Pearson Edexcel

INTERNATIONAL GCSE

Human Biology (9-1)

EXEMPLARS WITH EXAMINER COMMENTARIES

PAPER 2

Pearson Edexcel International GCSE in Human Biology (4HB1)

Contents

Introduction

1.1 About this booklet

This booklet has been produced to support teachers delivering the Pearson Edexcel International GCSE in Human Biology specification. The Paper 2 exemplar materials will enable teachers to guide their students in the application of knowledge and skills required to successfully complete this course. The booklet looks at questions from the June 2019 examination series, showing real candidate responses to questions and how examiners have applied the mark schemes to demonstrate how student responses should be marked.

1.2 How to use this booklet

Each example covered in this booklet contains:

- Question
- Mark scheme
- Exemplar responses for the selected question
- Example of the marker grading decision based on the mark scheme, accompanied by examiner commentary including the rationale for the decision and where relevant, guidance on how the answer can be improved to earn more marks.

The examples highlight the achievement of the assessment objectives at lower to higher levels of candidate responses.

Centres should use this content to support their internal assessment of students and incorporate examination skills into the delivery of the specification.

1.3 Further support

A range of materials are available from the Pearson qualifications website to support you in planning and delivering this specification.

Centres may find it beneficial to review this document in conjunction with teaching and learning materials and the Examiner's report.

Question 1(a)(iii)

(iii) Explain why this type of tooth is more likely to decay than other types of teeth.

Mark scheme

(iii)	Any three from: • contains ridges/crevices; • larger surface area/more in contact with food; • food trapped; • provides nutrients for bacteria/reference to bacteria digesting/using food/producing acid; • more difficult to clean/reference to location in mouth (making tooth more difficult to reach);	Reject cusp	Max 3

Exemplar response A

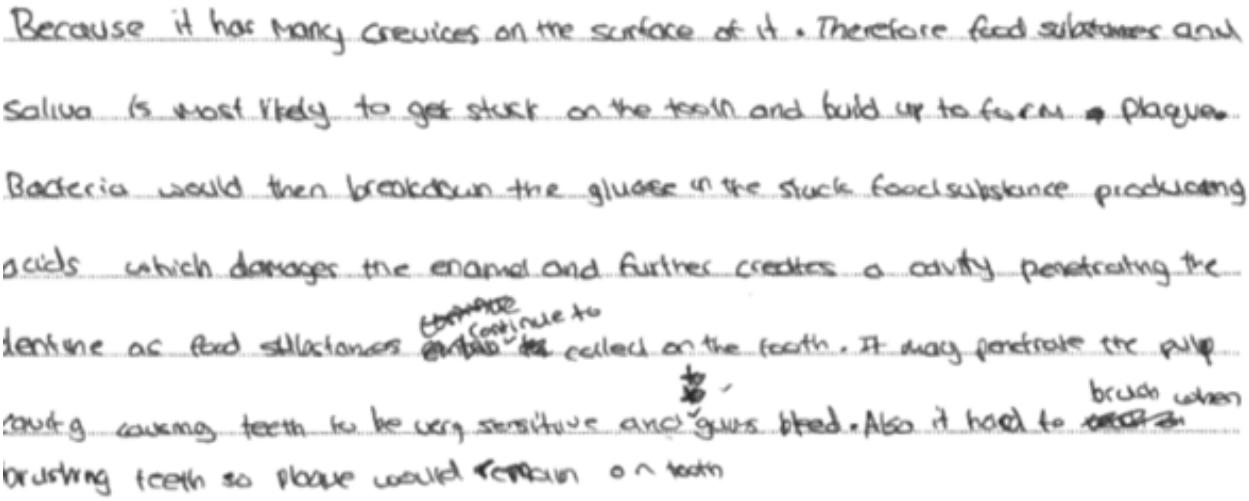
Sugar and acid in food cause tooth decay. This type of tooth comes into contact with food more as this tooth is used to break down food. The enamel will be broken down more causing decay.

Examiner's comments:

This response was given 1 mark.

This student has tried to explain why this type of tooth is more at risk of tooth decay although the details given are vague and do not provide the explanation expected to gain more than the one mark awarded. Much of the response is given to describing the cause of tooth decay (sugar and the breakdown of enamel) rather than an explanation of why this particular tooth is likely to decay more than others. This response gained one mark for identifying that the tooth is more likely to come into contact with food, which fulfils the second marking point in the mark scheme.

Exemplar response B



Examiner's comments:

This response was given 3 marks.

This is a clear 3-mark response which has covered all marking points in the answer. Use of the term 'crevices' gains one mark but many candidates preferred to use the term 'cusp', which was incorrect and failed to gain credit. Although the response has stated that 'saliva... get stuck on the tooth', which would have been insufficient on its own to gain marks, it has also mentioned that food will get stuck on the tooth – enough for marking point 2.

The details about saliva in this case were ignored as no incorrect science has been implicated in this part of the response. The response goes on to refer to bacteria breaking down the glucose (in trapped food) for a third marking point - the maximum number of marks awarded for this question - although if the student had failed to gain full marks thus far, then marking point 5 is covered in the details given in the last two lines of the response. These details clearly state that the teeth referred to in the question are harder to brush, which was acceptable for 'more difficult to clean'.

Question 1(b)(ii)

(ii) Suggest a reason for the change in the percentage of children with tooth decay over the 30 year period.

(1)

Mark scheme

(ii)	clean/brush/floss teeth (more regularly / properly)/(more/regular) visits to dentist/ reference to fluoride in toothpaste/drinking water/less sugary foods in diet;	Allow better dental hygiene	1

Exemplar response A

(1)

Technology has developed over the past 30 years as well as education and training therefore dentist have better equipment and training to deal with tooth decay

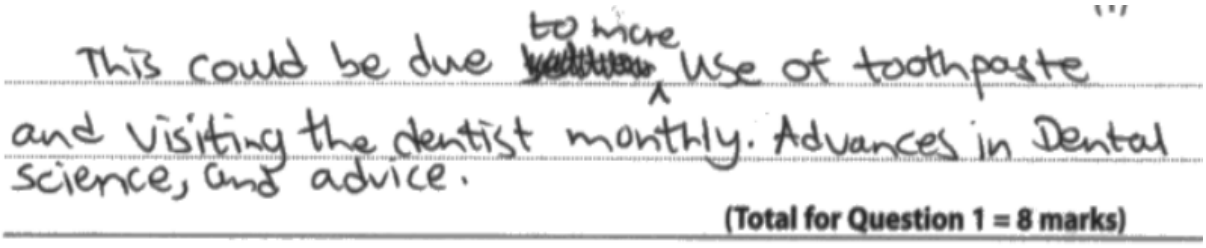
(Total for Question 1 = 8 marks)

Examiner's comments:

This response was given 0 marks.

This response was too vague to be awarded any mark - like others which included details relating to 'better technology' or 'improvements in dental care' or 'better educated in caring for teeth' without any further information. This candidate unfortunately provided a similar response and has indicated an advancement in technology without clarifying what was meant by this. If the response had stated that the development of technology has led to an understanding of the importance of fluoride in dental care/hygiene or drinking water, this would have gained a mark. The response also mentions 'better equipment and training', which again is vague and without clarification a mark could not be awarded.

Exemplar response B



Examiner's comments:

This response was given 1 mark.

The most common correct answer for this question included details about using toothpaste containing fluoride closely followed by more regular brushing although some students covered other aspects of the marking criteria.
In this case, the response has correctly stated that more regular visits to the dentist would lead to a decrease in tooth decay. Further details were given regarding advancements in dental science, which alone would have failed to gain credit and many candidates, unfortunately, provided similar details as their only answer.
Very few students included information about flossing or reducing the amount of sugar in foods consumed, implying that they were less aware of these as a cause of tooth decay.

Question 3(d)

(d) The table shows an incomplete risk assessment for the Biuret test.

Complete the table by describing how to reduce the risk of each hazard.

(2)

Mark scheme

(d)

Hazard	Reducing risk		
Broken glass - cuts	Clear up breakages using a dustpan and brush/keep equipment away from edge of tables;	Ignore wear gloves	1
Biuret reagent - irritant	Wear goggles/wash hands after use/don't use if skin is sensitive;	Ignore wear gloves	1

Exemplar response A

Hazard	Reducing risk
stools – trip hazard	keep stools under bench
broken glass – cuts	use a pair of tongs to handle test tubes
Biuret reagent – irritant	wear gloves and labcoats

Examiner's comments:

This response was given 0 marks.

Few responses gained full marks in this question, implying a significant lack of awareness of how to reduce and deal with hazards in laboratory practice.
It appeared that there was an element of guesswork in many responses where students preferred to go with what could be assumed to be the easy option: 'wear gloves', which unfortunately is not always the best choice. However, there was a great deal of responses that did opt for this measure as a way to reduce the risk of each hazard given in the table. It was surprisingly common to see 'use of tongs' in responses which referred to reducing the risk of cuts from broken glass and similarly the use of lab coats in reducing the risk of irritation from Biuret reagent. This response needs to consider how handling a test tube with tongs might reduce the risks of cuts from glass that is already broken and how a lab coat might protect a person from irritation caused by chemicals. Many responses repeated information in each of the boxes, mostly 'wear gloves', although few answers included 'wearing goggles' in the second box alongside 'wear gloves'. In these cases, benefit of the doubt was given and the use of gloves was ignored.

Exemplar response B

Hazard	Reducing risk
stools – trip hazard	keep stools under bench
broken glass – cuts	clean up - keep people away. (dust pan and brush)
Biuret reagent – irritant	keep in container - stored away. - wear gloves and goggles

Examiner's comments:

This response was given 2 marks.

This response has covered two marking points by providing correct details related to reducing the risk of both cuts from broken glass and irritation by Biuret reagent. Although alternatives to both answers have been provided, these were deemed insignificant and did not undermine the accuracy of the science given. In some instances, alternative answers could negate a correct answer if the list rule was applied and alternatives were incorrect although in this case there was no significant scientific error in the responses given. 'Wearing gloves' on its own would not have been awarded a mark but with the additional details added ('wear goggles'), this response was worthy of full marks.

Question 4(b)

(b) State the meaning of the term pathogens (line 7).

Mark scheme

(b)	a microorganism/named microorganism that causes disease;		1

Exemplar response A

An organism that causes disease in the organism infects.

Examiner's comments:

This response was given 0 marks.

This response was typical of significant number of responses to this question. It failed to distinguish between organisms and microorganisms. Although this response is correct in stating that it causes disease in the organisms that it infects, it fails to identify the 'organism' as a microorganism (or a named example) that causes the disease. In this case, the term 'organism' was rejected as this could imply any living creature, such as mosquitoes that are carriers of a pathogen, rather than the actual organism itself that causes disease.

Exemplar response B

(1)

A microorganism that causes disease

Examiner's comments:

This response was given 1 mark.

Use of the term 'microorganism' or similar i.e. 'bacteria', 'virus' or 'fungi' was a significant determinate in deciding whether responses gained or did not gain credit. Too many responses failed to give this term, preferring to use 'organism', implying a general lack of understanding of what a pathogen actually is. This response gave succinct details which met the expectations required for this question.

Question 6(a)(iii)

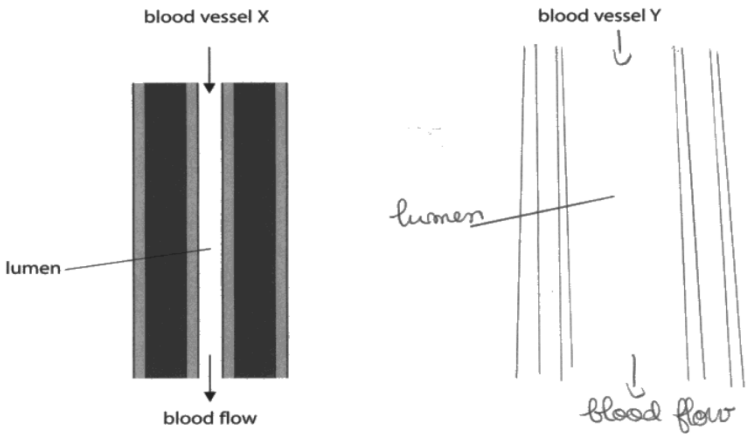
(iii) The diagram shows a longitudinal section through blood vessel X.

Draw a diagram to show a longitudinal section through blood vessel Y.

Mark scheme

(iii)	• wider lumen; • thinner walls; • valves; 	Ignore arrows Accept valves drawn either way round	1 1 1

Exemplar response A



Examiner's comments:

This response was given 2 marks.

The response was typical of many where 3 marks were not obtained due to the omission of valves in the diagram drawn. This response, like many, provided details in the subsequent question of vessel X containing valves but still failed to include them in the diagram drawn. The width of the vessel walls was only marginally less than that of the artery given in the question and, again, this was common in responses. Consequently, benefit of the doubt was given for this marking point for some responses, but not all.

Exemplar response B

Examiner's comments:

This response was given 3 marks.

This response has provided three clear marking points in the diagram drawn. The walls of the vessel are significantly thinner, the lumen wider and the addition of valves gains the final marking point. Like most diagrams, students drew arrows to indicate the direction of blood flow although this was not requested in the question. It should be noted that extra information given in answers could negate correct information given and students should be advised to provide details that only meet the expectations of the question.

Question 6(a)(iv)

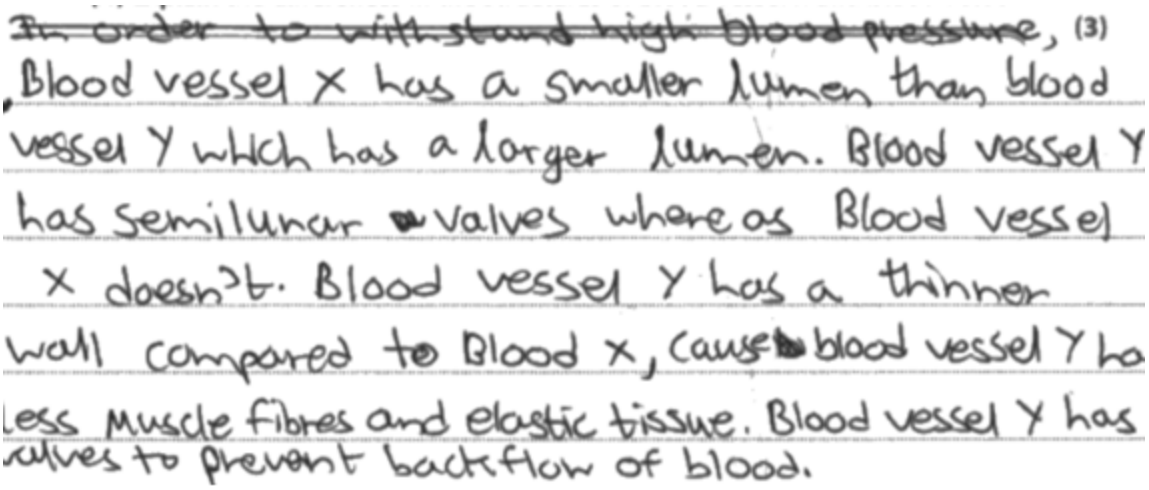
(iv) Explain the differences in the structures of blood vessel X and blood vessel Y.

(3)

Mark scheme

(iv)	Any three from: (Blood vessel X) • thicker walls/more muscle/elastic fibres in walls to maintain blood flow to maintain/withstand high (blood) pressure; • thinner lumen to maintain high blood pressure; OR (Blood vessel Y) - • less muscle/elastic tissue in walls so slower blood flow; • wider lumen so carries blood at lower pressure; • contains valves to prevent backflow;		Max 3

Exemplar response A

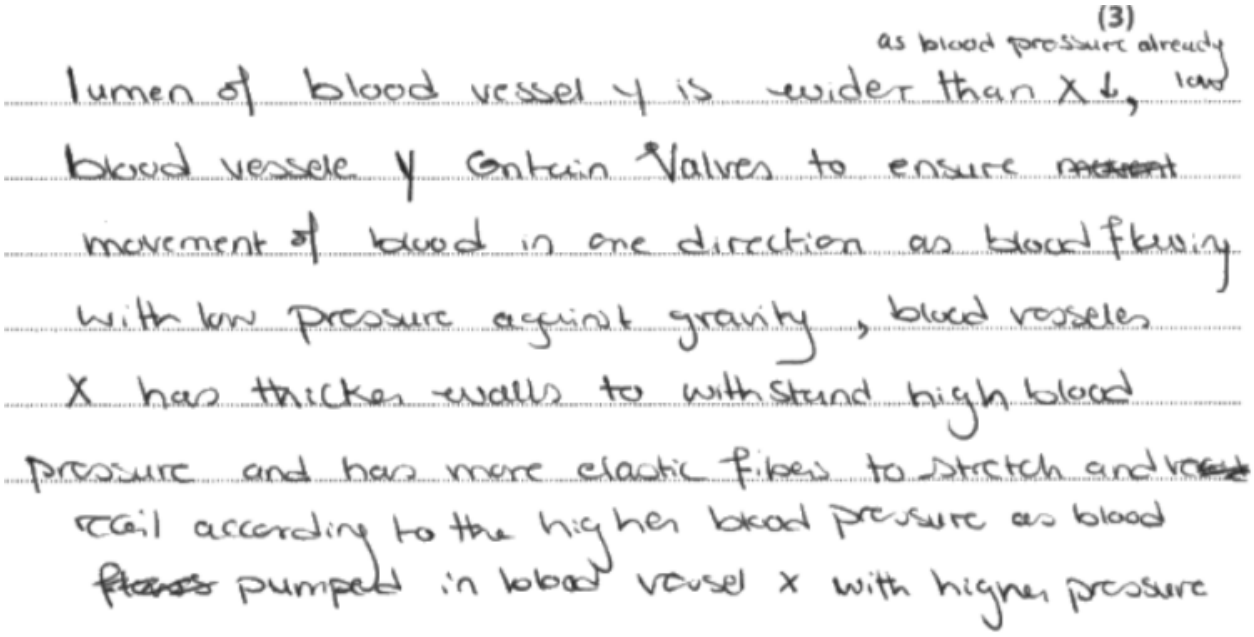

~~In order to withstand high blood pressure~~, (3)
Blood vessel X has a smaller lumen than blood vessel Y which has a larger lumen. Blood vessel Y has semilunar valves whereas Blood vessel X doesn't. Blood vessel Y has a thinner wall compared to Blood X, cause blood vessel Y ha less muscle fibres and elastic tissue. Blood vessel Y has valves to prevent backflow of blood.

Examiner's comments:

This response was given 1 mark.

This response was typical of a significant number of answers that failed to 'explain' the differences in structure of the two vessels. Although it identifies structural differences between the two vessels and these are written clearly, it does not include an explanation of why there are structural differences, which is what was asked by the question. This response, like most that gained one mark, explained the presence of valves in vessel Y for one mark although the reasons for lumen diameter and quantity of muscle fibres/elastic tissue was omitted. This has limited the total score achieved.

Exemplar response B


(3)
as blood pressure already low
lumen of blood vessel Y is wider than X ↓,
blood vessels Y contain valves to ensure
movement of blood in one direction as blood flowing
with low pressure against gravity, blood vessels
X has thicker walls to withstand high blood
pressure and has more elastic fibres to stretch and recoil according to the higher blood pressure as blood pumped in blood vessel X with higher pressure

Examiner's comments:

This response was given 3 marks.

Few responses managed to give an explanation like that shown in this response. It has named a feature of a vessel and given an explanation on why this feature is present in one vessel and not the other. For example, the response states clearly that blood vessel Y contains valves and goes on to explain the purpose of these, i.e. to prevent backflow. Despite this being the most common correct answer in all responses seen, this particular response continues to add that vessel Y carries blood at lower pressure and identifies the thicker walls in vessel Y along with a correct explanation for these. This is a clear, three-mark response that provides more than just a list of contrasting structures.

Question 6(b)

(b) Explain two adaptations of capillaries that increase the rate of diffusion of substances into body tissues.

(4)

Mark scheme

(b)	Any four from: • thin wall/wall one cell thick; • contains pores; • shorter diffusion pathway; • narrow lumen; • only one (blood) cell/few (blood) cells at a time can pass through;		Max 4

Exemplar response A

1 The are only one cell thick so there is a short diffusion distance meaning a fast rate of diffusion.

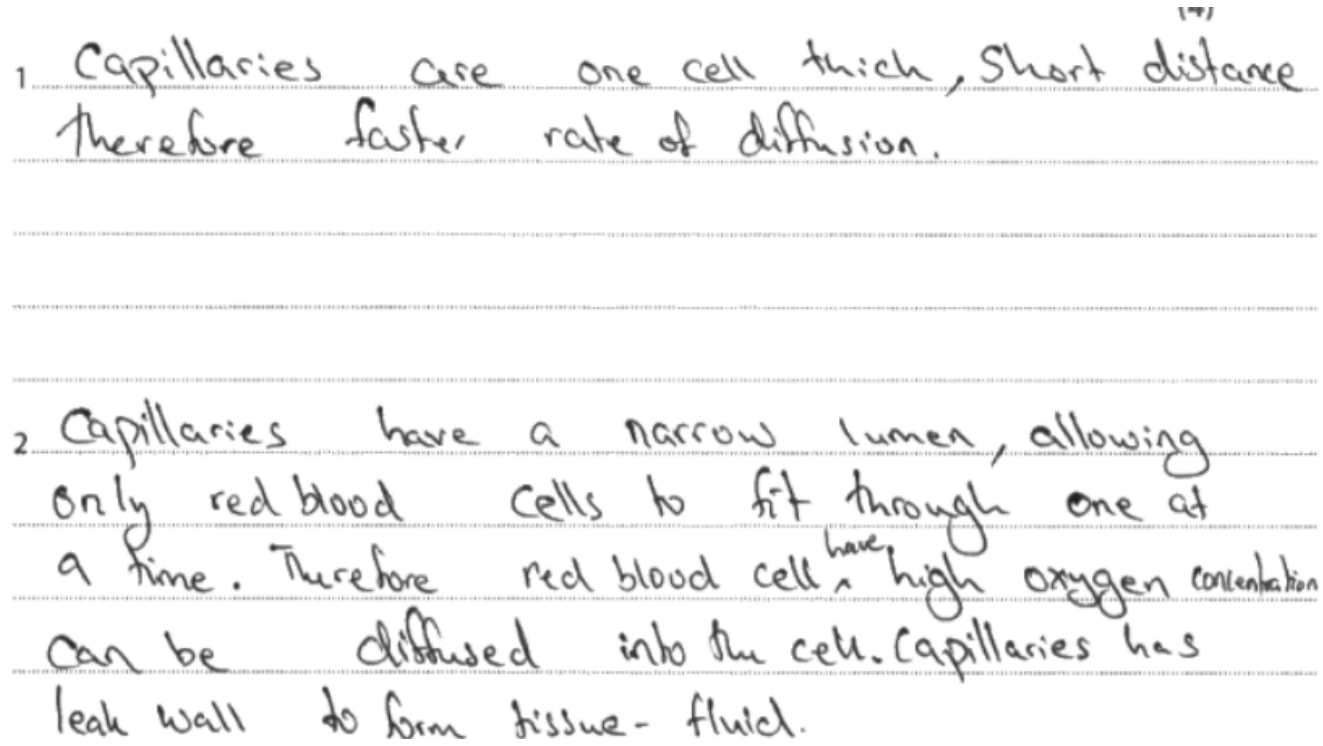
2 The blood is constantely moving so it maintains to concentration gradrent.

Examiner's comments:

This response was given 1 mark.

This response gained one mark for understanding that there is a short diffusion distance (between the capillaries and body cells). This detail was seen often in one-mark responses although it did appear that candidates were not fully aware of the science behind the information that they provided.
No mark was obtained for stating that the capillary was 'one cell thick'. This, again, was a very frequent error made by candidates who failed to elaborate by stating that it was the wall of the capillary, rather than the capillary itself, that was one cell thick.
Many candidates repeated information given in the question in their answer: 'fast rate of diffusion' or similar was quoted often but failed to gain any credit. The second part of this response failed to meet any point of the marking criteria and was not awarded any marks.

Exemplar response B



Examiner's comments:

This response was given 2 marks.

Had this response stated that the *walls* of the capillary are one cell thick, then it would have obtained a further mark. In addition to this, the omission of the term 'diffusion' in the second sentence has also cost a mark – it cannot be assumed that this is what the candidate intended to write.

The detail and wording of the second paragraph, however, is much clearer and two clear marks were awarded here. Firstly, the response states that capillaries have a narrow lumen - covering marking point 4, and that this only allows one blood cell at a time to pass, which covers marking point 5 of the mark scheme. The information given about a 'leaky wall' is not an acceptable alternative to marking point 2 (contains pores) and was, therefore, not awarded.

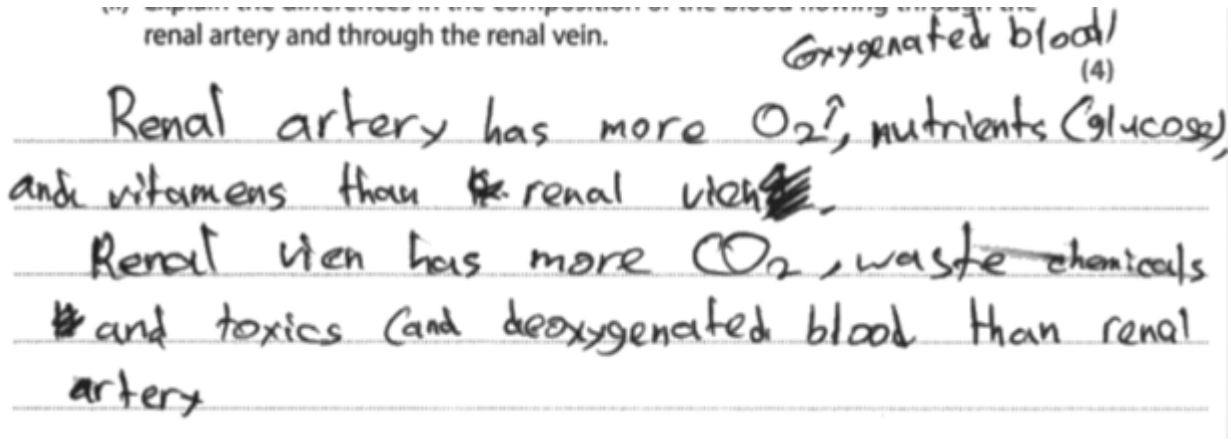
Question 8(a)(ii)

(ii) Explain the differences in the composition of the blood flowing through the renal artery and through the renal vein.

Mark scheme

(ii)	Any four from: • lower concentration of glucose/oxygen in blood in renal vein; • used in respiration; • less/no urea in renal vein; • urea excreted in urine; • more carbon dioxide in renal vein; • carbon dioxide produced in respiration;	Allow reverse argument throughout	Max 4

Exemplar response A


renal artery and through the renal vein.

Oxygenated blood

(4)

Renal artery has more O_2?, nutrients (glucose) and vitamens than renal vein.

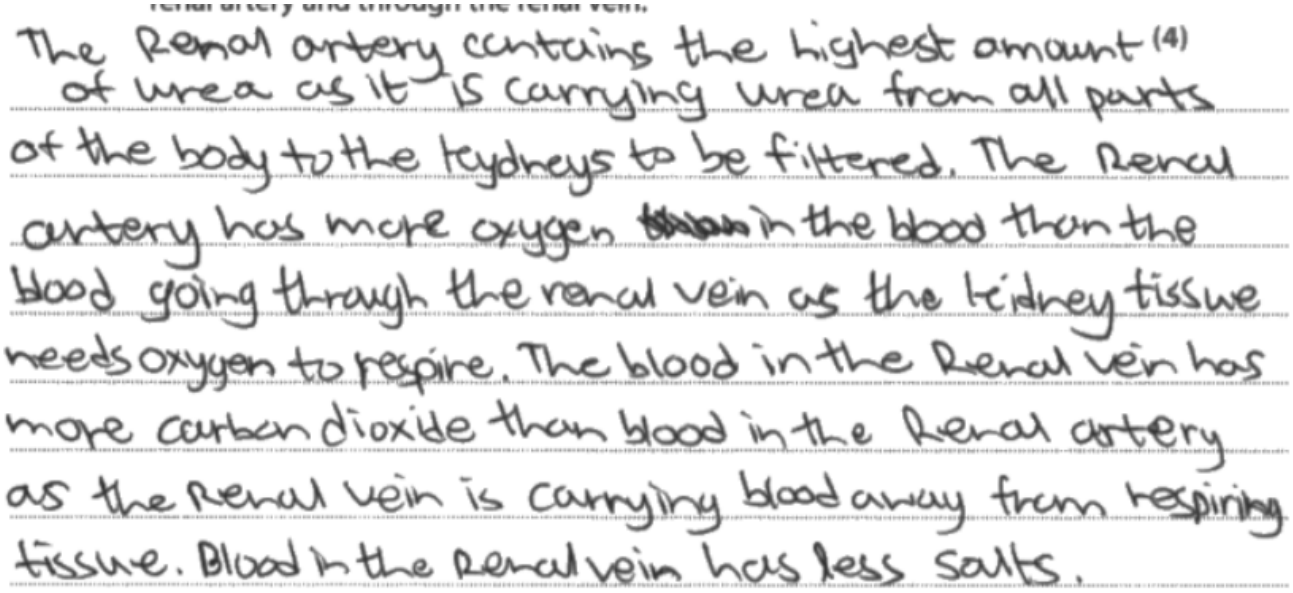
Renal vein has more CO_2, waste chemicals and toxics (and deoxygenated blood than renal artery

Examiner's comments:

This response was given 2 marks.

This response covered marking points 1 and 5 but failed to give any explanation for the two points made. The answer correctly states that the renal artery contains more oxygen for the first mark. The mention of more glucose would have gained a mark if oxygen had not been given, although this is the same marking point.
The response fails to explain why the artery has more oxygenated blood and does not state why the vein contains blood with less oxygen. Consequently, the second marking point was not awarded.
The fifth marking point was awarded for an understanding that the renal vein carried more carbon dioxide. Again, there is no explanation for this, so the response failed to gain marking point 6.
It was common to see explanations omitted from responses despite, like this response, most candidates listing differences in the composition of the blood in the two vessels. This was interesting as most were clearly able to determine differences so why they were unable to explain them was surprising.

Exemplar response B



The Renal artery contains the highest amount of urea as it is carrying urea from all parts of the body to the kidneys to be filtered. (4) The Renal artery has more oxygen in the blood than the blood going through the renal vein as the kidney tissue needs oxygen to respire. The blood in the Renal vein has more carbon dioxide than blood in the Renal artery as the Renal vein is carrying blood away from respiring tissue. Blood in the Renal vein has less salts.

Examiner's comments:

This response was given 4 marks.

This was a very clearly written, four-mark answer where a full list of differences in the composition of the blood in the two vessels as well as an explanation for each were given.
The response has compared the amount of urea for marking point 3 and has given the reverse argument for marking point 4 by stating that it is being carried to the kidneys for filtration. It links the amount of oxygen in the artery to respiring tissues – again a correct statement with an explanation which provides the reverse argument for marking point 2.
At this point, the response already gains full marks but it continues to provide correct details by stating that the vein contains more carbon dioxide as a result of respiration. These final comments would have gained two marks if full marks had not already been awarded. It is a good answer.

Question 9(a)(ii)

(ii) Explain how a blood clot in the coronary artery increases the risk of a heart attack.

(3)

Mark scheme

(ii)	• reduced blood flow to heart/cardiac muscle / tissue/cells; • less oxygen/glucose delivered; • less (aerobic) respiration/energy released (by cardiac tissue);		3

Exemplar response A

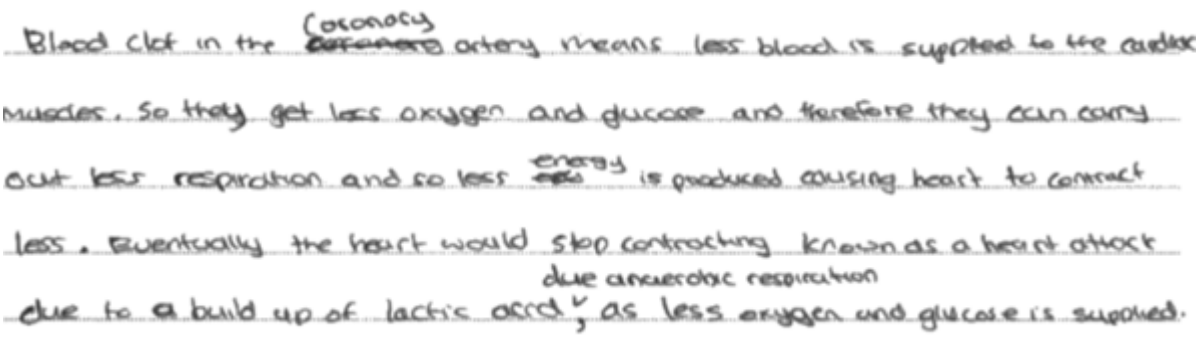
Blood flow will get difficult because of the clot. That would mean that oxygen transported to the cardiac muscle will not reach on time. This could lead to a decrease in the efficiency of the heart working and eventually cause a heart attack as the blood would try to push against the clot at a higher pressure.

Examiner's comments:

This response was given 1 mark.

One mark was awarded to this response for providing details that implied an understanding that less oxygen would be delivered to cardiac muscle. There were many answers that failed to state cardiac *muscle* and were, therefore, not awarded this marking point.
The remainder of the response fails to give details that correctly link the lack of oxygen to any further creditable detail, such as less respiration or energy.
Overall this answer lacked coherent sentence structure in some places and benefit of the doubt to award a generous mark.

Exemplar response B



Examiner's comments:

This response was given 3 marks.

This is an exemplary answer that covers all marking points for full marks.
The response clearly linked the presence of a clot in the artery to the consequences on the working of the heart.
The first mark was awarded for the details given in the first sentence, covering marking point 1. This response has given information in this sentence that a vast number of responses tended to omit – that blood flow to the heart/cardiac *muscle* is reduced.
The second sentence describes the effect of less blood flow and clearly covers marking point 2 where it states that less oxygen and glucose would be delivered. It is quite clear in this instance that the response is implying 'to the cardiac muscle' in the mention of less oxygen and glucose as it refers back to the previous sentence in the response.
The third marking point is gained for a correct reference to less respiration and the response has also concluded that there would be less energy as a result of this. However, it is unlikely that, had full marks not already been gained, the reference to energy would have gained the final mark as it states that energy is *produced* rather than *released* or another adequate alternative. The information given related to anaerobic respiration was ignored in this case.

Question 9(c)

Aspirin is an inhibitor of enzyme X.

Explain how the inhibition of enzyme X reduces the formation of blood clots.

Mark scheme

(c)	Any four from: • aspirin binds to enzyme/aspirin competes (with substrate) for active site; • active site of enzyme changed/blocked; • less/no substrate binds (to enzyme); • reaction involving release of chemicals reduced/stopped; • platelets do not stick together;		Max 4

Exemplar response A

(4)

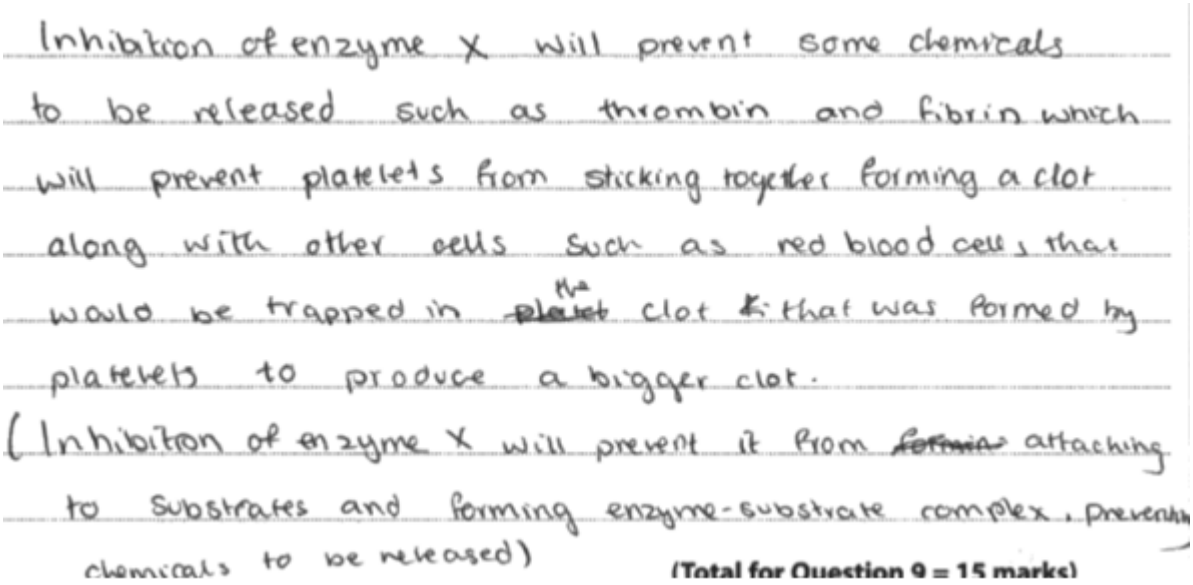
If enzyme X is not in blood. Chemicals are not released. This means platelets ~~can't~~ cannot stick together forming a clot. Blood flows normally. ~~platelets~~

Examiner's comments:

This response was given 2 marks.

This response was typical of many two-mark responses where the diagram was used directly to provide an answer without providing any further explanation to gain the final two marks. The last two marking points have been covered in this answer, both of which were common responses but there is no indication that the candidate understands how the action of an inhibitor affects enzyme activity and the consequences of this in this context.

Exemplar response B



Inhibition of enzyme X will prevent some chemicals to be released such as thrombin and fibrin which will prevent platelets from sticking together forming a clot along with other cells such as red blood cells that would be trapped in ~~the platelet~~ the clot that was formed by platelets to produce a bigger clot.

(Inhibiton of enzyme X will prevent it from ~~forming~~ attaching to substrates and forming enzyme-substrate complex, preventing chemicals to be released)

(Total for Question 9 = 15 marks)

Examiner's comments:

This response was given 3 marks.

The first two marks gained by this answer was for covering the last two marking points on the mark scheme, which many responses were able to achieve.
This response states that less chemicals will be released and therefore platelets would not stick together. The information given in brackets implies that the candidate knows more about enzyme inhibition than they have actually written and it is unfortunate that a mark has been lost for its vagueness.
A third mark has been awarded for including details that cover marking point 3 where the response has stated that the enzyme is prevented from binding to its substrate. If the information provided had been extended to explain why this binding would not occur, then a further mark - most likely covering marking point 2 - could have been obtained.

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