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Examiners' Report
June 2016

GCE Biology 8BN0 01

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Introduction

The paper was the first of the new specification and tested the knowledge, understanding and application of material from the topics 'Lifestyle, health and risk' and 'Genes and health'. The range of questions provided ample opportunity for candidates to demonstrate their grasp of these topics.

The paper appears to have worked well with nearly all questions achieving the full spread of marks. Very few questions were left blank and there was no evidence in the majority of papers that candidates had insufficient time to complete the paper. For example, nearly all candidates wrote lengthy answers to the last question on the paper.

It was evident that some areas of the specification are better understood than others. The application of knowledge regarding transcription and translation, protein structure and mutations proved more challenging, catching out some who had learnt a particular stock answer and were not able to apply their knowledge to the given scenario and information.

A significant issue for some candidates on the paper was not reading the question carefully and, in particular, not taking careful note of the command words in the questions. For example, an 'explain' question often had answers which just described and a 'compare and contrast' question often had just a description answer instead of a comparative answer.

It was pleasing to see such large numbers of excellent responses which were clear and comprehensive, answered the question asked and showed a good use of technical terms and application of relevant biological knowledge.

Question 1 (a)

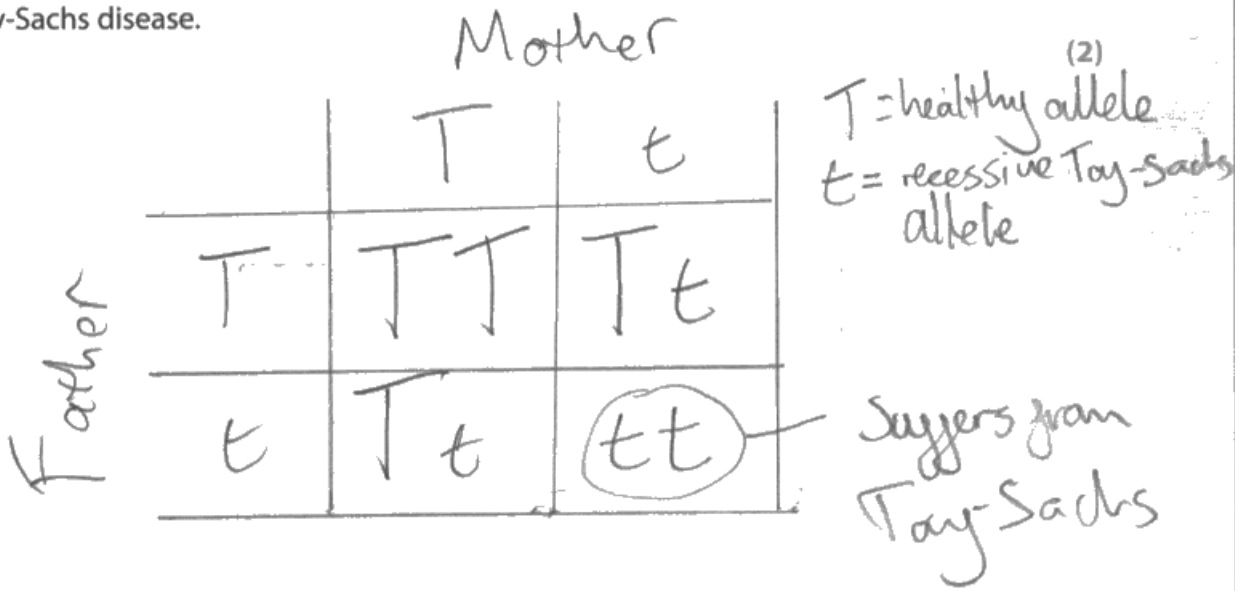
This question was generally answered very well, with nearly all candidates correctly determining the parent's genotype from the information given in the question. The majority of candidates drew a genetic diagram to show the correct offspring genotypes, enabling them to give the correct answer. A minority of candidates did not draw a correct genetic diagram and therefore lost a mark.

1 Tay-Sachs disease is a genetic disorder.

(a) A couple without Tay-Sachs disease are expecting their second child. Their first child died from the disease.

Use a genetic diagram to determine the probability of their second child having Tay-Sachs disease.

(2)



Answer 25%

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Examiner Comments

This response has clearly identified the parental genotypes and carried out the genetic cross correctly using a Punnett square to show the genotypes of the offspring to gain the first mark. They have gone on to give the correct answer and gained the second mark.

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Examiner Tip

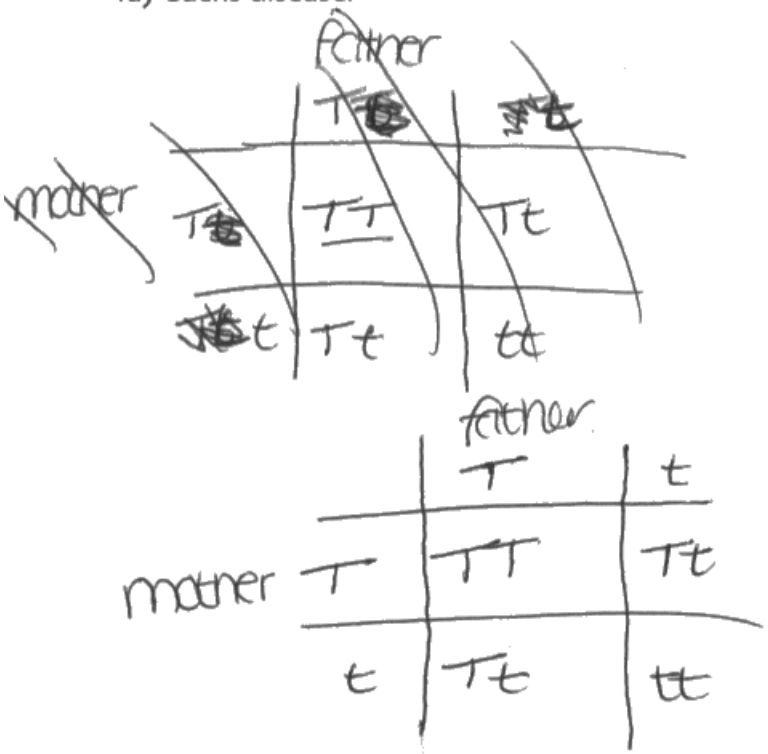
To demonstrate that you understand genetic crosses it is always good practice to fully label everything.

1 Tay-Sachs disease is a genetic disorder.

(a) A couple without Tay-Sachs disease are expecting their second child. Their first child died from the disease.

Use a genetic diagram to determine the probability of their second child having Tay-Sachs disease.

(2)



TT - homozygous dominant
Tt heterozygous
tt - homozygous recessive
↳ has the genetic disorder.

Answer 0.75

ResultsPlus
Examiner Comments

This is an example of a response where the candidate has correctly drawn a genetic diagram showing the parental and offspring genotypes to gain one mark. However, they have given an incorrect probability even though it is clear they knew that a homozygous recessive child would have the disorder.

ResultsPlus
Examiner Tip

It is good practice to state the phenotypes of the offspring.

Question 1 (b)

This was a straight-forward question but it was disappointingly answered by a significant number of candidates. Some did not pick up on the information about 11 weeks in the stem of the question and gave the incorrect answer of amniocentesis. Other candidates did not gain the mark due to incorrect spelling.

(b) Tay-Sachs disease can be detected during pregnancy.

Name the prenatal test that could be used to detect Tay-Sachs disease at 11 weeks of pregnancy.

(1)

Chorionic Villus Sampling (CVS)

ResultsPlus
Examiner Comments
This is an example of a correct response.

Name the prenatal test that could be used to detect Tay-Sachs disease at 11 weeks of pregnancy.

(1)

Amniocentesis

ResultsPlus
Examiner Comments
This is an example of an incorrect response.

(

Chronic Villus Sampling

ResultsPlus
Examiner Comments
This is an example of where a candidate has lost the mark due to incorrect spelling.

ResultsPlus
Examiner Tip
Be careful when spelling scientific terminology.

Question 1 (c)

This question gained a full range of marks, with nearly 60% scoring 2 or 3 marks.

Almost all candidates recognised that this test would increase the risk of miscarriage. A pleasing majority of candidates were able to explain that the test was not always accurate and false positives or false negatives could occur. However, fewer candidates were able to explain that the inaccuracy of a false positive could lead to the termination of a healthy foetus.

A significant number of candidates recognised that there were ethical reasons involved, but often referred to society as a whole and not to the parents and could not be awarded the final marking point as a result.

This response scores 3 marks.

(c) Explain why this couple may choose not to have this test.

(3)

Amniocentes involves a 1-2% chance of miscarriage and this is a risk as the fetus can die. Also amniocentesis may produce false positives or false negatives, this could lead to a healthy fetus being aborted. The couple may decide that there are alternative tests which are better such as chorionic villus sampling, which has a lower risk associated to it and results are available faster

ResultsPlus
Examiner Comments

This response gained marking point two as an error carried forward. They also successfully linked inaccuracies of a false positive to a healthy foetus being aborted to gain marking points one and three.

(c) Explain why this couple may choose not to have this test.

(3)

Chronic villa sampling runs a higher risk of miscarrage (1-2%) than than an amiotic fluid test which carrys a less risk. This risk comes from a needle ~~the~~ being inserted into the vagina and taking a ~~taken~~ sample of cells from the baby of the chronic villa. This test does not show a full range of gentic disorders which could be Present.

ResultsPlus
Examiner Comments

This response scores the most common marking point - that the test increased the risk of miscarriage.

(c) Explain why this couple may choose not to have this test.

(3)

They may choose not to have it as it can increase the risk of miscarriage by 1-2%. Also they may choose to abord if they know it has Tay-Sachs and may not want to have to make that decision. It's an invasive form of prenatal testing. The beating of having needle up vagina & through abdomen may put the woman off. They may believe its better not to know incase the results are a false positive or negative or rare so they do not need to stress over it.

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Examiner Comments

This response is an example of where the candidate has gained the last marking point in addition to the first two marking points.

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Examiner Tip

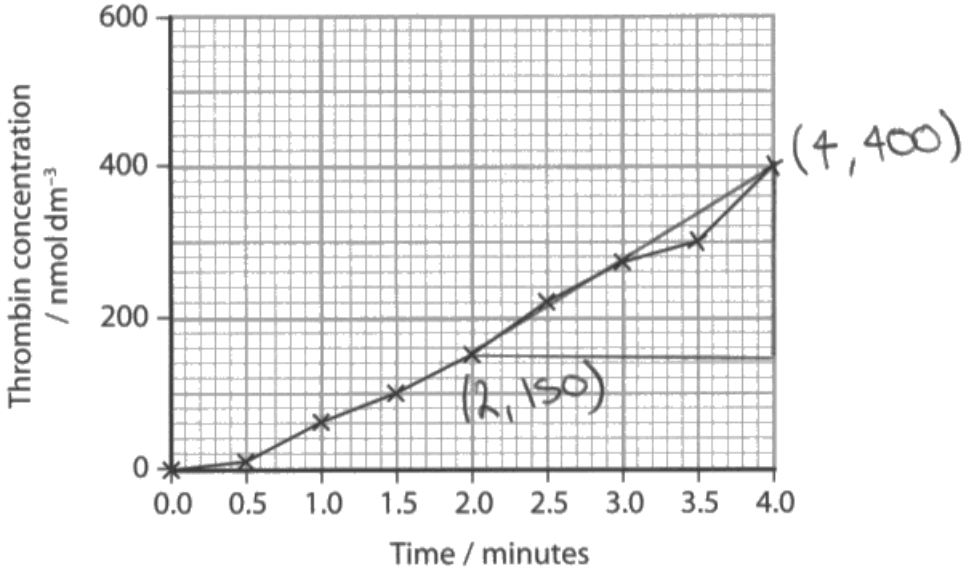
When writing about ethical issues it is important to have the right context and be specific in your answer.

Question 2 (a) (i)

This was a relatively straight-forward question requiring candidates to extract two numbers from the graph and use them to calculate a rate. A significant number gave an answer which was a rate per 2 minutes. It was disappointing to see that a large number of candidates either did not state a unit or did not give a correct unit.

(a) The effect of CVX on the rate of thrombin production was investigated.

The graph shows the concentration of thrombin in a sample of blood treated with CVX.



(i) Calculate the rate of thrombin production during the last two minutes of this investigation.

(2)

(4, 400)
(2, 150)
x y

$m = \frac{\Delta y}{\Delta x} = \frac{400 - 150}{4 - 2} = \frac{250}{2} = 125$

Answer 125 nmol dm^{-3} min^{-1}

ResultsPlus
Examiner Comments

This is an example of a response which scores full marks. The candidate extracts the correct data from the graph. They perform the correct calculation to get the answer of 125. They also adapt the units from the graph to write the correct unit.

(i) Calculate the rate of thrombin production during the last two minutes of this investigation.

(2)

400 - 150 = 250 / 2 = 125nmol per second

Answer 125

ResultsPlus
Examiner Comments

This is an example of an answer which gain 1 mark for the correct answer but does not give the correct unit. Therefore the second mark is not awarded.

ResultsPlus
Examiner Tip

If the answer line does not give a unit then it is always a good idea to write the correct unit next to your answer.

(i) Calculate the rate of thrombin production during the last two minutes of this investigation.

(2)

400 - 150 = 250 $\frac{250}{2}$ = 125

Answer 125moldm^{-3}/min

ResultsPlus
Examiner Comments

This is an example of an answer where the candidate gives a unit in addition to the correct answer. However, they do not give the correct unit as they have written 'mol' instead of 'nmol'. Hence they score only 1 mark.

ResultsPlus
Examiner Tip

Always make sure you copy information correctly.

Question 2 (a) (ii)

This question highlighted that many candidates are confused between a control and a controlled variable. Many candidates described ways that variables such as temperature should be controlled instead of understanding that in order to see if CVX had any effect on thrombin production they needed to compare the results with blood that had not been treated with CVX.

(ii) State and justify a suitable control for this investigation.

(2)

There must be the same concentration of CVX used as it may affect rate of reaction (repeats)
Temperature must be kept constant as it may act like a catalyst for the reaction.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate has confused control with controlled variables.

Volume of blood sample
Different amounts of thrombin will be in different volumes of blood.
More thrombin will be in a larger sample.

ResultsPlus
Examiner Comments

This is not a suitable control and therefore scores 0 marks.

(ii) State and justify a suitable control for this investigation.

(2)

You could test the thrombin concentration of a sample of blood which has not been treated with any convulxin. This would allow you to compare thrombin concentration fairly as you could just see the effects of the Convulxin.

ResultsPlus
Examiner Comments

This response correctly identifies a suitable control for this investigation and explains that it would provide a comparison

Question 2 (b)

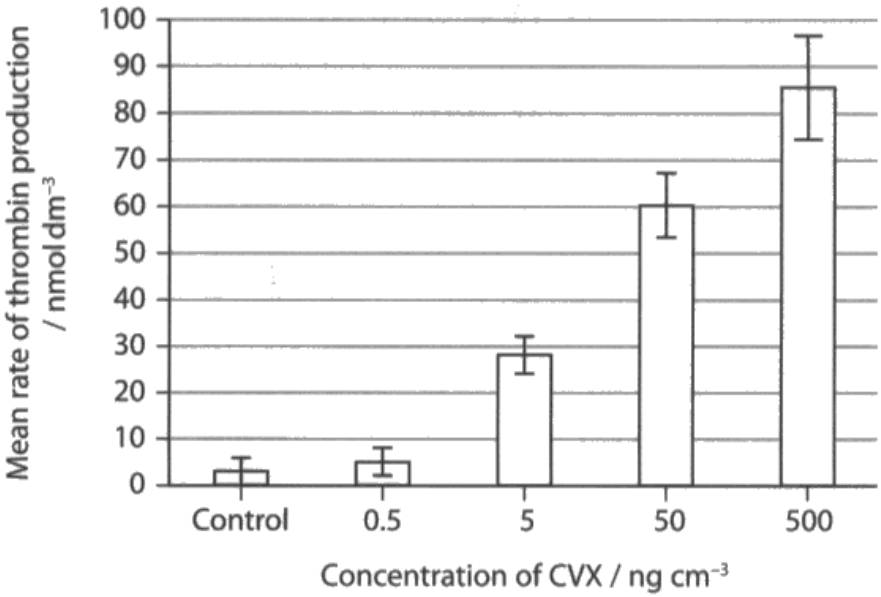
This question required candidates to analyse the data provided in order to write an answer which linked the data about thrombin production to the effect on blood clotting in the stem of the question.

Nearly all candidates were able to identify that there was increased thrombin production as CVX concentration increases and therefore gained the first mark. However, not many candidates were able to link this to increased fibrin production or increased blood clotting and therefore did not gain the fifth or sixth marking point.

A large number of candidates were able to identify that there was no significant difference between the control and 0.5ng cm-3 as the error bars overlapped.

(b) The effect of four different concentrations of CVX on thrombin production was investigated.

The graph shows the results of this investigation, with bars showing the standard deviation.



Analyse the data to assess the effect of CVX on the rate of blood clotting.

(5)

The data shows that as concentration of CVX increases, the mean rate of thrombin production increases. As thrombin is a part of the clotting cascade and forms a mesh which then traps cells to make a blood clot, this would suggest that CVX increases the rate of blood clotting. A concentration of 0·5 has very little effect compared to the control, as the mean is about 5 compared to 3 in the control, and as the standard deviations overlap it shows that there is no real difference. However, as the concentrations increase after 0·5, there is more of an effect, and none of the ~~d~~ standard deviations overlap, so there is a real difference. Once the thrombin is being produced very rapidly, the rate of blood clotting would be much higher.

ResultsPlus
Examiner Comments

This response identifies the effect of increasing the concentration of CVX on the rate of thrombin production and successfully links this to the effect on rate of blood clotting and therefore gains the first and last marking points.

They also identify that there was little difference between the control and 0.5 ng cm-3 and state that the SD bars are overlapping.

Therefore this response scores 4 marks.

Analyse the data to assess the effect of CVX on the rate of blood clotting.

(5)

the graph shows that as the concentration of CVX increases, so does the production of thrombin, meaning the rate of blood clotting increases. ~~Small amounts~~ At low concentrations of CVX, such as 0.5 ng cm^{-3}, have little affect on thrombin production. 0.5 ng cm^{-3} only increased thrombin production by about 2 nmol dm^{-3}, than the same control. A concentration of 5 ng cm^{3} shows an increase in thrombin production, meaning the rate of blood clotting increases as thrombin converts fibrinogen into fibrin. When the concentration of CVX is 500 ng cm^{-3}, this increases the rate of thrombin production around 3.4 times as much as 5 ng cm^{-3}. As the concentrations increases, so does the standard deviation. This shows that 500 ng cm^{-3}, potentially caused a the rate of thrombin production to be about 96 nmol dm^{-3}. Overall, the data shows that an increased concentration of CVX increases the rate of blood clotting

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Examiner Comments

This response clearly links the data to the effect of CVX on the rate of blood clotting. They gain the first and last marking points in the first sentence, followed by the third marking point in the next sentence.

This candidate is nearly awarded the fifth marking point but does not state that more fibrin would be produced or that fibrin would be produced more quickly.

This response gains 3 marks.

Analyse the data to assess the effect of CVX on the rate of blood clotting.

(5)

The higher the concentration of CVX
The higher the rate of thrombin production.
In all concentrations of CVX it increa
ses the production of thrombin.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate links increased CVX concentrations to increased thrombin production. They are not able to make the link between the rate of thrombin production and the rate of blood clotting to answer the question more fully.

ResultsPlus
Examiner Tip

Read your answer and check if it fully answers the question asked.

Question 2 (c)

This question required candidates to apply their knowledge and understanding of mutations and protein structure to this situation of blood clotting.

Most candidates recognised that the active site of the enzyme would change, but were not always specific in their use of language to explain why this would cause problems in the formation of enzyme-substrate complexes. Only a minority of candidates were able to link this reduction in enzyme-substrate formation to a specific effect on the blood clotting cascade.

It was surprising that fewer candidates were able to relate a different amino acid sequence to having different R groups in different places or then extend this to explain the effect this would have on the secondary and tertiary structure of the protein.

This response scores zero marks.

(c) Haemophilia is a disease that affects blood clotting. People with haemophilia are sometimes given a protein called factor VIII. Factor VIII is an enzyme that is involved in the process of blood clotting.

Explain how a change in the primary structure of factor VIII could cause difficulties with blood clotting.

(4)

A change in the primary structure of factor VIII may cause difficulties with blood clotting because the shape of the enzyme may be changed due to a change in the order of the base sequence which will cause the hydrogen bonds to form in different places and therefore change the shape of the enzyme. A change in the shape means that the enzyme will no longer be able to fit into the active site of the substrate molecule which means that the blood will not be able to clot.

ResultsPlus
Examiner Comments

This is an example of the most common reason why candidates did not gain the third marking point.

ResultsPlus
Examiner Tip

Be specific about the terminology you use to answer questions.

(c) Haemophilia is a disease that affects blood clotting. People with haemophilia are sometimes given a protein called factor VIII. Factor VIII is an enzyme that is involved in the process of blood clotting.

Explain how a change in the primary structure of factor VIII could cause difficulties with blood clotting.

(4)

changes in the primary structure of factor VIII could cause difficulties with blood clotting because the protein can't be as effective as it should be due to the change, which will cause more difficulties with blood clotting.

ResultsPlus

Examiner Comments

This is an example of a response where the candidate has not applied their knowledge and understanding to explain why there would be difficulties with blood clotting.

If there is a change in the primary structure of DNA such as a change in temperature or ph - this would lead to a different sequence of amino acids. A code of amino acids codes for a particular protein and if this code is disrupted / altered a different protein all together may be formed or the structue may be affected. This is because hydrogen bonding & disulphide bridges, hydrophobic / hydrophilic interactions would occur differently changing its secondary structure, which would then alter the shape formed in the tertiary structure. Enzymes are globular proteins with a specific active site shape, this active site may be changed if the primary structre leading up to the quaternary structure is affected. A mishaped active site means that the enzyme can no longer carry out the function of binding to substrate molecules and breaking them apart, this means that the enzyme may not actually help prevent blood clotting.

(Total for Question 2 = 13 marks)

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Examiner Comments

This response gains marking points one and three. Although they know that the bonding could change they do not relate this back to a change in the primary structure. They also do not link the fact that the active site would change to a possible role in the blood clotting cascade.

Question 3 (a) (ii)

This question enabled candidates to demonstrate their scientific recall as it was a straight-forward question requiring a description of the role of carrier proteins.

Many candidates could recall that carrier proteins were involved in both facilitated diffusion and active transport. However, a minority of these candidates did not fully explain the function of the carrier proteins in these processes and therefore did not gain more than 2 marks.

Some candidates only described the role of carrier proteins in one of these processes and could therefore not score more than 3 marks. It was important for candidates to be specific with their terminology for marking point 2, as the use of the word particles was not sufficient.

A minority of candidates described the role of both carrier and channel proteins which was not what the question asked.

(ii) Describe the function of carrier proteins in a cell surface membrane.

(4)

Carrier proteins are involved in both facilitated diffusion and active transport. In facilitated diffusion it allows large molecules such as glucose and amino acids to travel across the cell surface membrane down a concentration gradient either into or out of the cell. In active transport it allows substances to travel up a concentration gradient with the use of ATP.

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Examiner Comments

This is a well written and concise response which covered every marking point to gain full marks.

ResultsPlus
Examiner Tip

When describing the function you need to describe what they do and how they do it.

(ii) Describe the function of carrier proteins in a cell surface membrane.

(4)

Carrier proteins transport ~~the~~ large molecules across the cell surface membrane. These molecules are too large to diffuse through the membrane by themselves. This process is called facilitated diffusion.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate has only recognised the role of carrier proteins in facilitated diffusion of large molecules. They have not mentioned active transport or concentration gradients and therefore gain 2 marks.

ResultsPlus
Examiner Tip

If a question is worth 4 marks like this one think if you should be writing about more than one function.

(ii) Describe the function of carrier proteins in a cell surface membrane.

(4)

Carrier proteins in a cell surface membrane can be used for facilitated diffusion. This is to move molecules and ions down a concentration gradient - from a high to low concentration. They are transmembrane meaning that they can go through the membrane to reach the cell. This is a form of passive transport therefore no energy is needed.

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Examiner Comments

This response gains all three possible marking points for facilitated diffusion. As they do not describe the role of carrier proteins in active transport, they gain 3 marks overall.

Question 3 (b)

This question was based on the beetroot core practical and it identified the candidates who had been given the opportunity to carry out the core practical and were also encouraged to write it up using correct terminology and precise details.

It was clear that many candidates had experienced this core practical as they were able to write detailed methodology of how to carry out the practical and often gained marking points 3 and 4 in the process.

However, a significant number of candidates were unable to apply this to the context of investigating age of cabbage leaves. When this was attempted, candidates often did not write the specific details that would enable them to gain further marking points. For example, they would comment that different ages would be used without thinking of a suitable range to use.

(b) Anthocyanins are purple pigments found in the cells of red cabbage leaves.

A student investigated the following hypothesis:

'The permeability of cell membranes in a red cabbage leaf is affected by the age of the plant.'

Devise an investigation the student could use to test this hypothesis and collect valid data.

(4)

The student can collect red cabbage leaves of different ages for example: 1 week, 2 weeks, 3 weeks, 4 weeks and 5 weeks old with a control of fresh leaves. Then the student must can piece of the same ~~surface~~ area and same size and then ~~wash~~ place them in distilled water to remove excess pigment as the cell membrane would have been cut. Then the student should place the leaves section is ~~test~~ boiling tubes with the same volume of water at the same temperature controlled by a water bath. Leave the leaves for 15 minutes. After zero the colorimeter ~~and~~ using distilled water then for each solution place a sample in the colorimeter and record the absorbtion rate. Repeat at each age 2 more times.

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Examiner Comments

This response gains full marks. They clearly identify a suitable range for the independent variable, describe how another suitable variable has been controlled, state the colorimeter method for measuring permeability and state that repeats should be done at each age.

They nearly gain marking point 2 as well.

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Examiner Tip

Always think about suitable ranges for the independent variable and explain how variables should be controlled.

Get a sample of beetroot that are cut up into equally equal sized cubes and rinse under water to remove any excess pigment. Get a set volume of water and place it into five different test tubes. Place the sample of beetroot into a test tube. Set a water bath at different temperatures and place the test tube into the water bath at a set temperature, leave for about 5 minutes. Remove the test tube and take the beetroot sample out. Pour the coloured liquid from the test tube into a cuvette about three - quaters the way. Set a colorimeter at zero and place cuvette into colorimeter to read it's absorbance. Repeat with other test tubes at the other temperatures to find absorbance reading from the colorimeter.

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Examiner Comments

This is an example of a response where the candidate has not related the core practical to the context of the question and refers to beetroot and not cabbage.

They are also not specific about the range for the IV or how variables have been controlled.

ResultsPlus
Examiner Tip

Look at the context of the question and relate your knowledge to it.

Question 4 (a) (ii)

This was answered well by the vast majority of candidates. However, a small number did not read the question correctly and did not give their answer to one decimal place.

(ii) A woman is 154 cm tall and has a mass of 61 kg. Her body mass index is calculated using the following formula.

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

Calculate her BMI to one decimal place.

(2)

1.54m

$$\frac{61}{(1.54)^2}$$

Answer 25.72

ResultsPlus
Examiner Comments

This is an example of where the candidate has not read the question correctly and has given their answer to an incorrect number of decimal places. Therefore they do not gain the second mark. However, they gain the first mark for inserting the given numbers correctly into the equation.

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Examiner Tip

Always check if the question states how many decimal places to give answers to. Sometimes it is stated but sometimes it can be inferred, e.g. in tables this can be shown by the format of other numbers.

(ii) A woman is 154 cm tall and has a mass of 61 kg. Her body mass index is calculated using the following formula.

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

Calculate her BMI to one decimal place.

(2)

~~61kg~~ / ~~(1.54)²~~ = 61kg / (1.54)² = 25.7

Answer 25.7

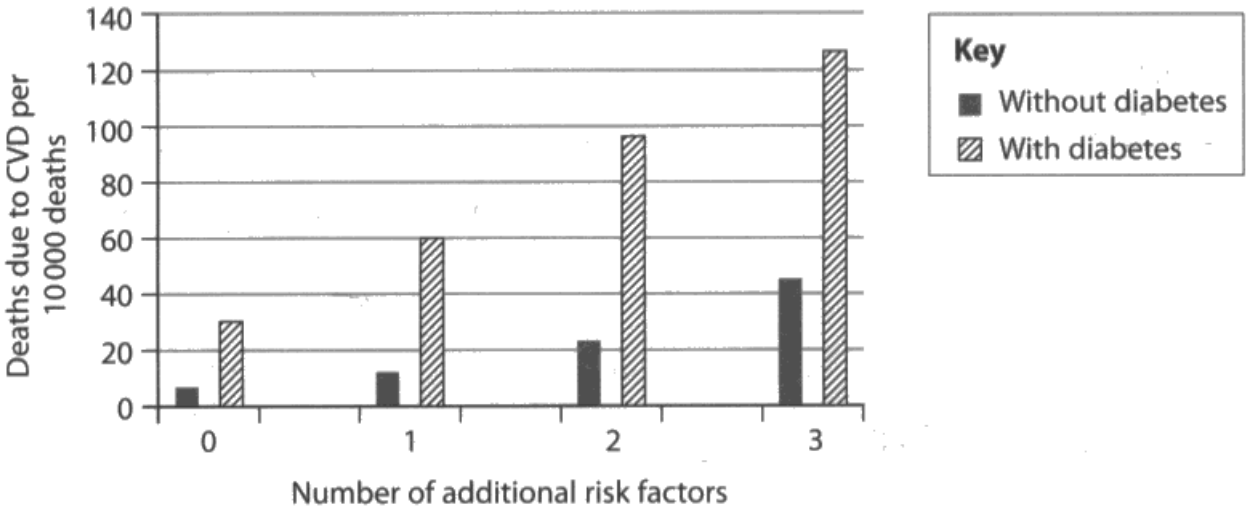
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Examiner Comments

This is an example of a response which gains full marks. The candidate calculates the BMI correctly and gives it to the required number of decimal places.

Question 4 (a) (iii)

It was pleasing to see that the vast majority of candidates could correctly analyse the data to identify a correlation between the number of risk factors and deaths due to CVD. A significant majority were also able to recognise that deaths due to CVD were higher for diabetics than non-diabetics.

(iii) The graph shows the effect of additional risk factors on deaths due to CVD for people with and without diabetes.



Identify the effect of the number of additional risk factors on deaths due to CVD for people with and without diabetes.

The more risk factors ~~no. these are the~~ a person has for dying (2) of a CVD related cause increases wheather your a person with or without diabetes.

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Examiner Comments

This is an example of a response which gains full marks as the candidate correctly identify the effect of the number of additional risk factors on deaths due to CVD for people with and without diabetes.

Identify the effect of the number of additional risk factors on deaths due to CVD for people with and without diabetes.

(2)

~~The effect of an increasing number of risk factors on deaths due to CVD is~~ As the number of additional risk factors increases, so does the number of deaths from CVD for people with and people without diabetes. However the people with diabetes have a substantially larger number of deaths as the number of additional risk factors increases from 0 to 3.

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Examiner Comments

Here, the candidate does not fully explain that there is a correlation between the number of risk factors and deaths due to CVD. They have also not recognise that the data shows that deaths due to CVD are higher for diabetics than non-diabetics.

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Examiner Tip

Make sure you have analysed all the data for trends.

Question 4 (b)

Most candidates had few difficulties in explaining that antihypertensive drugs would have the effect of lowering blood pressure. However, many candidates then went into detail explaining how all these different drugs worked which did not answer the question. Some candidates correctly linked lower blood pressure to the reduced risk of endothelium damage, but didn't specify arteries. Fewer candidates gained the fourth and final mark as they tended to repeat the information from the stem and refer to reduced risk of atherosclerosis instead.

(b) It is possible to reduce the risk of CVD by taking medication or changing diet.

Explain the role of antihypertensive drugs in reducing the risk of atherosclerosis.

(4)

~~There~~ drugs A healthy diet means you shouldn't have too much fats. fats can higher your blood pressure and cholesterol levels which can increase the risk of atherosclerosis. which is why a healthy diet is needed.

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Examiner Comments

This response does not answer the question asked and scores 0 marks.

ResultsPlus
Examiner Tip

Make sure you answer the question being asked. This question was asking about the role of drugs and not diet.

(b) It is possible to reduce the risk of CVD by taking medication or changing diet.

Explain the role of antihypertensive drugs in reducing the risk of atherosclerosis.

(4)

Antihypertensive drugs are used to reduce the risk of atheroclerosis because they stop plaque from building up too much reducing the risk of positive feedback. They ~~stop~~ limit the inflammatory response occuring so that there is a smaller chance of an atheroma forming, meaning blood vessels will not harden as much and therefore plaque will not build up.

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Examiner Comments

This response does not gain either of the first two marking points as they do not state the effect on blood pressure or the endothelium of the artery. However, they correctly identify a reduced risk of an inflammatory response and formation of an atheroma and therefore score 2 marks.

(b) It is possible to reduce the risk of CVD by taking medication or changing diet.

Explain the role of antihypertensive drugs in reducing the risk of atherosclerosis.

(4)

Antihypertensives reduce the blood pressure as high blood pressure is more likely to cause damage to the endothelium lining in the artery. Antihypertensives - there are 2 examples One is Diuretics which increases the volume of the urine so you get rid of more salts/water this decreases the volume of the blood which decreases the pressure of the blood as there is less volume. Or Beta-blockers which block the response of the heart to adrenaline as Adrenaline increases the heart rate and increased heart rate increases blood pressure. So heart rate is decreased so lower blood pressure so less likely to cause damage to endothelial lining and cause inflammatory response and an atheroma which leads to atherosclerosis.

ResultsPlus

Examiner Comments

This response makes it clear that antihypertensives would reduce blood pressure (1 mark), has stated the converse to the second marking point, referred to reduced risk of inflammatory response (1 mark) and atheroma formation (1 mark).

Question 5 (a)

It was surprising that very few candidates could compare and contrast the molecular structures of globular and fibrous proteins. Many candidates who did understand what was meant by molecular structures lost marks by not being comparative in their answers. They would, for example, state that globular had hydrophilic groups on the outside without going on to describe the same aspect for fibrous proteins.

Many incorrectly described the different functions of these proteins, referring to the structural role of fibrous proteins for example.

Another common mistake was to list examples of each type of protein, for example haemoglobin and keratin without describing their structure.

This question provided many examples of how marks were lost due to vague answers that failed to address the question.

5 Muscle cells contain globular and fibrous proteins.

(a) Compare and contrast the molecular structures of globular and fibrous proteins.

(4)

Fibrous proteins are long chained structures that are present in the secondary structure such as the alpha helix. They are joined together with hydrogen bonds. Globular proteins are spherical structures that are present in the tertiary staucture and sometimes in the quaternary structure. They are joined together again with hydrogen bonds and ~~something~~ also ionic bonds.

ResultsPlus
Examiner Comments

This clearly written and succinct answer gains 2 marks for comparing the overall shape and bonds found in the molecules. They gain a further mark for correctly stating that fibrous have secondary structures whereas globular have tertiary.

ResultsPlus
Examiner Tip

Comparing and contrasting means you need to make comparative statements. Make sure you say similarities and differences.

5 Muscle cells contain globular and fibrous proteins.

(a) Compare and contrast the molecular structures of globular and fibrous proteins.

(4)

Fibrous Proteins have more cross links and banding between molecules and so have longer to break down. Globular proteins are larger structures yet do not contain 1-4 and 1-6 glycosidic bonds like fibrous proteins which means that they are not as strong. They both contain 1-4 glycosidic bonds and they are both made up of chains of amino acids.

ResultsPlus
Examiner Comments

Here the candidate understands what is meant by the phrase 'molecular structures', but incorrectly names bonds holding the primary, secondary and tertiary structures and therefore gains no marks.

5 Muscle cells contain globular and fibrous proteins.

(a) Compare and contrast the molecular structures of globular and fibrous proteins.

(4)

Globular and fibrous proteins are both quadternary structures, but they are very different. Globular proteins are soluble and can be transported easily. Red blood cells are globular proteins. Fibrous proteins are insoluble so can not transport molecules as be transported well. They are quite strong Keritein is a fibrous protein. Keritein is what hair and nails are made from.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate states some comparative features of globular and fibrous proteins but does not link these characteristics to the molecular structures. They also name some proteins which is also not credit worthy. This response gains 0 marks.

ResultsPlus
Examiner Tip

Check what specific part of your knowledge you should use to answer a question.

5 Muscle cells contain globular and fibrous proteins.

(a) Compare and contrast the molecular structures of globular and fibrous proteins.

(4)

A difference between globular and fibrous proteins is that fibrous proteins are based upon the secondary structure of proteins with only hydrogen bonds between the ~~et~~ ori groups, whereas globular proteins are based upon the tertiary and quaternary structures of proteins with hydrogen, ~~disulphide~~ disulphide and ionic bonds present. Fibrous proteins are insoluble and strong compared to globular which are soluble and based on the quaternary structure can have a haem group for example haemoglobin with a haem group of Fe^{+}

ResultsPlus
Examiner Comments

This answer gains 2 marks for comparing the overall structures and bonding of the two types of proteins.

Although the candidate comments on the properties of solubility and insolubility, they do not relate this to the molecular structure and where the hydrophilic/ hydrophobic groups could be found.

Question 5 (b)

It was clear to see that many candidates understand the processes of transcription and translation as there were some very detailed descriptions of these processes.

The majority of candidates either ignored, or did not grasp, the subtleties of the question however, and did not relate these processes to the transcription of the specific gene and resulting production of a specific sequence of amino acids for the protein mentioned in the question. Therefore they did not gain the first or last marking point.

A large majority of candidates were not specific enough in their use of relevant terminology and this prevented the awarding of marks. For example they just referred to nucleotides being used in transcription instead of RNA nucleotides. A minority stated that DNA nucleotides were used.

Another common point that was missed by candidates was that tRNA molecules attach to a specific amino acid.

(b) Describe the roles of transcription and translation in the synthesis of a globular protein by a muscle cell.

(5)

In the nucleus of the cell there will be DNA which can be accessed by mRNA polymerase which will travel through the nuclear envelopes. The ~~mRNA~~ RNA polymerase will ~~unzip~~ break the hydrogen bonds between the bases of the strech of DNA it is accessing and transcribe the DNA ~~the~~ from the antisense strand. Then translation will occur when the mRNA leaves the nucleus and enter the cytoplasm and attatches onto ribosomes (rRNA) which translates the mRNA into a sequence of amino acids (using tRNA), that will form a polypeptide chain. This polypeptide chain will be in the correct sequence to then obtain a 3D shape ~~and~~ through bonding to become a globular protein

(Total for Question 5 = 9 marks)

ResultsPlus

Examiner Comments

This answer is an example of a response where the candidate describes some aspects of transcription and translation, but without the required level of detail to gain more than 1 mark.

(b) Describe the roles of transcription and translation in the synthesis of a globular protein by a muscle cell.

(5)

Transcription occurs in the nucleus, where RNA polymerase unwinds the double helix of the DNA, due to it breaking the Hydrogen bonds between the base pairs. The free RNA nucleotides align themselves with the complementary base pairs*. Phosphodiester bonds form between the adjacent nucleotides. This forms a chain of nucleotides (polynucleotide) called mRNA. This is the process of transcription * of the template strand, to produce a chain of nucleotides which are the same as the coding strand. * (apart from thymine being replaced by Uracil in RNA)

Translation occurs when mRNA leaves the nucleus through a nuclear envelope, and binds onto the smaller subunit of a ribosome in the cytoplasm. The mRNA binds to this smaller subunit with its codon. Each of the two binding sites on the large subunit, tRNA molecules attached to the large sub unit each with a specific amino acid. The anticodons form complementary base pairs on the ribosome and a peptide bond is formed between the two amino acids. Once this is complete the mRNA chain is moved along to expose another two codons, so that two more tRNA molecules can bind and so two more amino acids can be added to the chain by a peptide bond. This process continues until a stop codon is reached, and the protein is released into the cytoplasm. It can then be modified to produce the globular protein, by the muscle cell.

(Total for Question 5 = 9 marks)

ResultsPlus
Examiner Comments

This is a good answer which scores 4 marks for a detailed description of transcription and translation. However they do not relate these processes enough to the synthesis of the protein from the stem of the question to gain the fifth marking point.

ResultsPlus
Examiner Tip

Underlining key parts of the question can help you to focus on what is needed to answer the question.

Question 6 (a) (ii)

This was a straight-forward question asking how enzymes leave the cells of the pancreas and small intestine. It was pleasing to see so many candidates being able to apply their knowledge from specification point 2.4 to this context. However, there were a minority of candidates who gave incorrectly spelt answers or gave incorrect answers such as diffusion and endocytosis.

(ii) Name the process by which enzymes leave the cells of the pancreas and small intestine.
(1)

exocytosis

ResultsPlus
Examiner Comments

This is an example of a correct answer which gains the mark.

(ii) Name the process by which enzymes leave the cells of the pancreas and small intestine.
(1)

Digestion

ResultsPlus
Examiner Comments

This is an example of an incorrect answer given by a minority of candidates.

Question 6 (a) (iii)

This question wanted candidates to explain why hydrolysis of lipids resulted in a decrease in pH. Over 60% of candidates did not answer this question correctly which was very disappointing.

Only a fifth of candidates correctly related the production of fatty acids to the decrease of pH.

The most common incorrect type of response focused on the role of the water molecules in hydrolysis.

Another reason why candidates lost a mark was by referring to the small intestine becoming more acidic instead of using the stem of the question and referring to a decrease in pH of the small intestine.

(iii) Explain why the pH in the small intestine would change after lipase hydrolyses lipids.

(2)

Water is used up in hydrolysis, so there is less of an amphoteric buffer to keep the pH constant.

ResultsPlus
Examiner Comments

This is an example of the most common incorrect response, where the candidate has focused on the use of water molecules in hydrolysis instead of the effect of the products.

(iii) Explain why the pH in the small intestine would change after lipase hydrolyses lipids.

(2)

Produces fatty acids as products. This would decrease pH in small intestine.

ResultsPlus
Examiner Comments

This is an example of a clear and succinct answer which gains full marks.

Question 6 (b)

Many candidates failed to assemble all of the information they had been provided with to answer Q6(b). The question clearly referred to the triglyceride diagram they had been given in Q6(a). Candidates were expected to recognise that this was a saturated triglyceride and apply this to the context of combining with protein to form a lipoprotein. As it was saturated, candidates were expected to conclude that an LDL would be formed and extend this to the effect that this would have on blood cholesterol levels.

However, it was clear that the link to the diagram had not been made by many candidates. Therefore they did not gain the first marking point.

Many candidates gave good explanation of the roles of both HDL's and LDL's and the subsequent effects on each on the blood cholesterol levels. In such cases the candidates were limited to gaining just 1 mark, either marking point 4 or 5.

(b) The triglyceride in the diagram can combine with protein to form a lipoprotein.

Explain the effect that large quantities of this lipoprotein would have on blood cholesterol levels.

(4)

The lipoprotein formed will be a low density lipoprotein. Lipoproteins have a high propotion of lipids to proteins. ~~Too many~~ LDLs ~~are~~ transport cholesterol to cells by binding onto receptor sites. Too many LDLs will block the receptor sites of the cell and therefore LDLs remain in the bloodstream rather then going into cells. This will raise blood cholesterol levels which may lead to atherosclerosis, since high blood presure will occur as there is more fat in the body.

as lipids cant be absorbed into the blood stream

ResultsPlus
Examiner Comments

This candidate has failed to state that the triglyceride was saturated and so does not gain marking point 1. However they correctly go on to say that an LDL would be produced and that the blood cholesterol level would rise. They also give a correct explanation as to why the level would rise and gain 3 marks.

ResultsPlus
Examiner Tip

Always remember to set the scene and state the obvious.

(b) The triglyceride in the diagram can combine with protein to form a lipoprotein.

Explain the effect that large quantities of this lipoprotein would have on blood cholesterol levels.

(4)

Large quantities of this lipoprotein will cause the blood cholesterol levels to rise, which results in an increase in the risk of developing CVD.

ResultsPlus
Examiner Comments

This response does not make reference to either a saturated triglyceride or a low density lipoprotein and therefore does not gain marking points 1 or 2.

They do however, correctly state that the blood cholesterol levels would increase but do not go on to explain why.

ResultsPlus
Examiner Tip

Use the number of marks as a guide as to how many points you should make in your answer.

(b) The triglyceride in the diagram can combine with protein to form a lipoprotein.

Explain the effect that large quantities of this lipoprotein would have on blood cholesterol levels.

(4)

The triglyceride is one with saturated fatty acids. Therefore lipoprotein would be a low density lipoprotein - High levels of low density lipoproteins are bad. The blood cholesterol levels rise and excess amounts of LDLs mean that cell receptors cannot take all of it in. High LDL concentration leads to higher CVD risk.

ResultsPlus
Examiner Comments

This candidate correctly states that the triglyceride in the diagram was saturated and then goes on to explain why the LDL would cause blood cholesterol levels to rise to gain full marks.

Question 6 (d) (i)

In this question it was clear that a significant number of candidates did not understand the mathematical terminology of either 'ratio' or 'simplest form'. It is important for centres to look at what Level 2 mathematics (and above) is included in the new specification.

In addition, some candidates did not read the question correctly and did not give a ratio for amylose : amylopectin. They used the 51.9 from the table instead of calculating the percentage of amylopectin in cassava.

(d) Starch contains two different molecules, amylose and amylopectin. The percentage of each molecule found in starch varies depending on its source.

The effect of amylose content on the hydrolysis of starch from different sources by enzymes was investigated.

Source of starch	Amylose content (%)	Percentage of starch hydrolysed after 4 hours (%)
Cassava	20.0	51.9
Peruvian carrot	18.7	54.2
Potato	28.9	39.6
Yellow maize	35.8	37.5

(i) Calculate the ratio of amylose to amylopectin in cassava. Give your answer in simplest form.

(1)

$\frac{20}{52} - \frac{5}{13}$ = 5:13

Answer 5 : 13

ResultsPlus
Examiner Comments

This is an example where a candidate either does not read the information above the table, or does not understand the question. They have calculated the ratio of amylose to the percentage of starch hydrolysed after 4 hours. Therefore they score 0 marks.

ResultsPlus
Examiner Tip

Read the question and make sure you are extracting the correct data from the table.

(i) Calculate the ratio of amylose to amylopectin in cassava. Give your answer in simplest form.

(1)

20 : 80

1 : 4

Answer 1 : 4

ResultsPlus

Examiner Comments

This is an example of a response where the candidate works out that if 20% of the starch is amylose, then 80% must be amylopectin. They then simplify the ratio correctly to 1:4 to gain the mark.

Question 6 (d) (ii)

This question differentiated well between candidates with roughly the same proportion gaining marks from 0 to 4.

The command word used here was 'explain'. It was therefore expected that their answers contained elements of reasoning or justification of the trend they identified.

The majority of candidates were able to correctly identify that as the proportion of amylose in starch decreased, the percentage of starch hydrolysed increased. Fewer candidates were able to apply their biochemical understanding to this context to explain why.

The most common explanation mark was marking point 3 for stating that amylose is unbranched/amylopectin is branched but less than 40% of candidates could explain how this structure affected the rate of hydrolysis.

(ii) Explain the relationship between the composition of the starch and the rate of hydrolysis by enzymes.

(4)

The greater the ~~eg~~ content of amylopectin in starch, the faster it will hydrolyse. So, the greater the ratio of amylopectin to amylose, the ~~bigger~~ higher the rate at which the starch can by hydrolysed by enzymes. This is because amylopectin has 1, 6 glycosidic bonds which means it is branched compared to amylose which has 1, 4 glycosidic links which makes it a long chain molecule. It is quicker to hydrolyse a branched molecule because the enzymes can catalyse the reaction from any branch to break down the molecule. Where as, if the molecule is un branched then the hydrolysis can only occur at the two ends of the molecule and work their way down the molecule that way. So, the rate of hydrolysis by enzymes depends on the composition of the starch. If the starch is composed of more amylose in ratio to amylopectin, that rate will be lower and the enzymes will hydrollerase ~~the~~ the molecule more slowly. If the starch is composed of more amylospectin in ratio to amylose then the opposite is true and the rate of hydrolysis by enzymes will be quicker

ResultsPlus
Examiner Comments

This is an example of a response which gains full marks. The candidate correctly identifies the trend in the data and explains it using correct biological knowledge.

(ii) Explain the relationship between the composition of the starch and the rate of hydrolysis by enzymes.

(4)

The data shows that the greater the percentage of amylose content, the smaller the percentage of starch hydrolysed after 4 hours, which demonstrates a negative correlation between the 2 sets of data. This means that amylopectin decomposes at a faster rate than amylose.

ResultsPlus
Examiner Comments

This is an example of a type of response given by nearly a fifth of candidates. They correctly identify the trend shown by the data to gain the first marking point but do not go on to explain this relationship.

ResultsPlus
Examiner Tip

Read the question with care and decide what aspects of your knowledge would be relevant to apply.

Question 7 (a) (i)

This question was answered correctly by 90% of candidates. A minority did not gain the mark as they gave an incorrect response such as ribosomes, or spelt nucleus incorrectly e.g. nuclease. As this was another biological word, credit could not be given.

(a) (i) State where transcription occurs in an animal cell.

(1)

in the nucleus.

ResultsPlus
Examiner Comments

This is an example of the correct answer.

Question 7 (b) (i)

This question was testing specification points 2.8 and 2.13. Candidates are expected to know the meaning of certain terminology encountered in the course. As the specification stated the definition of a gene, it was disappointing that the majority of candidates did not gain this mark.

(i) State what is meant by the term gene.

(1)

a gene is the sequence of mononucleotide bases of a DNA molecule that codes for a sequence of amino acids in a polypeptide chain of a protein.

ResultsPlus
Examiner Comments

This is an example of a response which has all the required components and therefore scores full marks.

ResultsPlus
Examiner Tip

Learn the meanings of terms as stated in the specification.

(i) State what is meant by the term gene.

(1)

sequence of bases on a DNA strand which code for a specific characteristic e.g eye colour

ResultsPlus
Examiner Comments

This response does not gain the mark as they do not refer to a polypeptide or protein.

(i) State what is meant by the term gene.

(1)

The sequence of amino acids on a DNA molecule that codes for a characteristic

ResultsPlus
Examiner Comments

This candidate is confused between amino acids and bases. They have also do not refer to a polypeptide or protein.

Question 7 (c)

This question was answered poorly with 80% of candidates gaining half marks or less. Marks were more commonly awarded for the substitution of a base explanation than for the deletion of a base explanation.

Many did refer to the idea that substituting a base may result in the same amino acid being coded for, but then failed to explain why this may have been the case.

With respect to the deletion of a base concept, the main mark awarded was for a reference to a frame shift.

Marking point 2 was very rarely awarded.

This question provided many examples of how marks were lost due to vague answers that failed to address the question.

(c) Mutations to DNA can affect the structure of proteins produced in the cell.

Removing one base from a DNA sequence will affect the primary structure of a protein.

Changing one base for another may not affect the primary structure of a protein.

Explain why these two types of mutation have different effects on protein structure.

(4)

Removing a base is a frameshift mutation, will alter all subsequent codons, likely to code for many different amino acids. Therefore order of amino acids and primary structure is different. Changing one base for another may not change the amino acid coded for as DNA is degenerate code. This means the same sequence remains.

ResultsPlus
Examiner Comments

This response gains full marks as they correctly stated and explained points for each type of mutation.

(c) Mutations to DNA can affect the structure of proteins produced in the cell.

Removing one base from a DNA sequence will affect the primary structure of a protein.

Changing one base for another may not affect the primary structure of a protein.

Explain why these two types of mutation have different effects on protein structure.

(4)

There are four types of mutations in DNA, insertions, deletions, substitutions and ____. By inserting or deleting a base from the sequence this causes a 'frame shift' (primary structure), where by the ~~base~~ code of bases ↑ will be different from then on and therefore it is possible a different protein or unfunctioning one is produced. However substitutions may only change one base and doesn't cause frame shift and therefore the protein may still be made as the structure is the same.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate gains just 1 mark for correctly stating that deletion of a base could cause a frameshift.

They have just repeated information from the question stem for the substitution concept and therefore gain no additional marks.

ResultsPlus
Examiner Tip

Make sure you are explaining information you have been given and not just repeating it.

Question 8 (b) (i)

This question was designed to test the candidates' knowledge of the structure of the heart and provide the context for the rest of the question. It was surprising that the majority of candidates did not recognise that the aorta and pulmonary artery were attached to the wrong ventricles.

The most common incorrect answer focused on the fact that the pulmonary vein was not shown, even though the openings were clearly visible in the atria.

(i) Identify the problem with the blood vessels of this heart.

(1)

Some blood vessels are missing
Such as the pulmonary vein

ResultsPlus
Examiner Comments

This is the most common incorrect response.

(i) Identify the problem with the blood vessels of this heart.

(1)

The ~~blo~~ pulmonary artery and the aorta are linked together so deoxygenated and oxgenated blood can mix

ResultsPlus
Examiner Comments

This candidate identifies the blood vessels that are causing a problem but gives an incorrect explanation.

(i) Identify the problem with the blood vessels of this heart.

(1)

The problem is that in the blood vessels there ~~are~~ is the mixing of oxygenated and deoxygenated blood

The problem is that the aorta is pointing into the right ventricle and the pulmonary artery is pointing into the left ventricle

ResultsPlus

Examiner Comments

The mark is awarded here for recognising that the aorta and pulmonary arteries are connected to the wrong ventricles, although the terminology isn't as precise as it should be.

Question 8 (b) (ii)

It was surprising that very few candidates could explain why the hole in the heart would allow the survival of the baby. The question proved to be a very good differentiator between candidates.

This question needed the candidates to recognise that there would be mixing between the deoxygenated blood in one ventricle and the oxygenated blood in the other. As the aorta is leaving the right ventricle, it would be carrying deoxygenated blood.

Therefore the candidates were expected to recognise that the mixing of blood between the two ventricles would have allowed the aorta to carry some oxygenated blood to the body cells. A minority of candidates were able to extend their answer to explain why this oxygen was needed by the body cells.

A common incorrect response was to say that the hole would allow leakage of blood from the heart.

(ii) The baby survived because of the hole in the septum of the heart.

Explain how the hole in the septum allowed this baby to survive.

(3)

The septum normally separates the ventricles to keep oxygenated and deoxygenated blood apart. The hole in the septum allowed this blood to mix so some oxygenated blood arriving from the pulmonary vein into the left ~~exxdxx~~ atrium could travel along the aorta to the rest of the body, thus delivering enough oxygen needed for respiring cells, to produce energy. Some deoxygenated blood could travel to the lungs to be oxygenated.

ResultsPlus
Examiner Comments

This is one of the rare responses which gain all 3 marks.

The candidate correctly recognises the importance of the hole in the heart to allow some oxygenated blood to be transported to body cells. They also extend their answer to say that the oxygen was needed for respiration.

(ii) The baby survived because of the hole in the septum of the heart.

Explain how the hole in the septum allowed this baby to survive.

(3)

This means that the oxygenated and deoxygenated blood mixed so the aorta still recieved some oxygenated blood to transport to the tissues around the body and the pulmonary artery still recieved some deoxygenated blood which it could take to the lungs to become oxygenated again. If there was no hole the blood would'nt mix so there would be no oxygen for respiration so the baby would have died.

ResultsPlus

Examiner Comments

Another excellent answer which gains all 3 marks.

(ii) The baby survived because of the hole in the septum of the heart.

Explain how the hole in the septum allowed this baby to survive.

(3)

Because the whole meant that less blood was being pumped into the ventricles so less blood was being pumped into the arteries if there hadn't been holes to drain the amount of blood.

ResultsPlus
Examiner Comments

This candidate does not recognise the importance of the hole in the heart with regards to the delivery of oxygen to respiring body cells and therefore gains 0 marks.

(ii) The baby survived because of the hole in the septum of the heart.

Explain how the hole in the septum allowed this baby to survive.

(3)

Because it would allow oxygenated blood to mix with deoxygenated blood so, deoxygenated blood was still pumped through the pulmonary artery and oxygenated blood thrug the aorta. Otherwise the baby would have died as oxygen would not have been supplied to its organs and muscles.

ResultsPlus
Examiner Comments

This response gains the first 2 marking points as they correctly identify the importance of the hole in the heart at allowing oxygenated blood to be transported to body cells. However they do not explain the importance of this oxygen.

ResultsPlus
Examiner Tip

Think about why molecules are needed by body cells.

Question 8 (b) (iii)

This was a level based question as required by the new specification. It required candidates to fully analyse the data provided, both quantitative and qualitative, as well as the knowledge from Q8(b)(i) and Q8(b)(ii) in order to assess the effect of the heart defect on the rate of oxygen diffusion.

The question differentiated very well between the candidates. It showed that some candidates failed to analyse the data provided and instead wrote about how the lungs are adapted for gas exchange.

A minority of candidates misinterpreted the table of data provided and instead referred to the volumes of blood entering the lungs which was not credit worthy.

Many candidates just used the data in the table to help them asses the effect of the heart defect on rate of diffusion. Therefore they were limited to Level 1.

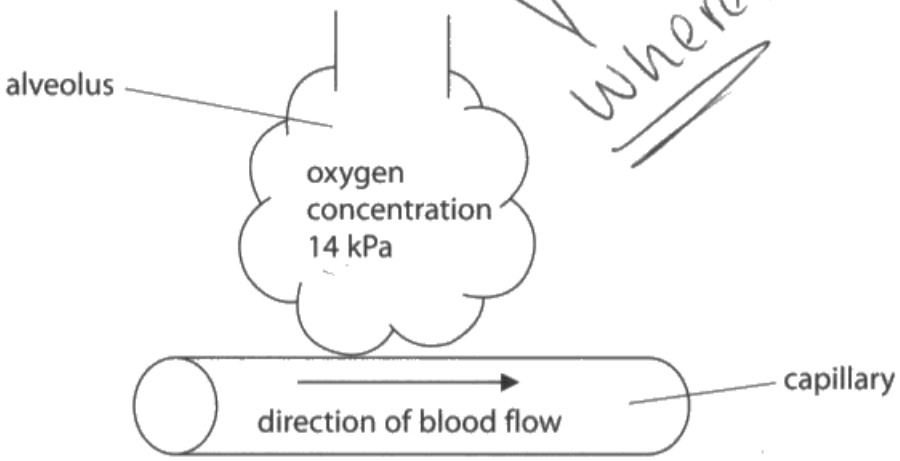
Where responses clearly used both pieces of quantitative data to calculate concentration differences they were able to access Level 2 and above. Answers which also used the Fick's law equation and information from Q8(b)(i) and Q8(b)(ii) accessed Level 3.

(iii) Oxygen diffuses between the alveoli of the lungs and the blood.

Fick's Law shows how three factors affect the rate of diffusion:

$$\text{Rate of diffusion} = \frac{\text{surface area} \times \text{concentration difference}}{\text{diffusion distance}}$$

The diagram and the table give information about the oxygen concentration in the alveoli and in the blood.



Heart	Oxygen concentration / kPa	
	Blood entering the lungs	Blood leaving the lungs
Normal	5	13
With hole in the septum between the ventricles	8	10

Rate of diffusion = ? x 8 / ?

" " = ? x 2 / ?

*Assess the effect of this heart defect on the rate of oxygen diffusion between the alveoli and the blood.

(6)

The heart defect will reduce the rate of diffusion as there is less surface area. This is evident through Ficks law which shows that a decreased surface area with increase diffusion

ResultsPlus
Examiner Comments

This response shows no evidence that the candidate analyses the data provided as there is no mention of oxygen concentration in either the alveoli or the blood entering the lungs. They incorrectly state that the surface area has decreased and relate this to the rate of diffusion instead. Therefore it scores 0 marks.

ResultsPlus
Examiner Comments

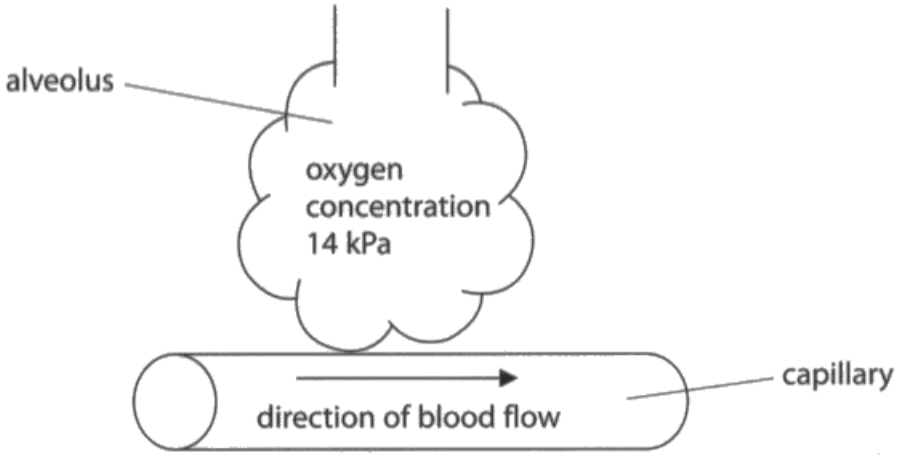
If you are provided with data, look at it carefully to see what information you can gain from it to use in your answer.

(iii) Oxygen diffuses between the alveoli of the lungs and the blood.

Fick's Law shows how three factors affect the rate of diffusion:

$$\text{Rate of diffusion} = \frac{\text{surface area} \times \text{concentration difference}}{\text{diffusion distance}}$$

The diagram and the table give information about the oxygen concentration in the alveoli and in the blood.



Heart	Oxygen concentration / kPa	
	Blood entering the lungs	Blood leaving the lungs
Normal	5	13
With hole in the septum between the ventricles	8	10

13 - 5 = 8

10 - 8 = 2

$\frac{2-8}{8} \times 100 = -75$

*Assess the effect of this heart defect on the rate of oxygen diffusion between the alveoli and the blood.

(6)

The heart defect caused the ~~blood~~ oxygen concentration concentration of blood entering the lungs to be higher than normal by 3 kPa so the concentration difference is reduced from 9 kPa to 6 kPa which would reduce the rate of diffusion between the alveoli and the blood. This resulted in blood leaving the lungs having a lower oxygen concentration at 10 ~~kpa~~ kPa rather than the normal concentration of 13 kPa so the heart defect caused the gaseous exchange to be 75% less effective than a normal heart would

ResultsPlus
Examiner Comments

This candidate analyses the data provided to be able to make correct conclusions as to the effect on the rate of diffusion between the alveoli and the blood in the capillaries. They correctly use the data to calculate the concentration gradient difference between the alveoli and the blood delivered from the two different hearts.

The explanation does not show all the linkages and lines of scientific reasoning that could be provided, e.g. Fick's Law, and is therefore awarded the lower mark in the band

ResultsPlus
Examiner Tip

Use all the information you have been provided with, both quantitative and qualitative.

*Assess the effect of this heart defect on the rate of oxygen diffusion between the alveoli and the blood.

(6)

With a heart defect ~~Between an a defected system~~ the concentration gradient is lower than a normal one being only (14-8=6) 6 compared to (14-5=9) 9. As such the rate of diffusion will be lower as the concentration gradient is lower as shown by ~~Sicks~~ Fick's law.
The concentration gradient is the only differing factor as diffusion distance and surface area remain the same.
Because a regular heart will yield a greater concentration difference (gradient) it has a higher rate of diffusion and so will be better.

ResultsPlus
Examiner Comments

This response uses all of the information provided to explain why the hole in the heart would result in a lower rate of diffusion. The candidate accesses Level 3 and 5 marks as they are able to recognise that the concentration difference is the only factor that is affecting the rate of diffusion as the surface area and distance for diffusion are not affected.

*Assess the effect of this heart defect on the rate of oxygen diffusion between the alveoli and the blood.

(6)

The heart defect will cause the rate of oxygen diffusion between the alveoli and the blood to decrease, since there will be a lower concentration gradient, since some oxygenated blood will travel to the lungs again since it has been mixed in the ventricles. This will mean that the concentration difference (basically) will be lower than that of a normal heart. Overall, this will cause a slower rate of diffusion. Although the surface area and the diffusion distance is the same, the concentration difference is lower, so diffusion will happen less quickly, as shown by Fick's law (there is only a concentration difference of 6kPa in the hole in the septum baby, yet there is a 9kPa difference in the normal baby).

ResultsPlus

Examiner Comments

This response uses all of the information provided to explain why the hole in the heart would result in a lower rate of diffusion. The candidate accesses Level 3 and 6 marks as they are able to recognise that the concentration difference is the only factor that is affecting the rate of diffusion as the surface area and distance for diffusion are not affected. They link the mixing of the blood in the ventricles to the oxygen concentration difference in the blood entering the lungs from the two hearts.

The candidate provides a well-developed and sustained line of reasoning in their answer which is clear and logically structured.

Paper Summary

Based on their performance in this paper, candidates are offered the following advice:

- use appropriate biological terminology, use glossaries both online and in text books
- when describing practical procedures include sufficient detail so that someone else could follow your instructions to repeat the same experiment and collect valid data
- when describing the measurement or control of variables be specific about what is to be measured, e.g. volume or mass. Do not use vague terminology such as 'amount'
- read the questions carefully and take into account the command words as well as the context given. Do not try and make a mark scheme you have learnt from a previous paper fit a different question with different command words and a different context
- use all of the information provided in the question to help you with your answer, e.g. diagrams, graphs and tables of data
- look at the mathematical content of the specification.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx





Llywodraeth Cynulliad Cymru
Welsh Assembly Government



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