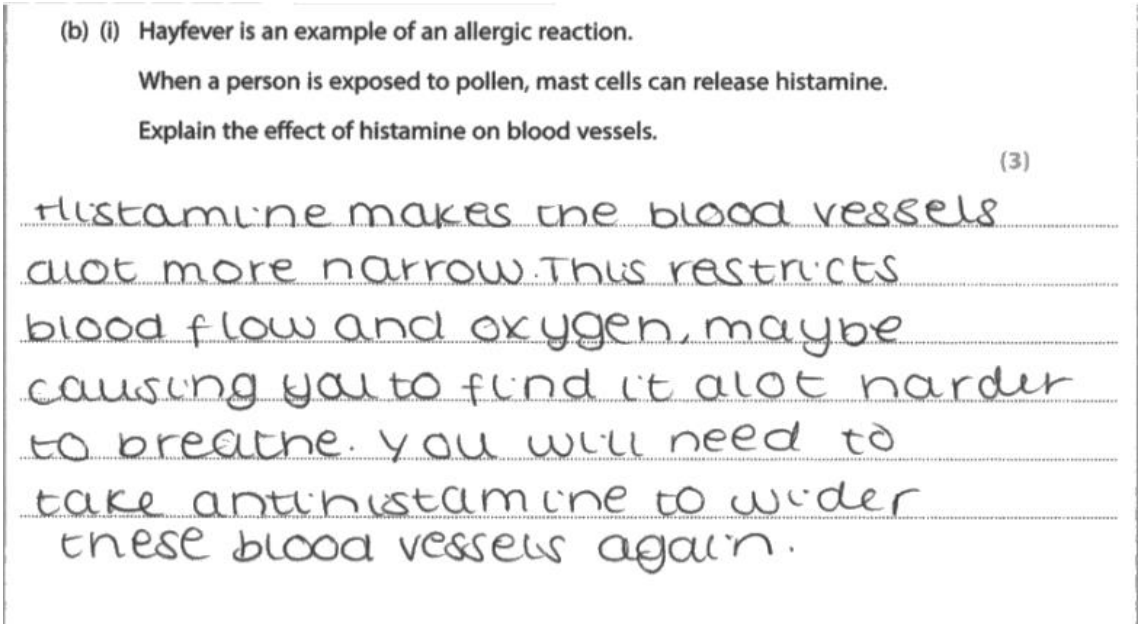
This question was answered correctly by around half of the learners. The understanding of named conditions within the specification has been an area that learners have previously struggled with, so this is an improvement.

Question 5bi

This question proved challenging for the majority of learners. Responses scoring more than 1 mark were in the minority.

The first marking point – that histamine causes a response by binding to receptors on the blood vessels was not seen in learner responses. The role of receptors as part of signalling pathways is a concept which learners have previously found difficult. The appreciation that responses to chemical messages within the body involves the binding between signalling molecule and receptor is absolutely fundamental and underpins several specification sections so it is important that learners are able to engage with this concept.

The action of histamine was poorly understood, and it was common to see responses where learners confused the responses of blood vessels and airways. An example of this can be seen below in a learner response awarded 0 marks. The learner has referred to constriction of the blood vessels and linked this to difficulty in breathing – indicating a degree of confusion around the context of the question.



(b) (i) Hayfever is an example of an allergic reaction.

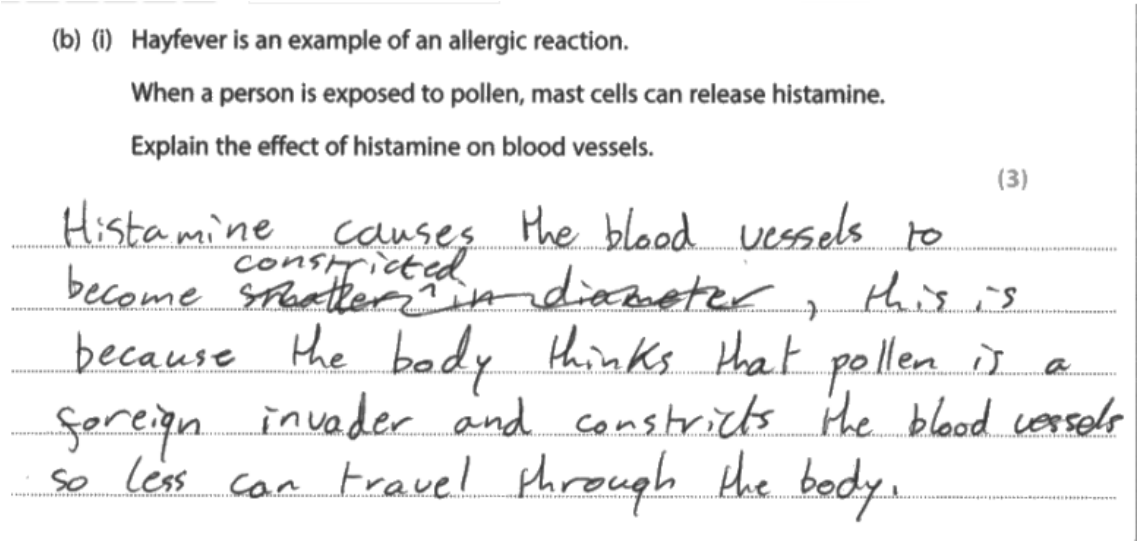
When a person is exposed to pollen, mast cells can release histamine.

Explain the effect of histamine on blood vessels.

(3)

Histamine makes the blood vessels alot more narrow. This restricts blood flow and oxygen, maybe causing you to find it alot harder to breathe. You will need to take antihistamine to widen these blood vessels again.

Another common misconception seen in learner responses where constriction of blood vessels was given as a response to histamine was the idea that this was as a mechanism to prevent the pollen from being able to travel in the bloodstream. An example of a learner response where this is seen is below. The response scored 0 marks.



(b) (i) Hayfever is an example of an allergic reaction.

When a person is exposed to pollen, mast cells can release histamine.

Explain the effect of histamine on blood vessels.

(3)

Histamine causes the blood vessels to become ~~smaller in diameter~~ constricted, this is because the body thinks that pollen is a foreign invader and constricts the blood vessels so less can travel through the body.

This misconception was seen frequently enough that it may indicate a broader and more fundamental misunderstanding of the nature and purpose of the inflammation response within the body.

The concept of increased permeability of blood vessels in response to histamine was better understood by learners. Where learners incorrectly stated vasoconstriction as a result of histamine, responses could often be awarded MP5 for descriptions of vessels becoming “leaky”. An example of this type of learner response, awarded 1 mark, can be seen below.

(b) (i) Hayfever is an example of an allergic reaction.

When a person is exposed to pollen, mast cells can release histamine.

Explain the effect of histamine on blood vessels.

(3)

Mast cells release histamine which causes blood vessels to vasoconstrict which ~~allows~~ allows less blood to move through the body. It can also cause the blood vessels to become more leaky so more leukocytes gather and cause swelling.

An example of a learner response awarded all 3 marks can be seen below. This response is clear, and the learner has done well to demonstrate their understanding through the use of correct scientific terminology.

(b) (i) Hayfever is an example of an allergic reaction.

When a person is exposed to pollen, mast cells can release histamine.

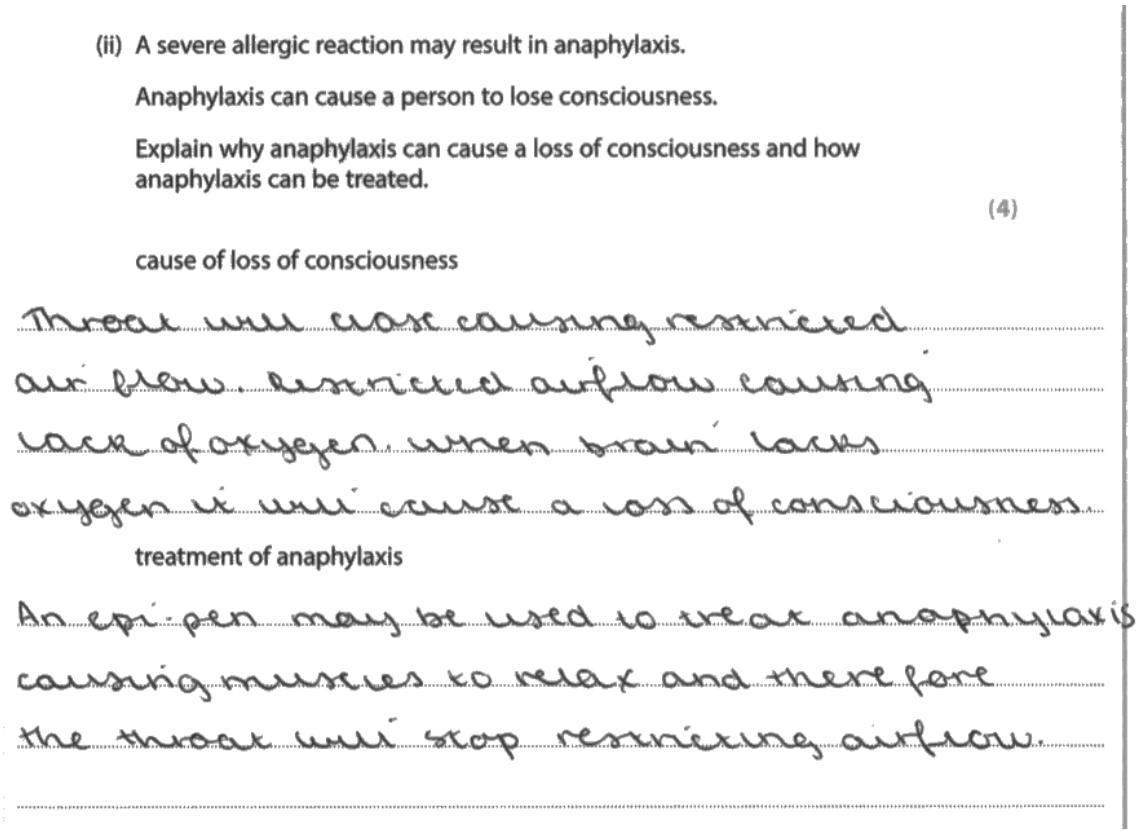
Explain the effect of histamine on blood vessels.

(3)

Histamine causes blood vessels to vasodilate meaning there is more blood flow in the blood vessels. It also increases membrane permeability, meaning more fluid can enter the tissue which causes swelling.

Question 5bii

Responses to this question spanned the full range of marks with many learners demonstrating a good understanding of the effects and treatments of anaphylaxis. An example of a response scoring all 4 marks is below.



(ii) A severe allergic reaction may result in anaphylaxis.

Anaphylaxis can cause a person to lose consciousness.

Explain why anaphylaxis can cause a loss of consciousness and how anaphylaxis can be treated.

(4)

cause of loss of consciousness

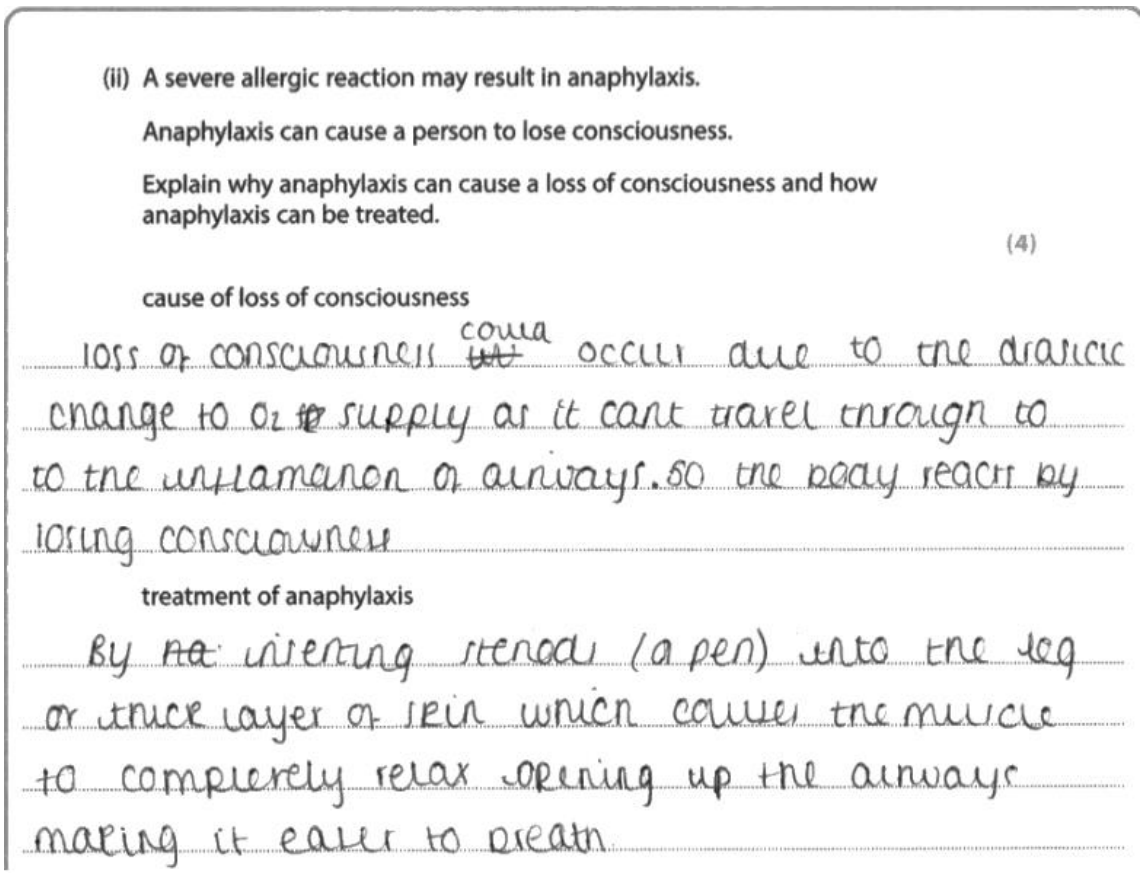
Throat will close causing restricted air flow. Restricted airflow causing lack of oxygen. When brain lacks oxygen it will cause a loss of consciousness.

treatment of anaphylaxis

An epi-pen may be used to treat anaphylaxis causing muscles to relax and therefore the throat will stop restricting airflow.

Here the learner has demonstrated a clear line of reasoning for both parts of their explanation. Answers that made the link between a sudden drop in blood oxygen level and a loss of consciousness were rare, more common were answers that explained that loss of consciousness was due to a lack of oxygen reaching the brain. The learner's description of the treatment for anaphylaxis is awarded both marking points and so the response scored full marks.

The response below is an example where the learner's explanation about why a decrease in oxygen level leads to a lack of consciousness does not meet the required standard to be given credit. The rest of the answer is correct and so the learner scored 3 marks overall.



(ii) A severe allergic reaction may result in anaphylaxis.

Anaphylaxis can cause a person to lose consciousness.

Explain why anaphylaxis can cause a loss of consciousness and how anaphylaxis can be treated.

(4)

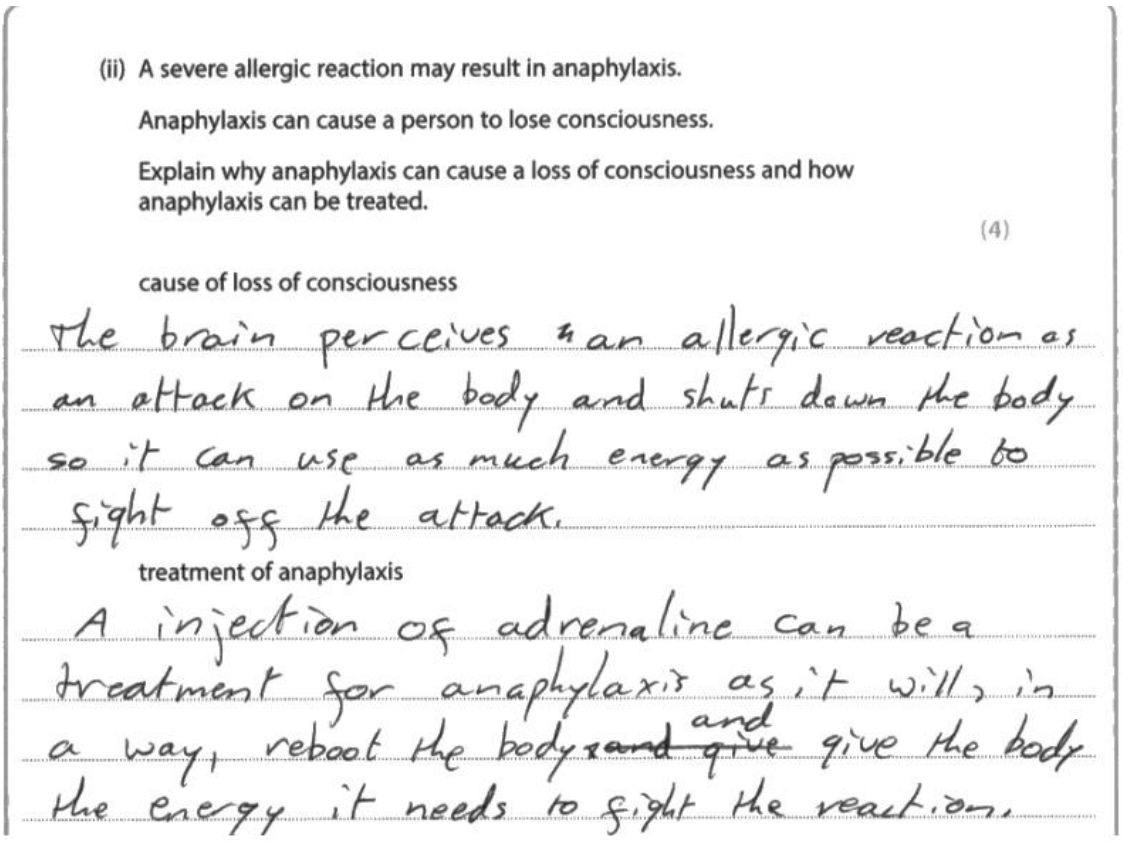
cause of loss of consciousness

loss of consciousness ~~wt~~ could occur due to the drastic change to O2 to supply as it cant travel through to to the inflamation of airways. so the body reacts by losing consciousness

treatment of anaphylaxis

By ~~he~~ inserting steroid (a pen) into the leg or thick layer of skin which caused the muscle to completely relax opening up the airways making it easier to breath

The response below is an example where the learner has only been awarded 1 mark overall. The learner has correctly identified the treatment for anaphylaxis, which has been credited with a mark.



(ii) A severe allergic reaction may result in anaphylaxis.

Anaphylaxis can cause a person to lose consciousness.

Explain why anaphylaxis can cause a loss of consciousness and how anaphylaxis can be treated.

(4)

cause of loss of consciousness

The brain perceives an allergic reaction as an attack on the body and shuts down the body so it can use as much energy as possible to fight off the attack.

treatment of anaphylaxis

A injection of adrenaline can be a treatment for anaphylaxis as it will, in a way, reboot the body ~~and give~~ and give the body the energy it needs to fight the reaction.

The framing of anaphylaxis as a deliberate attempt by the body to "shut down" or "prevent attack" was one seen in many incorrect responses. This has been a theme across many of the questions focusing on the immunology sections of the specification – a misconception held by many learners appears to be that one of the roles of the immune system is to "shut down" the body in response to pathogens. It is important that learners understand that a response which could prove fatal to the affected person does not class as a normal function of the immune system.

Question 5ci

This question was generally very well answered by learners. The most common correct answer was chemotherapy, as seen in the response below, awarded 1 mark.

(c) (i) Give **one** example of a medical treatment that reduces the function of the immune system.

(1)

chemotherapy

Correct responses naming immunosuppressant therapies (including those which named organ transplants as an example of a medical treatment, as these procedures would require the use of immunosuppressants) were also seen fairly often. An example of a response given 1 mark is seen below.

(c) (i) Give **one** example of a medical treatment that reduces the function of the immune system.

(1)

immunosuppresant drugs.

The two most common incorrect answers are seen below. Both responses were awarded 0 marks.

(c) (i) Give **one** example of a medical treatment that reduces the function of the immune system.

(1)

vaccinations

(c) (i) Give **one** example of a medical treatment that reduces the function of the immune system.

(1)

antibiotics

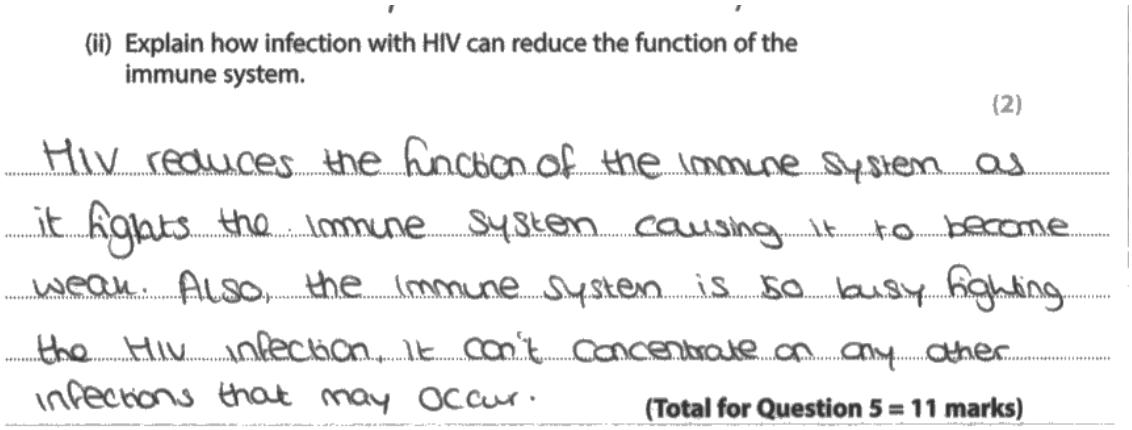
In both of the examples above it could be a case of learners misinterpreting the question and recalling medical treatments for communicable diseases. However, both vaccines and antibiotics were given as responses frequently enough that it may be worth considering

if there is a misunderstanding for some learners in the nature of how the immune system functions and how medical treatments support this function.

Question 5cii

The effect of HIV on the immune system has been examined previously and although there is a marked improvement in terms of the quality of learner responses, there is still an overall lack of understanding when it comes to how an infection with HIV can affect the immune response.

The following is an example of a learner response awarded 0 marks demonstrates a common misconception seen within answers given on this topic.



(ii) Explain how infection with HIV can reduce the function of the immune system.

(2)

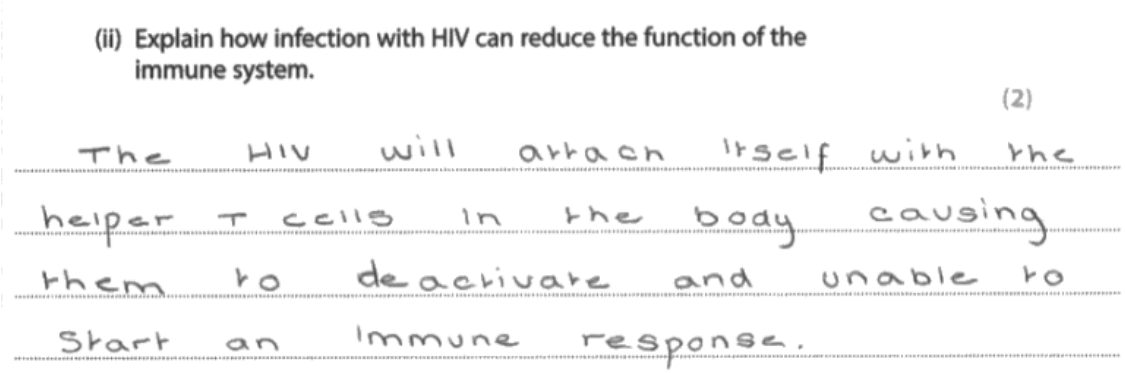
HIV reduces the function of the immune system as it fights the immune system causing it to become weak. Also, the immune system is so busy fighting the HIV infection, it can't concentrate on any other infections that may occur.

(Total for Question 5 = 11 marks)

The learner suggests that a reduction of immune function is due to the immune system being "busy" fighting the HIV and so not able to respond to other infections. The idea of the HIV infection overwhelming the immune system was seen frequently in responses that scored 0 marks. Many incorrect learner responses referenced the idea of the immune system "attacking" the virus directly, indicating a lack of understanding of the mechanisms behind viral infection.

There was evidence of comprehensive understanding seen in the higher scoring learner responses to this question. In some cases, learners provided additional detail well beyond the expected scope of that required by the mark scheme.

An example of a learner response given 2 marks which displays the level of detail expected of learners on this topic is seen below.



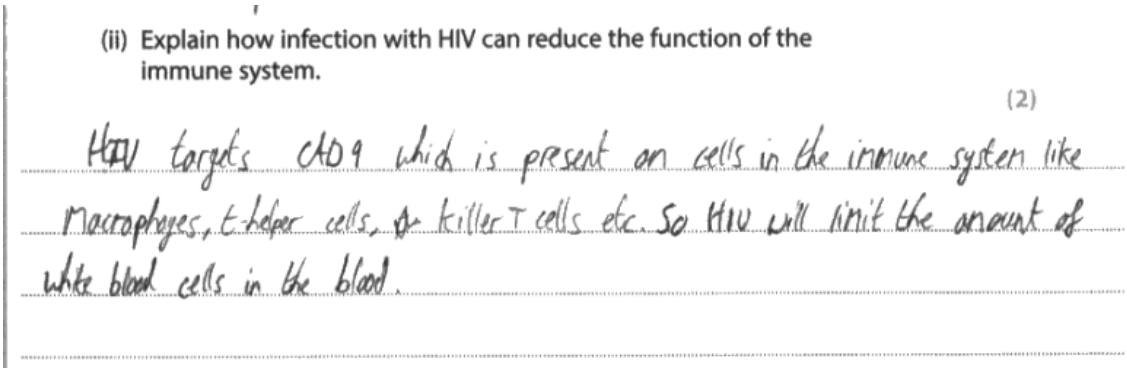
(ii) Explain how infection with HIV can reduce the function of the immune system.

(2)

The HIV will attach itself with the helper T cells in the body causing them to deactivate and unable to start an immune response.

Here the learner has explained that HIV infects (phrased as "attaches to" which, here, is sufficiently clear) T cells and has linked the decrease in T cell function to the overall decrease of immune function within the body. The response is clear and to the point, for a short open response question this is enough detail for both of the marks to be awarded.

Another example of a learner response awarded 2 marks can be seen below.



(ii) Explain how infection with HIV can reduce the function of the immune system.

(2)

HIV targets CD4 which is present on cells in the immune system like Macrophages, t-helper cells, & killer T cells etc. So HIV will limit the amount of white blood cells in the blood.

Although the learner has not managed to correctly recall the name of the CD4 protein they have correctly referenced T cells as a "target" of the virus for the first of the two marking points. They have then linked this to a limit of the number of white blood cells, which is an acceptable alternative phrasing for the idea of reduction in white blood cell count and so is given the second mark.

Question 6ai

Most learners answered this question correctly. Learners' understanding around the anatomy of the heart appears to be one of the more well understood sections of the specification and this is demonstrated in the number of learners scoring marks for questions on this topic, even at this relatively late point in the paper.

Question 6aii

Learners answered this question well, on the whole. Most learners were able to correctly identify the structure labelled Q as a ventricle. The identification of structure P proved more difficult for learners with many responses given being either incorrect or too general to gain credit.

An example of a learner response given 2 marks can be seen below.

(ii) Figure 2 shows a cross section of the heart.

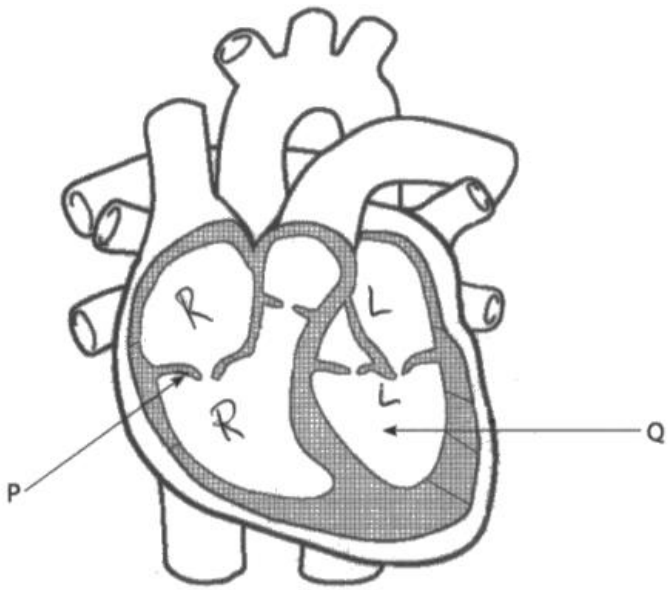


Figure 2

Name the parts of the heart labelled P and Q in Figure 2.

(2)

P ~~[illegible]~~ tricuspid valve

Q Left ventricle

The learner has correctly identified Q as the left ventricle and named structure P as the tricuspid valve. Many learners identified P as an atrioventricular/AV valve which was also awarded a mark when seen.

In some cases, learners identified the incorrect valve for structure P – "semilunar" was seen more frequently than "bicuspid" as an incorrect response here. However, more often the type of valve was not specified in the response, resulting in answers that were too generic for credit to be given. An example of this can be seen below. This learner was given 1 mark.

(ii) Figure 2 shows a cross section of the heart.

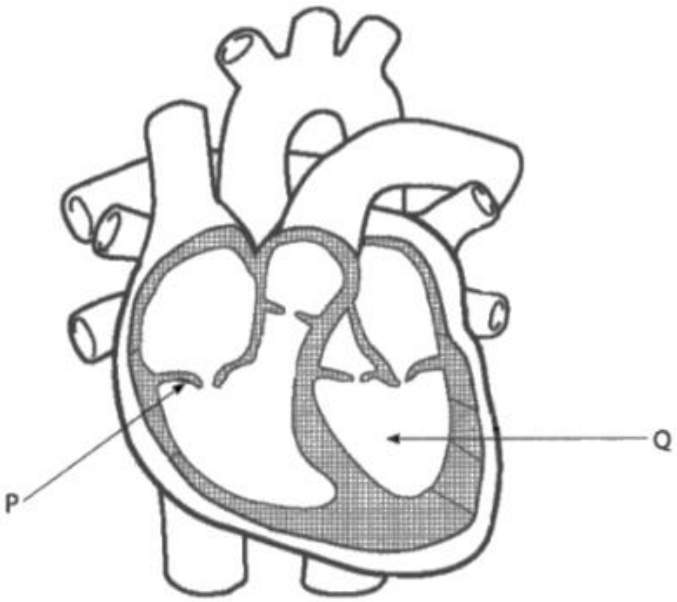


Figure 2

Name the parts of the heart labelled P and Q in Figure 2.

(2)

P valve

Q left ventricle

The learner has correctly identified the left ventricle, but the unqualified "valve" is insufficient to gain the mark here. The two types of valve found in the heart have significant enough differences that it is important the distinction is made here. A similar example would be if the learner were asked to label the pulmonary artery – the identification as an artery without recall of the specific name may be worth credit while a learner response using the general term of blood vessel, while not technically incorrect, would not be specific enough to be awarded a marking point.

An example of a learner response that was awarded 0 marks can be seen below.

(ii) Figure 2 shows a cross section of the heart.

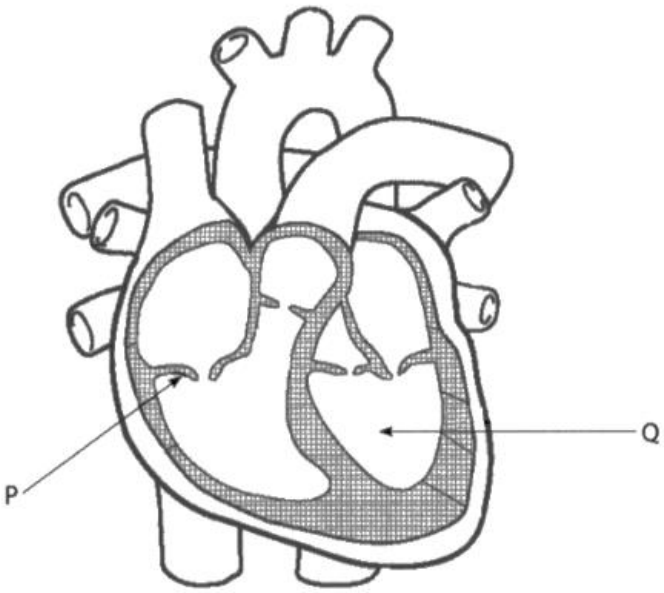


Figure 2

Name the parts of the heart labelled P and Q in Figure 2.

(2)

P valve

Q right ventricle

The identification of P as a "valve" is too general for the first marking point, as explained above, because the learner has incorrectly identified Q as the right ventricle, therefore this cannot be awarded a marking point as the learner is referring to the wrong side of the heart. This is a very common error seen on questions assessing the anatomy of the heart.

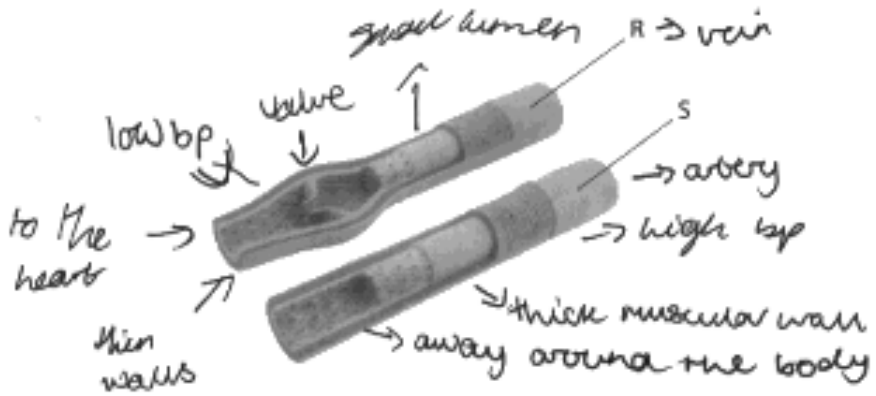
Question 6b

This is the first of the two 9-mark extended open response questions and here, learners were required to use a stimulus in the form of a diagram and use the features shown as well as their own knowledge to evaluate how the structures of the two blood vessels were adapted to their function. Learner responses here were generally much stronger than on the second 9-mark question, which would be expected as the circulatory system is an area where learners generally demonstrate a much greater degree of confidence in their responses. In general, the vein (R) was more thoroughly described than the artery (S), which in some cases was mistaken for a capillary. In more than a few cases learners correctly described the features of each vessel but identified them the wrong away around. In these cases, the structural features were considered as related to the vessel shown in the diagram where it was clear that the learner had simply made an error in recall of the names, and so learners were still able to demonstrate their ability to apply their knowledge within the context of the question.

There were many strong responses to this question where learners showed an impressive depth of knowledge as well as a solid understanding of how best to apply their understanding within the context given by the question.

An example of a learner response at Level 3 can be seen below.

(b) Figure 3 shows two types of blood vessel.



(Source: https://www.elscolabs.com/products/anatomy-of-artery-vein-and-capillary)

Figure 3

Evaluate how the structure of each type of blood vessel, R and S, is adapted for its function.

(9)

Blood vessel, R, is a vein. They carry deoxygenated blood to the heart. The veins have valves, this stops backflow of blood. The veins have low blood pressure and therefore only have thin muscular walls. The veins do not have elastic walls as they do not need to be able to stretch. They don't carry as much blood as arteries so do not have a large lumen. Due to the low blood pressure, it is vital the lumen is small so the flow of blood doesn't decrease or even stop.

Blood vessel, S, is an artery. They carry oxygenated blood around the body to

the muscles and tissues. The arteries have a very high blood pressure as it needs to be able to get oxygen everywhere in the body quickly. The walls of the arteries have to be able to stretch so that they don't burst, this means they have thick elastic walls. They also have thick muscular walls to stop the walls from breaking due to high blood pressure. The lumen of the arteries a medium size to stop any blood from clotting.

(Total for Question 6 = 12 marks)

Here the learner is consistent in the way that their response links each structural aspect with the function the vessel performs within the body, the response refers to specific elements of the structure shown in the figure as well as drawing on the learner's own understanding to support and add detail to their answer. There are some areas of confusion which leads to a degree of inaccuracy in the response, especially concerning the relative lumen size for veins compared with arteries, but this does not prevent the learner from being awarded a mark within Level 3 as there is enough evidence of understanding shown throughout the rest of the response. The response overall is well developed and there are clear links between the content written by the learner and the context of the question.

In the above example the learner has annotated the diagram provided in the question with key points about each of the vessels. In many responses seen, information added onto the figure or included as diagrams or lists contained content that the learner was given credit for. As mentioned in the overview of paper performance at the start of this report, learners are not required to present their information in any particular style for these extended open responses and while continuous prose is often the format learners use most effectively, all learners are

encouraged structure their answers in whatever manner allows them to best demonstrate their understanding of the content.

Below is an example of a learner response at Level 2. As with the previous example response, there is some incorrect information in this response, although in this Level 2 response it is more pronounced than in the Level 3 response. The learner attempts to make links between the structural features and the function of each vessel, but the lines of reasoning are only partially developed and do not provide evidence of a detailed understanding.

Figure 3

Evaluate how the structure of each type of blood vessel, R and S, is adapted for its function.

(9)

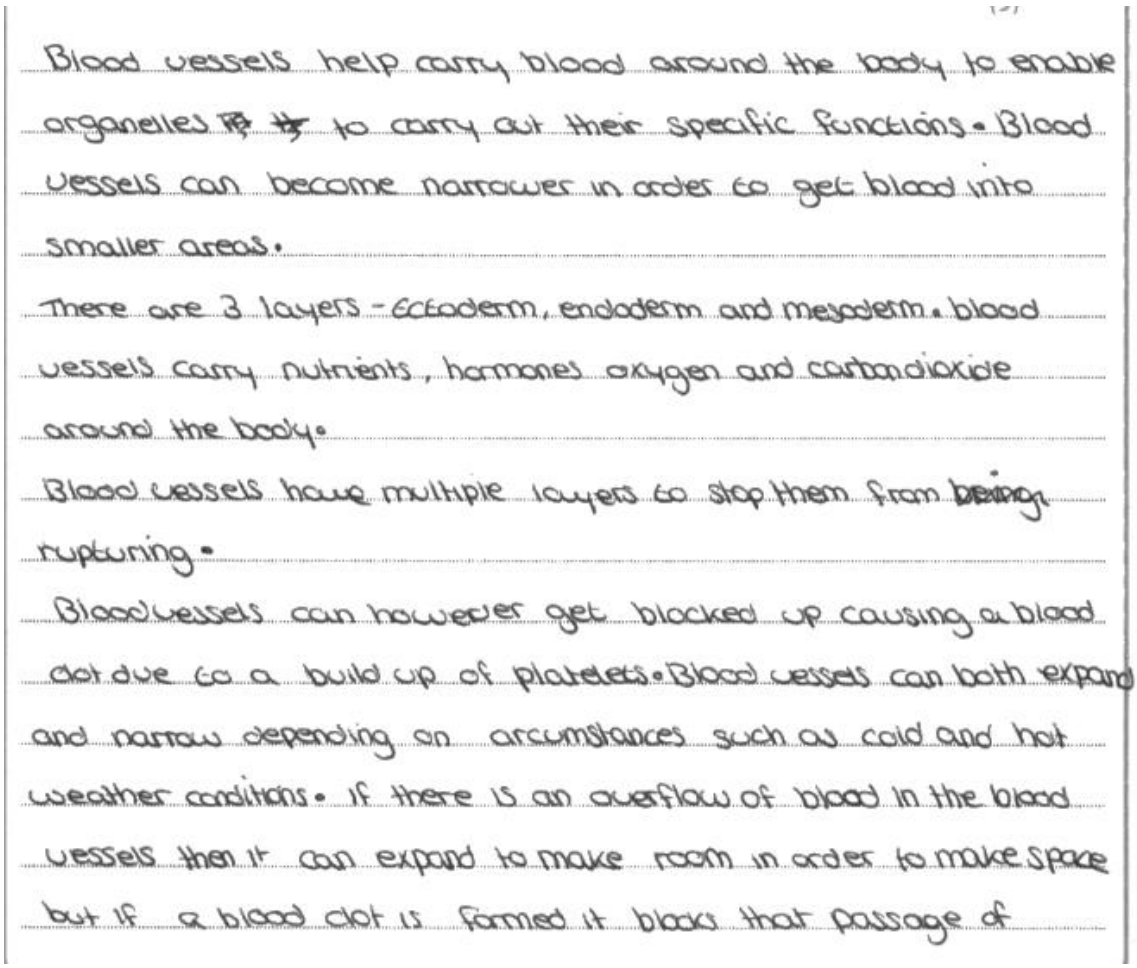
R is the vien and it has a valve inside it which stop blood from ~~going~~ back. So it flow back to the heart. It has many layers like the lumen, ~~epi~~ epithelial layer and ~~inter~~ ~~tw~~ lumen. All of these layers help the blood vessels stay intact so the blood doesnt flow out. The lumen and epithelial layer bothe contract when ~~blod~~ ~~bbl~~ blood is passing through to allow enough blood to flow through and around your body. Although to much pressure can cause hypertension.

The S is the called the attery it has the same amount of layers including the lumen, ~~inter~~ lumen and epithelial layer which help it stay together. There are also ~~stre~~ chy so that allow

8) blood can pass through without breaking the vessel.

Points made in answers that were awarded marks from Level 2 tended to be more generalised in nature but there was still evidence in most cases that learners were attempting to use the context of the question to apply their understanding. Learners given marks in Level 3 were able to select relevant elements of the topic to apply in their responses, whereas the responses in Level 2 were not able to discriminate which information to include in their answers as effectively.

The learner response below was awarded marks from Level 1 for this question. Learner responses scoring in Level 1 tended to be very brief and lacking in relevant content, in many cases learners did not give a substantial enough answer and their understanding of the topic was limited. However, this response below contains a lot more content than most answers at Level 1. What is significant in this response is that, although there is a lot of information given by the learner, there has been no application of this knowledge to the context of the question. While the learner has provided some good information on the general structure of blood vessels, the response does not engage with the command word from the question and as such the learner has not given an answer which provides any evidence of an evaluation of how the different functions of veins and arteries necessitate different structures. Even where the learner has described a structural feature, there is no link between this and the function of the vessel.

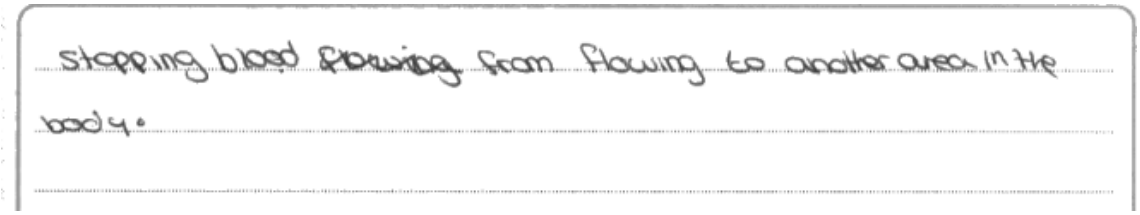


Blood vessels help carry blood around the body to enable organelles ~~to~~ to carry out their specific functions. Blood vessels can become narrower in order to get blood into smaller areas.

There are 3 layers - Ectoderm, endoderm and mesoderm. blood vessels carry nutrients, hormones oxygen and carbondioxide around the body.

Blood vessels have multiple layers to stop them from being rupturing.

Bloodvessels can however get blocked up causing a blood clot due to a build up of platelets. Blood vessels can both expand and narrow depending on circumstances such as cold and hot weather conditions. If there is an overflow of blood in the blood vessels then it can expand to make room in order to make space but if a blood clot is formed it blocks that passage of

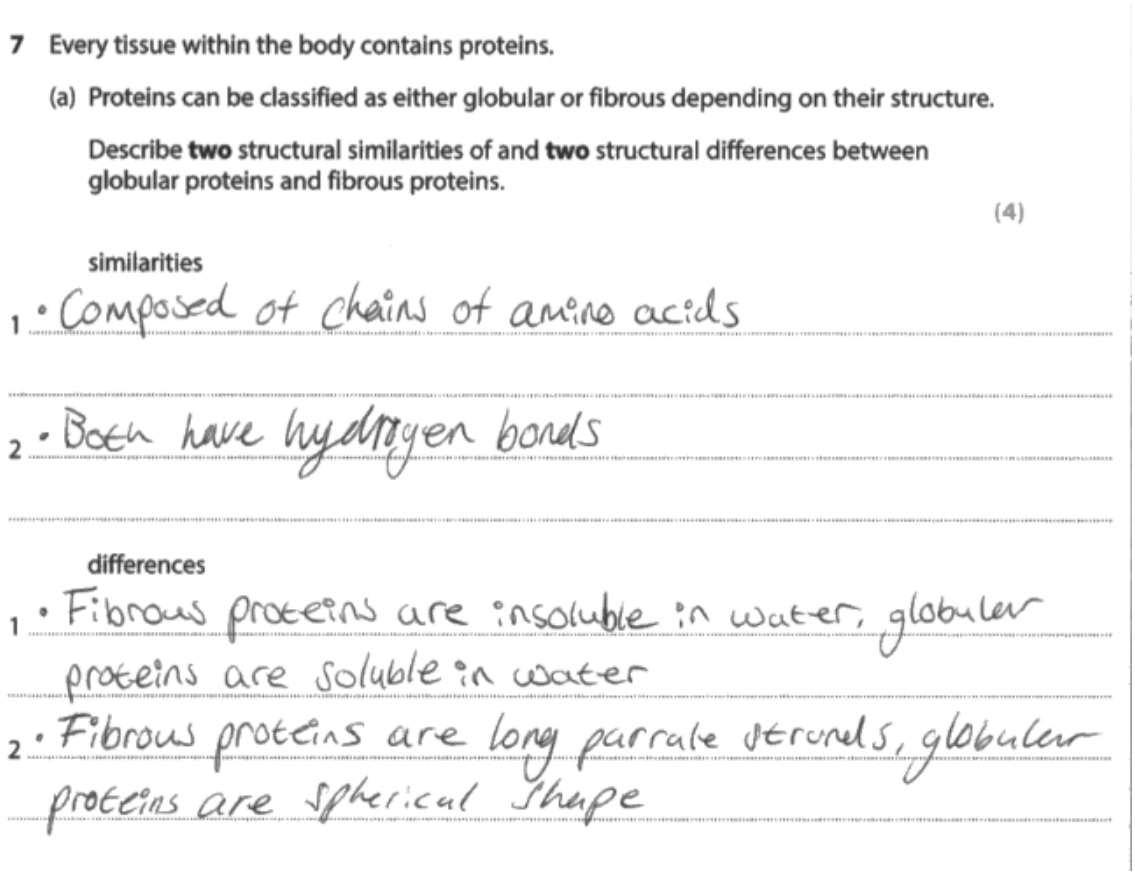


There is some correct information here that is worth credit. However, because of the lack of application seen in the answer, marks were not awarded above a Level 1 as the learner has not been able to demonstrate the skills required for the higher bands.

Question 7a

This question was one where the greatest proportion of non-responses were seen. In the cases where learners do not attempt questions these are typically found towards the end of the paper, but this question appeared to provide a particular level of challenge for learners.

Below is an example of a response that was awarded all 4 marks. The relative solubilities of the two types of protein are allowed as a difference under the additional guidance provided in the mark scheme and so all 4 marking points can be awarded.



7 Every tissue within the body contains proteins.

(a) Proteins can be classified as either globular or fibrous depending on their structure.

Describe **two** structural similarities of and **two** structural differences between globular proteins and fibrous proteins.

(4)

similarities

1 • Composed of chains of amino acids

2 • Both have hydrogen bonds

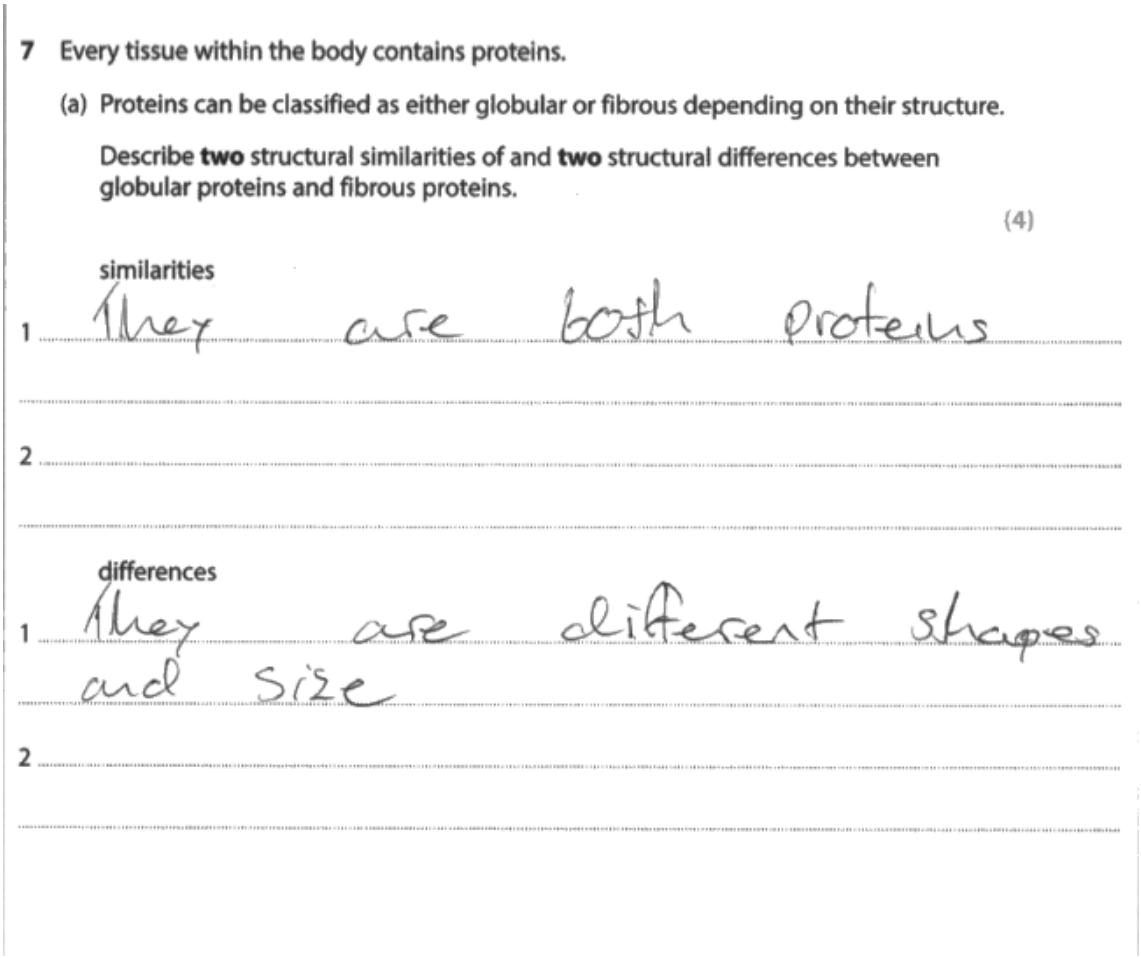
differences

1 • Fibrous proteins are insoluble in water, globular proteins are soluble in water

2 • Fibrous proteins are long parrale strands, globular proteins are spherical shape

Comments concerning shape were the most common differences given. Where these comments made a correct comparison, as in the answer above, these responses were awarded credit.

Learner responses lacked clarity in many cases, and often language was too vague to be given credit. An example can be seen in the learner response below, given 0 marks.



7 Every tissue within the body contains proteins.

(a) Proteins can be classified as either globular or fibrous depending on their structure.

Describe **two** structural similarities of and **two** structural differences between globular proteins and fibrous proteins.

(4)

similarities

1 They are both proteins

2

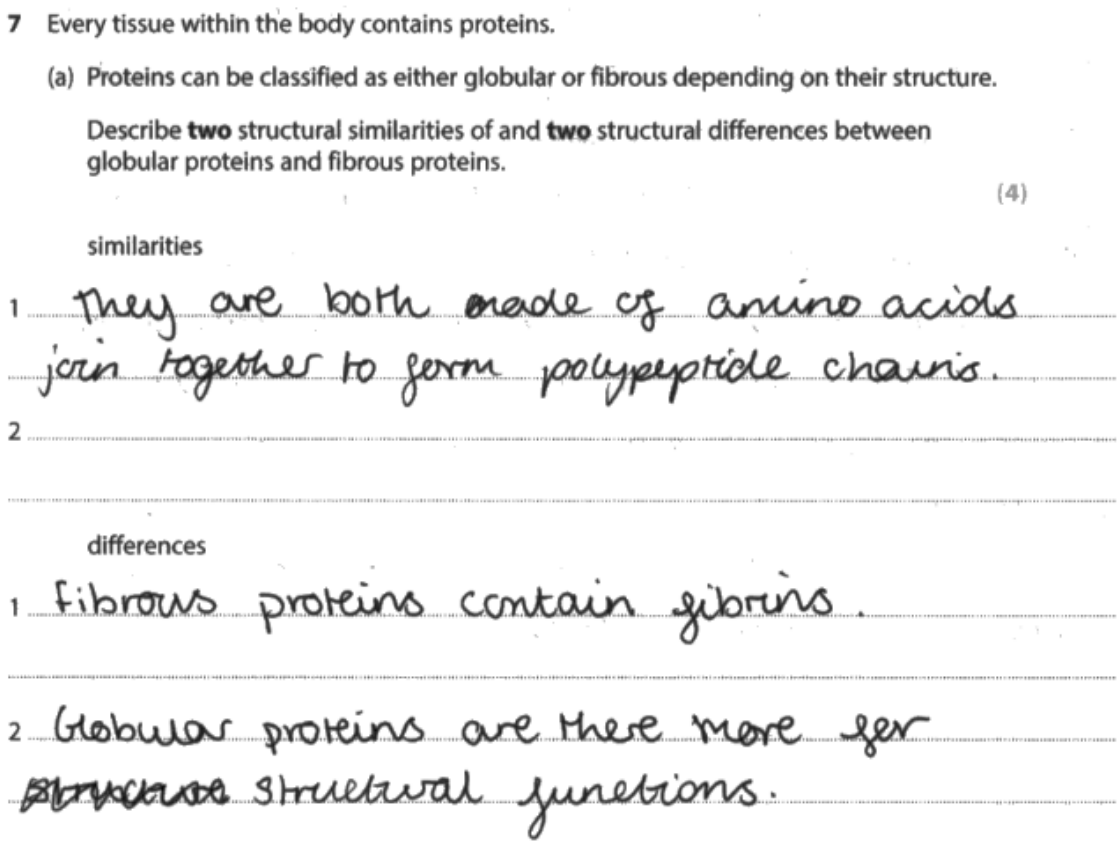
differences

1 They are different shapes and size

2

The statement of "they are both proteins" given as a similarity was seen frequently and was not worth a mark as this is information given within the stem of the question. The learner's description of different shapes and sizes does not provide enough information to be given a mark here. This type of generalised answer was quite common.

The following response is most typical of the standard of the answers awarded marks for this question. This learner was given 2 marks.



7 Every tissue within the body contains proteins.

(a) Proteins can be classified as either globular or fibrous depending on their structure.

Describe **two** structural similarities of and **two** structural differences between globular proteins and fibrous proteins.

(4)

similarities

1 they are both made of amino acids join together to form polypeptide chains.

2

differences

1 fibrous proteins contain fibrins.

2 Globular proteins are there more for ~~structure~~ structural functions.

The learner has been awarded both marks for the statement made about similarities between the two types of proteins as this single sentence covers two separate marking points. This was fairly typical, learners appeared to be much more confident when recalling the general structure of proteins than when it came to the more in depth understanding of protein structure required to differentiate between the two protein types given.

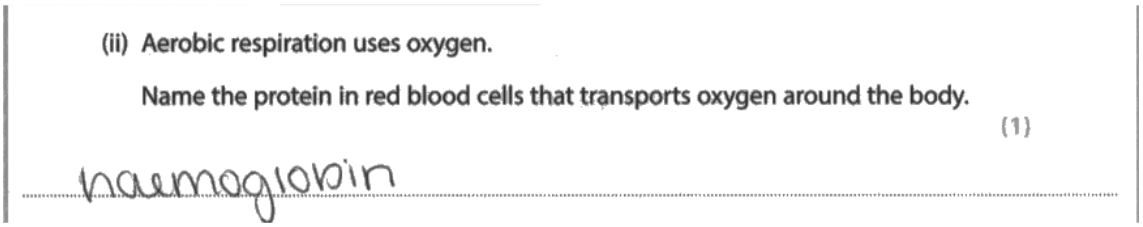
Some learner responses indicated confusion about the nature of and role of the proteins. Some learners referred to the presence or absence of cell walls and nuclei, usually seen in responses discussing prokaryotic and eukaryotic cells. There was also evidence in several responses where fibrous proteins and dietary fibre were confused with each other.

Question 7bi

The vast majority of learners selected the correct response for this question, showing an understanding of the biochemistry of the biological molecules. This area of the specification can often prove challenging for learners, so it is good to see the demonstration here that learners have engaged with the key points of the topic.

Question 7bii

This question was well answered by most learners. An example of a correct response, awarded 1 mark, can be seen below.

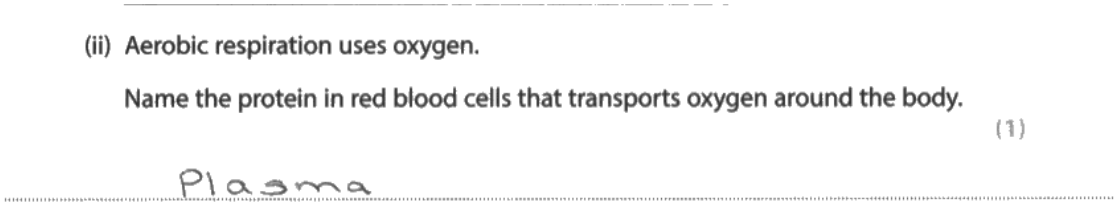

(ii) Aerobic respiration uses oxygen.

Name the protein in red blood cells that transports oxygen around the body.

(1)

haemoglobin

Although most responses given were correct, an example of the most common incorrect response can be seen below. This response scored 0 marks.


(ii) Aerobic respiration uses oxygen.

Name the protein in red blood cells that transports oxygen around the body.

(1)

Plasma

Plasma was the only incorrect response seen consistently across a range of learners. This may be due to the learners misinterpreting the question and identifying the proteins found dissolved within the blood rather than the haemoglobin found within the red blood cells themselves.

Question 7biii

Most learners answered this question well. Learners presented their responses in a variety of formats, including the use of chemical formulae. All correct answers were awarded credit.

Examples of two correct answers, each awarded 1 mark, can be seen below.

(iii) State **one** waste product formed during aerobic respiration. (1)

Carbon dioxide

(iii) State **one** waste product formed during aerobic respiration. (1)

Water

An example of an incorrect learner response awarded 0 marks is shown below.

(iii) State **one** waste product formed during aerobic respiration. (1)

lactic acid

Here the learner has incorrectly given the product of anaerobic respiration in their answer. Another incorrect answer seen relatively often was "oxygen" which may be due to learners incorrectly interpreting the question and giving a reactant rather than a product for the process.

There were some learner responses where learners gave two answers to the question. Where these responses were both correct (carbon dioxide and water), the learner was awarded the mark as neither answer would have been incorrect if given individually. However, in some cases learners listed one correct answer and one incorrect answer – for example lactic acid and carbon dioxide. Here list principle has to be applied when awarding marks for the answer and so 0 marks are awarded. Learners should be conscious of where questions may have list principle applied and be encouraged to only give the number of responses required by the question.

Question 7biv

This is the question learners found the most challenging across the paper. Non-responses were relatively common as were responses where learners gave the same response (usually ATP) for all four answer lines. As each answer line is labelled separately, the four answers are marked independently.

An example of a response awarded all 4 marks can be seen below.

(iv) Anaerobic respiration can also release energy within the muscle cells.

Figure 4 shows the process of anaerobic respiration.

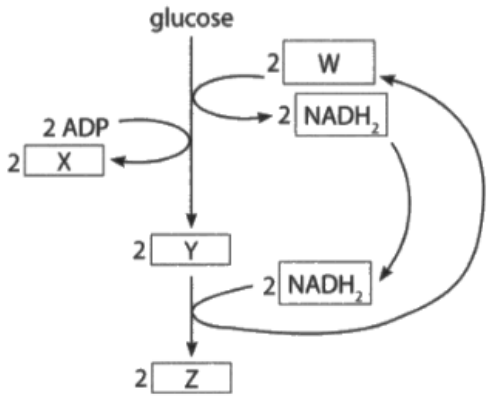


Figure 4

Identify molecules W, X, Y and Z in Figure 4.

(4)

W NAD+

X ATP

Y Pyruvate

Z Lactate

The learner has given the names of Y and Z as pyruvate and lactate rather than pyruvic acid and lactic acid, these are names which are commonly used and so are given credit as alternative correct answers on the mark scheme. It is understood that centres and learners use a wide variety of resources while preparing for this assessment and there is no expectation that learners give names of molecules in any particular form. Likewise, it is always acceptable for learners to use the conventional abbreviations and acronyms for molecules such as the nucleotide bases, ATP, NAD^+ etc.

One example of a response awarded 2 marks can be seen below.

(iv) Anaerobic respiration can also release energy within the muscle cells.

Figure 4 shows the process of anaerobic respiration.

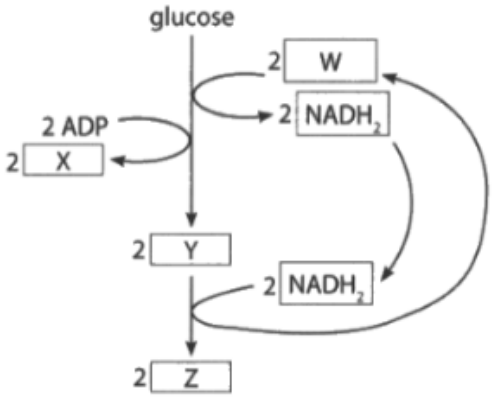


Figure 4

Identify molecules W, X, Y and Z in Figure 4.

(4)

W NAD

X ATP

Y Fructose Biphosphate

Z Pyruvate

Here the learner has been awarded 2 marks for W and X (NAD is an accepted response under the additional guidance in the mark scheme and was the most common format seen in learner responses giving correct answers for W). These were the most common two marking points awarded for this question. The expectation when assessing this topic is usually that learners will be able to recall lactic acid as a final product in anaerobic respiration, even if they did not recall the other stages in the process, but this was rarely seen in the actual responses given.

The learner above has not been given credit for their responses for Y and Z as they are incorrect for the process of anaerobic respiration. It is interesting to note that this combination of answers, fructose bisphosphate for Y and pyruvate for Z, was seen in several responses and may be due to learners recalling the process of glycolysis rather than anaerobic respiration.

An example of a learner response awarded 1 mark for this question can be seen below.

(iv) Anaerobic respiration can also release energy within the muscle cells.

Figure 4 shows the process of anaerobic respiration.

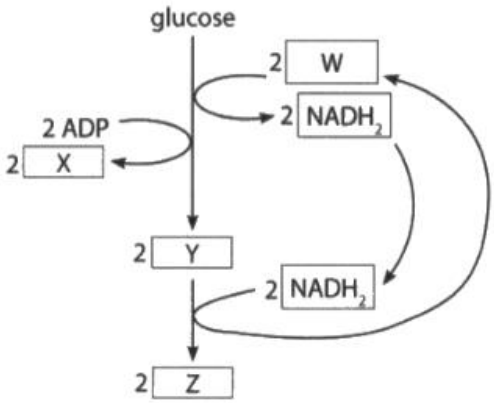


Figure 4

Identify molecules W, X, Y and Z in Figure 4.

(4)

W Oxygen

X ATP

Y Glucose

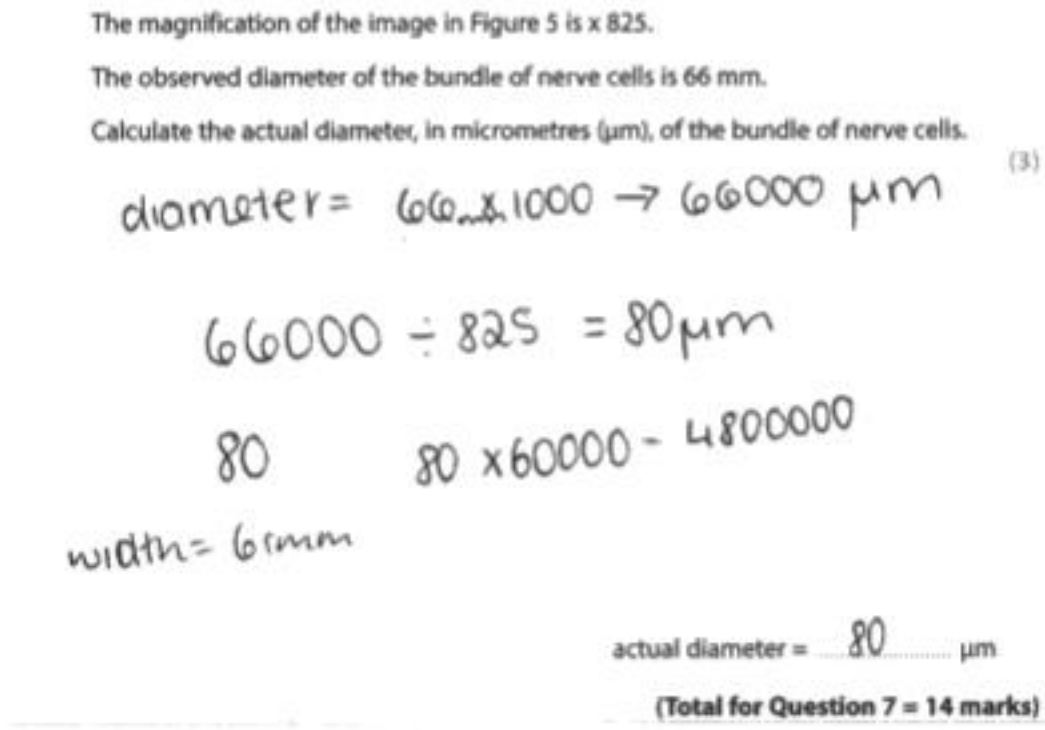
Z carbon dioxide.

Here the learner has recognised the formation of ATP for molecule X but has used other molecules associated with aerobic respiration for the other three responses and so has only been given a total of 1 mark overall.

Question 7c

Learners found this question more challenging than previous questions assessing their use of mathematical skills and in many cases, there were evidence of errors that could have been avoided by sense checking the final answers. In some responses, learners obtained final answers that were of an unrealistic magnitude. This was common in cases of incorrect conversions, where learners divided by 1000 rather than multiplying and in where learners multiplied the measurement for the image by the magnification. Learners should be encouraged to consider whether the answers calculated for this type of question are realistic and use this as a guide when checking their work.

Some learners performed the calculation correctly at all stages. An example of a response scoring all 3 marks can be seen below.



The magnification of the image in Figure 5 is x 825.

The observed diameter of the bundle of nerve cells is 66 mm.

Calculate the actual diameter, in micrometres (μm), of the bundle of nerve cells.

(3)

diameter = 66 x 1000 → 66000 μm

66000 ÷ 825 = 80μm

80 80 x 60000 - 4800000

width = 6mm

actual diameter = 80 μm

(Total for Question 7 = 14 marks)

The learner has started by converting the measurement given in mm and has then performed the calculation. The conversion could be performed either before or after the division step in the calculation and full marks were awarded for a correct final answer irrespective of which method was used.

A common error seen in learner attempts at this question involved an inversion of the division step of the calculation. An example response which was given 2 marks can be seen below.

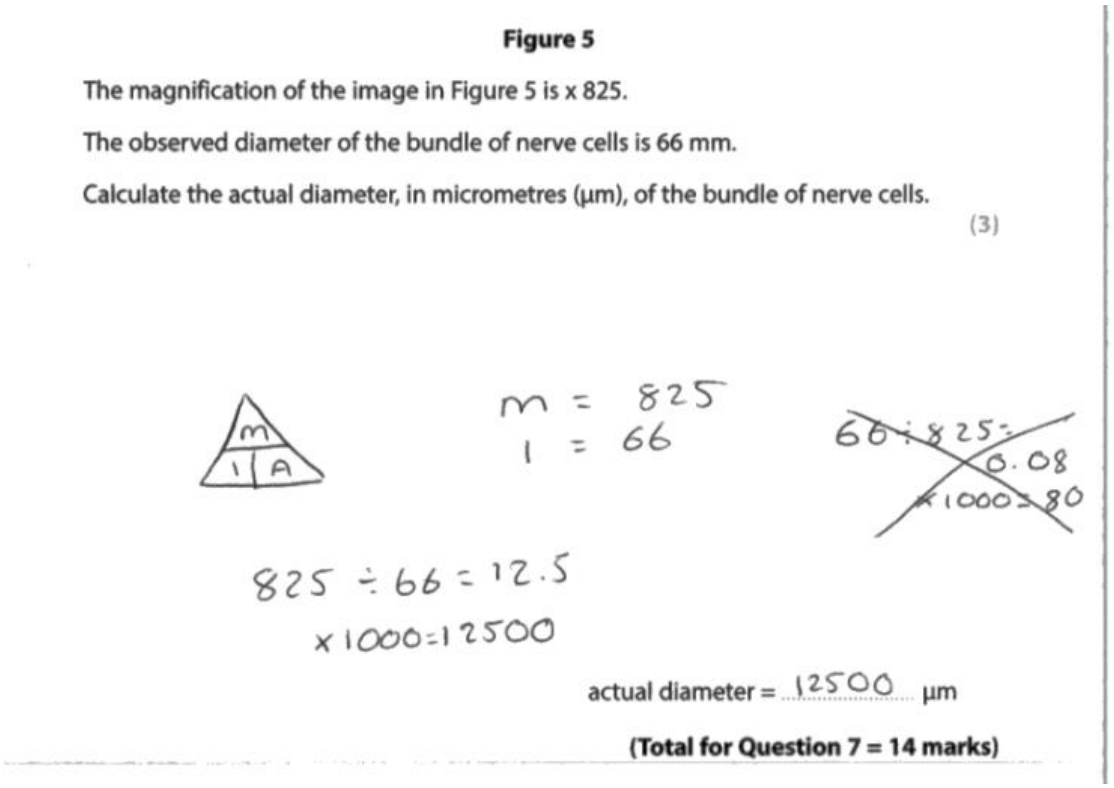


Figure 5

The magnification of the image in Figure 5 is x 825.

The observed diameter of the bundle of nerve cells is 66 mm.

Calculate the actual diameter, in micrometres (µm), of the bundle of nerve cells.

(3)

m
I | A

m = 825
I = 66

66 ÷ 825 = 0.08
× 1000 = 80

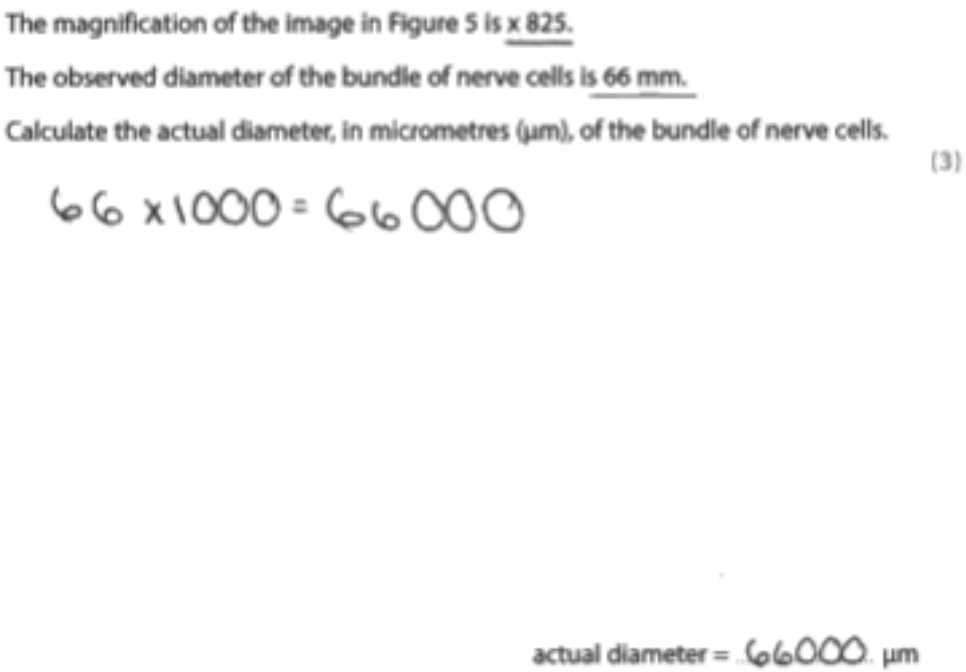
825 ÷ 66 = 12.5
× 1000 = 12500

actual diameter = 12500 µm

(Total for Question 7 = 14 marks)

Here the learner has incorrectly recalled the equation for calculating magnification and so they have not been awarded the first marking point for substitution into the correct equation. However, their evaluation is correct and there is error carried forward applied when marking the subsequent conversion step. Because of this they have been awarded the second and third marking points from the mark scheme for a total of 2 marks.

In some cases, learners did not attempt to perform the magnification calculation, as in the example below which was awarded 1 mark.



The magnification of the image in Figure 5 is x 825.

The observed diameter of the bundle of nerve cells is 66 mm.

Calculate the actual diameter, in micrometres (µm), of the bundle of nerve cells.

(3)

66 x 1000 = 66000

actual diameter = 66000 µm

The marking point for conversion is separate from those for the rest of the calculation as the learners are able to convert their answer at any point in the process. Here the learner has correctly converted the measurement given in mm and has been awarded 1 mark. There is no further attempt at the calculation and so no further marks were awarded.

Conversely, there were several calculations seen where learners did not attempt the conversion step – in these cases the responses could still be awarded the substitution and evaluation marks for correct completion of these stages of the calculation. Learners should be encouraged to always attempt calculations even if they are not comfortable with the skill of converting from one unit to another – the mark given for unit conversion is always independent from the other marking points for the question.

Question 8ai

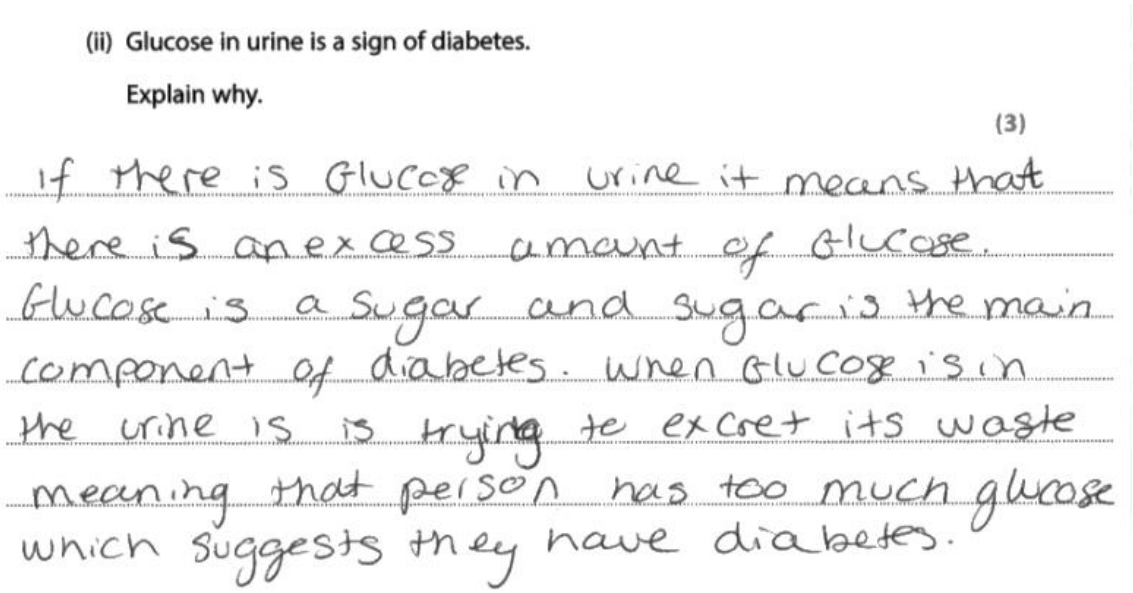
This question was answered correctly by around half of the learners. This is similar to the observations made in Q6. Even though the kidney which is a topic that learners usually find less accessible than the study of the heart, learners appear more confident with questions which focus on anatomy.

Question 8aii

This question was not well answered by learners as would be expected. Typically, learners display a strong understanding of the process of blood glucose regulation both in healthy individuals and those with diabetes. The application of a less standard context in this question created challenge for many learners.

Many responses did make reference to the role of insulin in regulating blood glucose levels and made the link between a lack of insulin and an increased blood glucose level. Some learner responses state that insulin acts to break down glucose in the blood itself which is a significant misconception for this topic.

Many learner responses approached the question from the context of the glucose being treated as "waste" by the body. The following is an example of a learner response awarded 0 marks.



(ii) Glucose in urine is a sign of diabetes.

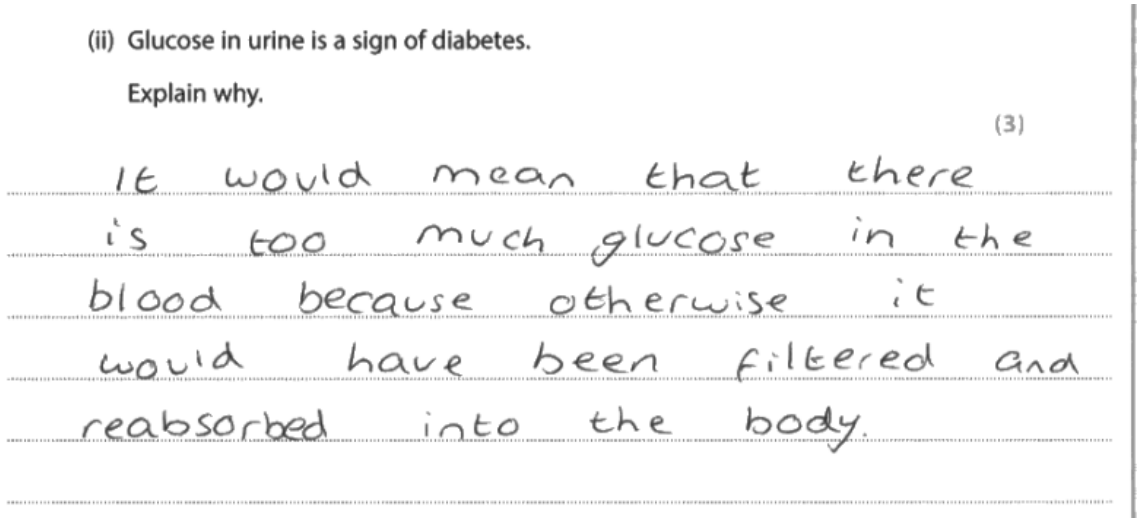
Explain why.

(3)

if there is Glucose in urine it means that there is an excess amount of Glucose. Glucose is a sugar and sugar is the main component of diabetes. when Glucose is in the urine is is trying to excret its waste meaning that person has too much glucose which suggests they have diabetes.

The learner has mentioned there being an excess of glucose, but without the clarification that this glucose is found in the blood, there isn't sufficient detail for this marking point to be awarded. The response then gives the reason for glucose present in the urine as a result of the kidney "trying" to remove the glucose. This is a very common misconception seen among learners – the kidney is incorrectly described as selecting substances to remove from the blood, demonstrating that these learners do not have a clear understanding of ultrafiltration and the purpose of active processes such as selective reabsorption in the nephron.

An example of a learner response given 2 marks can be seen below.



(ii) Glucose in urine is a sign of diabetes.

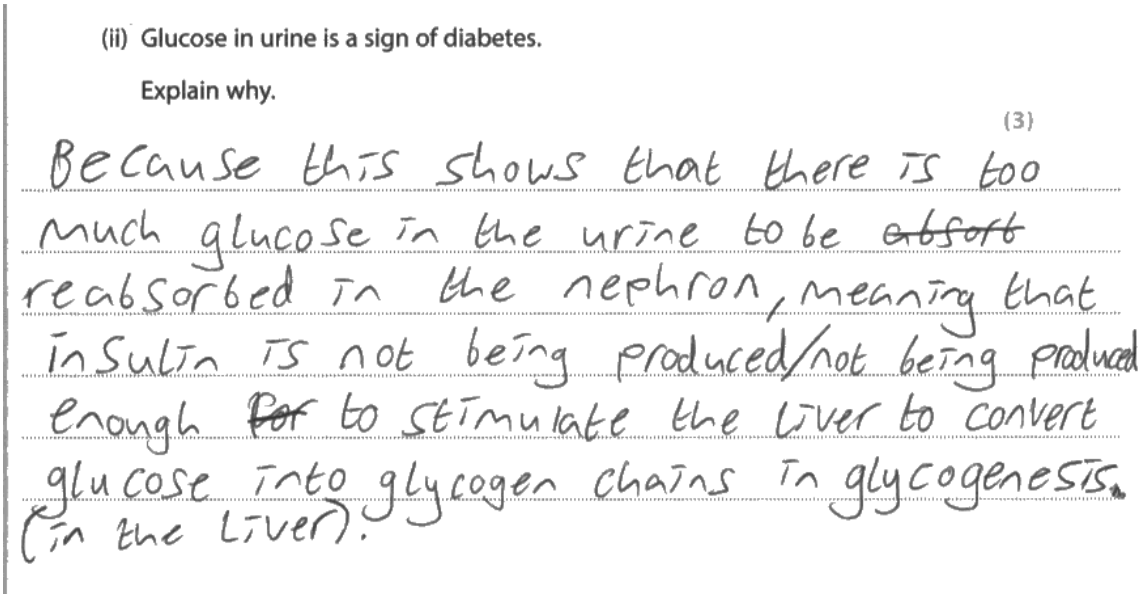
Explain why.

(3)

It would mean that there is too much glucose in the blood because otherwise it would have been filtered and reabsorbed into the body.

Here the learner has identified the high blood glucose level caused by diabetes and has also given an answer referencing that under normal conditions the glucose would be fully reabsorbed – this is just sufficient wording for a second marking point under the additional guidance in the mark scheme that reverse answers are accepted throughout.

An example of a very good learner response awarded all 3 marks can be seen below.



(ii) Glucose in urine is a sign of diabetes.

Explain why.

(3)

Because this shows that there is too much glucose in the urine to be ~~absorb~~ reabsorbed in the nephron, meaning that insulin is not being produced/not being produced enough ~~for~~ to stimulate the liver to convert glucose into glycogen chains in glycogenesis. (in the liver).

Here the learner has correctly identified that glucose in the urine is due to not all of the glucose in the nephron being reabsorbed into the blood. The learner has gone on to make link between a decrease in insulin leading to less conversion of glucose to glycogen.

Question 8aiii

Over half of learners answered this question correctly. Questions on the structure and function of the kidney are often challenging for learners. The number of correct responses seen this series, especially for a question this late in the paper, indicates that learners have a better understanding of this topic.

Question 8b

This question proved to be the more challenging of the two 9-mark extended open response questions, especially as the function of the kidneys is an area of the specification that learners often find more difficult to access.

Level 3 answers were not as common here compared with the previous 9-mark question, although there were some examples of very high quality learner responses seen. An example of a very high-quality learner response given marks from Level 3 is below.

(b) Discuss how the negative feedback mechanism controls the body's water balance.

Your answer should include the role of:

- the brain
- the kidneys.

(9)

The Hypothalamus in the brain detects a low or high water potential in the body.
In the case of low water potential the Hypothalamus stimulates the posterior pituitary gland to release ADH (anti-diretic hormone). This travels to the kidneys where it binds to ADH receptors in the collecting ducts and distal convoluted tubules of the nephrons. This binding activates the enzyme phosphorylase. ~~In the~~ Activated phosphorylase caused vesicles of aquaporin to bind to the collecting ducts and distal convoluted tubule cell membranes. Aquaporin is a specialised protein channel which allows

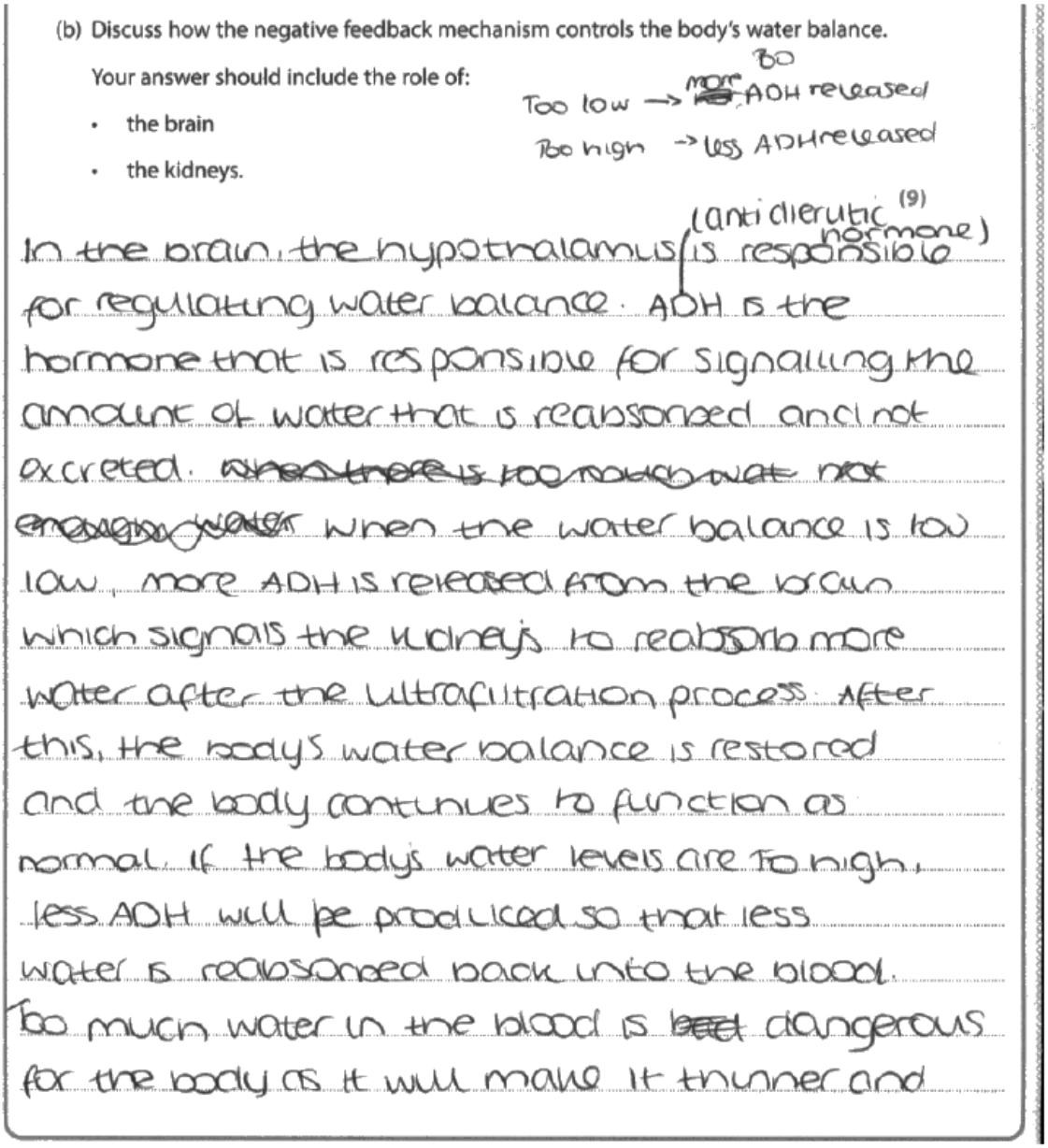
water to diffuse through it, so the aqua pores on the cell membrane surface allow more water from the solution in the nephron to be reabsorbed. once reabsorbed the water is released into the blood stream and taken out of the kidneys.
In the case of high water potential the Hypothalamus ~~dette~~ detects this and stimulates the posterior pituitary gland to stop secreating ADH, meaning that phosphorylase enzyme is not activated, so ~~a~~vesicles of aquaporin don't bind to cell membranes and no additional water is reabsorbed. Then as time goes on the body uses/excreates water and water potential is returned to normal levels.

(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

It should be noted that the above response is an example of one where the learner has given an impressive level of detail, far beyond the scope of what would be expected for a learner to be given marks at Level 3.

An example of another Level 3 answer can be seen below. This is a response that does not contain as much specific detail, but is still gives more than enough evidence to be awarded a mark in the top band.



(b) Discuss how the negative feedback mechanism controls the body's water balance.

Your answer should include the role of:

- the brain
- the kidneys.

Too low → ~~more~~ too ADH released

Too high → less ADH released

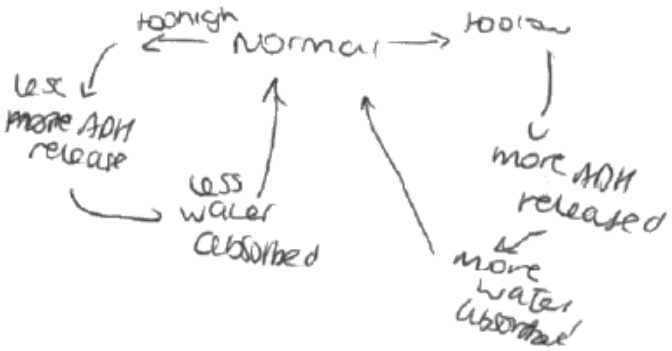
(9)

In the brain, the hypothalamus (anti diuretic hormone) is responsible for regulating water balance. ADH is the hormone that is responsible for signalling the amount of water that is reabsorbed and not excreted. ~~When there is too much water not enough water~~ When the water balance is too low, more ADH is released from the brain which signals the kidneys to reabsorb more water after the ultrafiltration process. After this, the body's water balance is restored and the body continues to function as normal. If the body's water levels are too high, less ADH will be produced so that less water is reabsorbed back into the blood. Too much water in the blood is ~~beet~~ dangerous for the body as it will make it thinner and

less viscous, making it harder to clot and prevent pathogen entry.
The negative feedback loop is effective because the brain can quickly sense how much water is in the body/blood and if it is too much, or not enough. furthermore, even a slight unbalance compared to its usual level can be quickly sensed and rectified before it becomes a significant issue.

(Total for Question 8 = 14 marks)

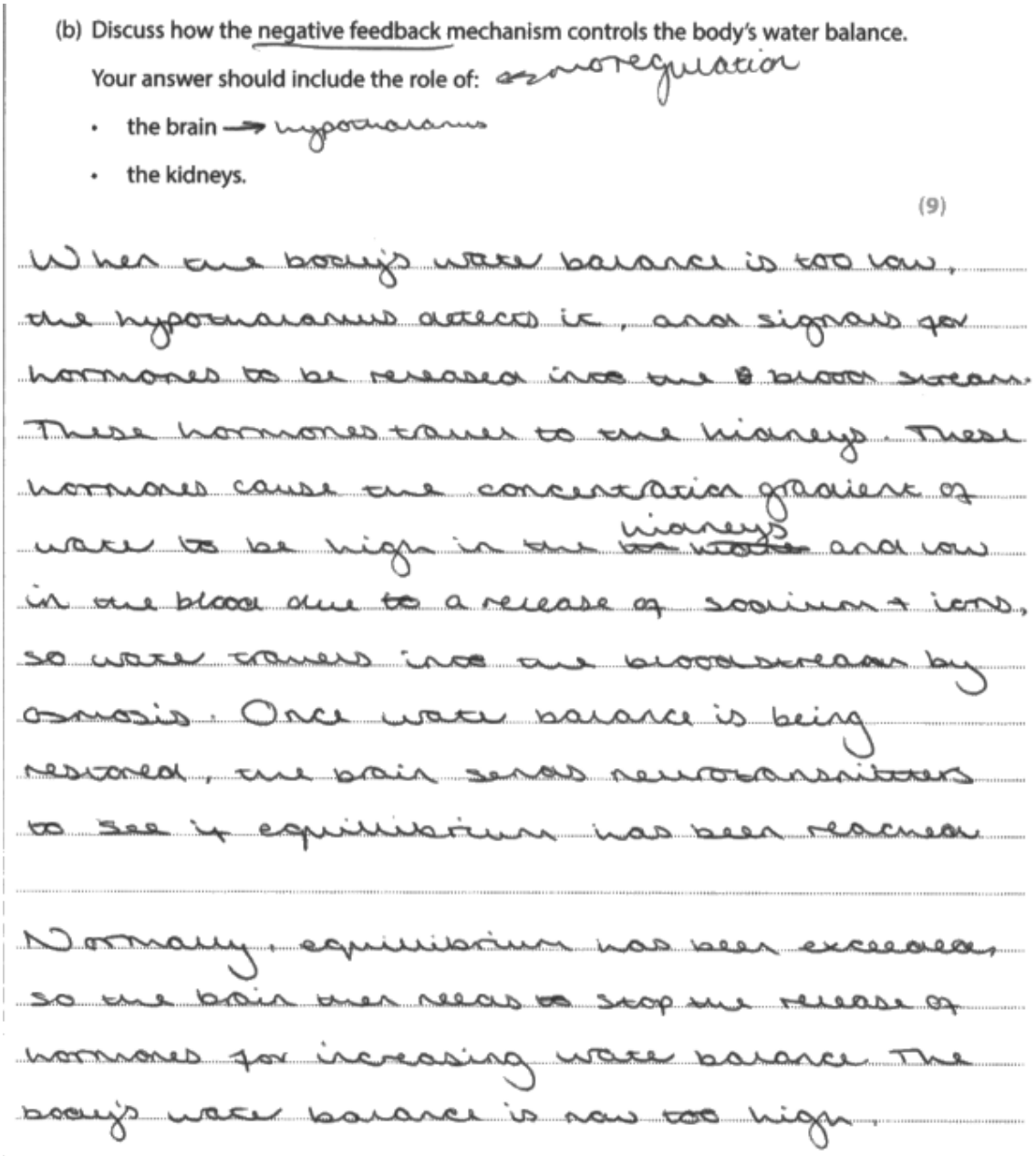
TOTAL FOR PAPER = 80 MARKS



This response is clear and well-structured using straightforward language and correct scientific terminology throughout. The link between the roles of the brain and the kidneys has been clearly made and all points given are relevant to the context of the question. The learner has included a diagram at the end of their response

demonstrating the negative feedback loop that controls the water balance in the body. Here the learner has also described the process within the text of their response, however, had the learner not included this description in their response, the diagram alone would still have been credited for the relevant content shown.

Level 2 answers were more frequently seen for this question than those at Level 3. The following is an example of a learner response awarded marks at Level 2.



(b) Discuss how the negative feedback mechanism controls the body's water balance.

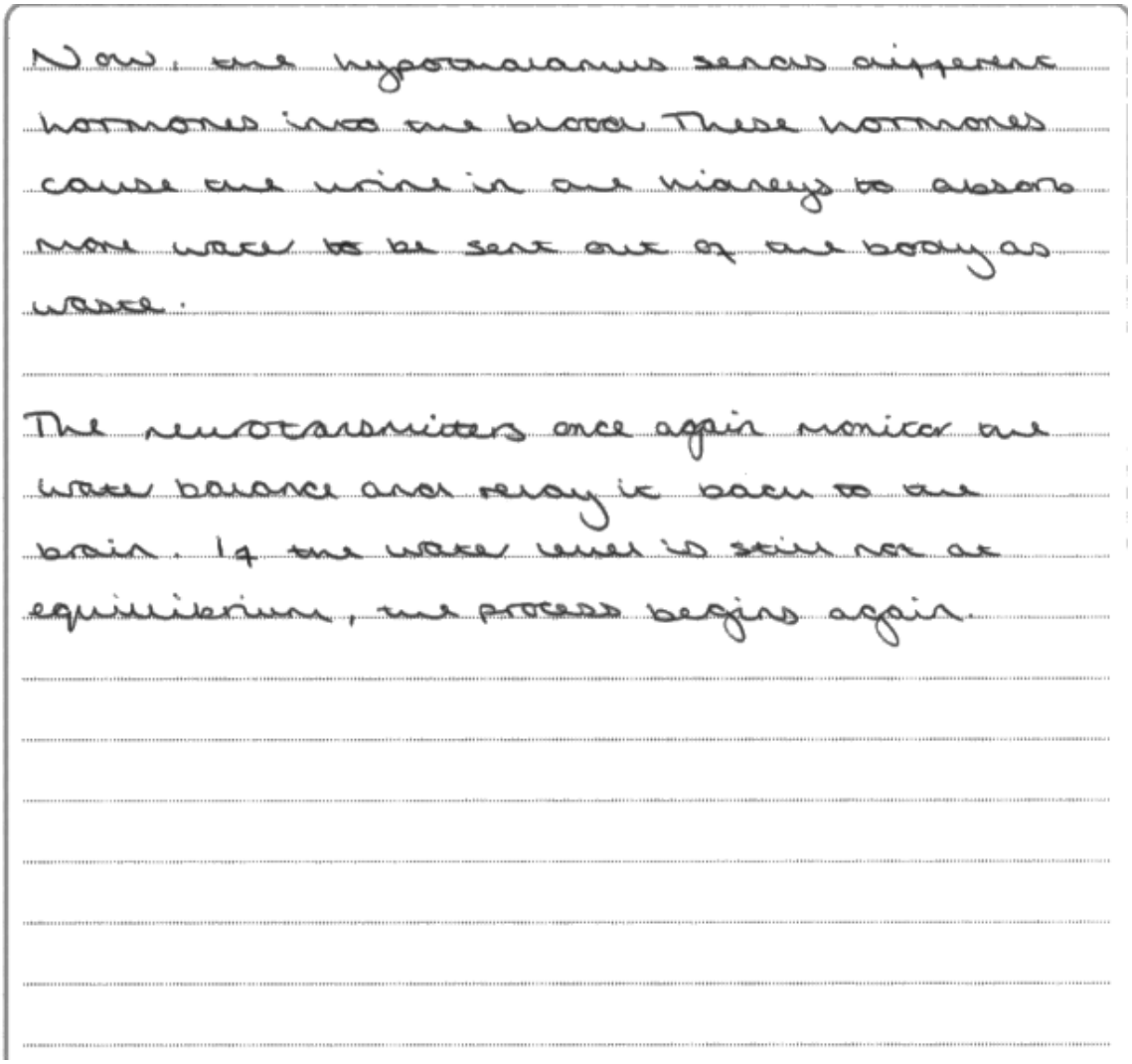
Your answer should include the role of: osmoregulation

- the brain → hypothalamus
- the kidneys.

(9)

When the body's water balance is too low, the hypothalamus detects it, and signals for hormones to be released into the blood stream. These hormones travel to the kidneys. These hormones cause the concentration gradient of water to be high in the ~~kidneys~~ kidneys and low in the blood due to a release of sodium + ions, so water travels into the bloodstream by osmosis. Once water balance is being restored, the brain sends neurotransmitters to see if equilibrium has been reached.

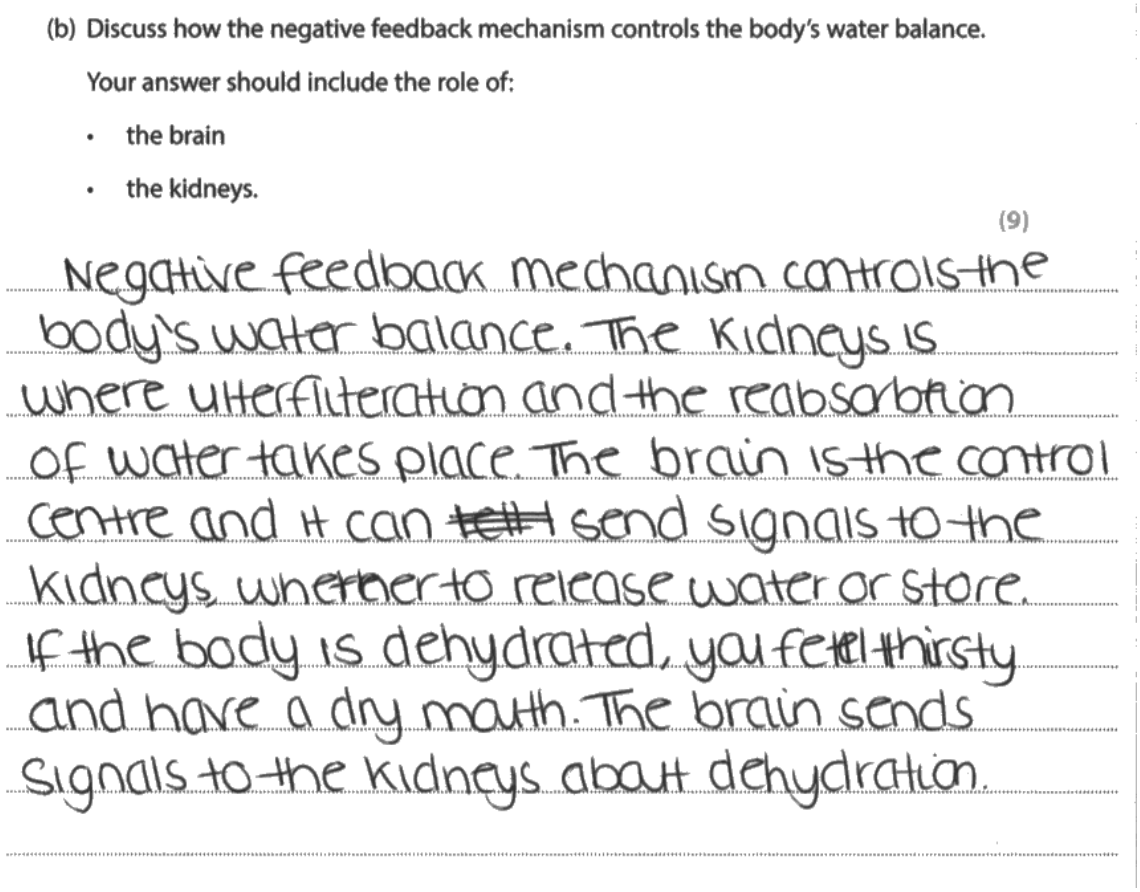
Normally, equilibrium has been exceeded, so the brain then needs to stop the release of hormones for increasing water balance. The body's water balance is now too high.


Now, the hypothalamus senses different hormones in the blood. These hormones cause the kidneys to absorb more water to be sent out of the body as waste.

The neurotransmitters once again monitor the water balance and relay it back to the brain. If the water level is still not at equilibrium, the process begins again.

The learner has used the context given in the question and has clearly expressed the idea of negative feedback. When looking at the level of depth demonstrated in the learner's response, there is not enough detail shown in the knowledge to be given a mark at Level 3.

Level 1 answers, such as the response shown below, were often written in much more generalised terms.



(b) Discuss how the negative feedback mechanism controls the body's water balance.

Your answer should include the role of:

- the brain
- the kidneys.

(9)

Negative feedback mechanism controls the body's water balance. The kidneys is where ulterfiltration and the reabsorbtion of water takes place. The brain is the control centre and it can ~~tell~~ send signals to the kidneys, whether to release water or store. If the body is dehydrated, you feel thirsty and have a dry mouth. The brain sends signals to the kidneys about dehydration.

Many learner responses at Level 1 had the idea of how negative feedback might be applied to the control of water balance within the body. Some Level 1 responses made the link between the kidneys and the level of urine production, but most commonly seen, as in the example above, was the idea that the brain's role in water balance control was to send signals such as thirst. With no further suggestion about the biological mechanisms behind the negative feedback processes, the response above was awarded a mark at Level 1.

Summary

Based on their performance in this paper learners should:

- Ensure that they are engaging with specific wording contained in each question, particularly where a question concerns a process which could be confused with another of a similar name (for example, aerobic and anerobic respiration).
- Take care to consider the context of each question carefully so that they are able to apply their knowledge in the correct way.
- Use key scientific terminology as often as possible when preparing for the examination so that they are comfortable interpreting the terminology found in exam questions and that they are able to accurately use these terms in their written responses.
- Make sure that responses given are not overly general or too vague to gain marks. Where a comparison is needed between two substances or structures, learners should ensure that their answers are clear, and they should make sure that there is no confusion between the two in their response by avoiding ambiguous phrasing e.g. “one has a bigger surface area”
- Where a question calls for an explanation, ensure that there is a clear line of cause and effect throughout their response.
- Focus on understanding how the processes learned as part of the unit support normal function of body systems – particularly those involved in the immune response. It is important that, as well as recalling these processes, learners are able to understand what effects there are on the body when normal function is not maintained.